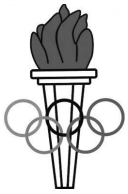


CROATIAN KINESIOLOGY ASSOCIATION

in cooperation with

Fédération Internationale d´Éducation Physique – Europe

and

Faculty of Kinesiology, University of Zagreb, Croatia

PHYSICAL EDUCATION AND NEW TECHNOLOGIES

Editors
Dario Novak
Branislav Antala
Damir Knjaz

Zagreb, 2016

CROATIAN KINESIOLOGY ASSOCIATION
Zagreb, 2016

Publication: PHYSICAL EDUCATION AND NEW TECHNOLOGIES

Editors: Dario Novak (Croatia)
Branislav Antala (Slovakia)
Damir Knjaz (Croatia)

Publisher: CROATIAN KINESIOLOGY ASSOCIATION
Zagreb, 2016

General Secretary: Đurđica Kamenarić (Croatia)

Reviewers: Branislav Antala (Slovakia)
Yesim Bulca (Turkey)
Giyasettin Demirhan (Turkey)
Eng Wee Hoe (Malaysia)
Hrvoje Podnar (Croatia)
Ivan Prskalo (Croatia)
František Seman (Slovakia)

Printed by: Tiskara Zelina, Katarine Krizmanić 1
10380 Sveti Ivan Zelina

Circulation: 200 copies

CIP record is available from the National and University Library in Zagreb under No. 000935590.

ISBN: 978-953-7965-05-1

Preface

There are alarming worldwide trends that demonstrate a high prevalence of physical inactivity among children and adolescents. One of the health threatening consequences of the insufficient level of physical activity for children and youth is certainly the high prevalence of overweight and obesity. Physical education classes cannot solve the obesity epidemic on their own, but physical education plays an especially important role because it can help students adopt and maintain healthy habits and physical activity behaviours. *Physical Education and New Technologies* provides a review of new directions in physical education worldwide. The book offers information regarding contemporary practices and models in physical education. We hope that the book will offer a basis to inform and improve current practices throughout the world. Authors from across the globe have contributed chapters examining the importance of using technology in physical education. The goal of the book is to draw together experts from throughout the world to offer an exposition of using new technologies in the field of physical education. It is our hope that by sharing such information that gains can be made in combating the universal problem of obesity and overweight and in strengthening health and physical education pedagogy as an important component of the school curriculum.

Editors

Dario Novak
Branislav Antala
Damir Knjaz

TABLE OF CONTENTS

MHEALTH: A RETROSPECTIVE WITH INITIAL EVIDENCE FROM THE PHYSICAL ACTIVITY FIELD

MANOLIS ADAMAKIS
Faculty of Physical Education and Sport Science, National and Kapodistrian University of Athens Athens, Greece

INTRODUCTION

Mortality rate is increasing due to lack of physical activity (PA), since 40% of the premature deaths are related to unhealthy living habits, such as smoking, poor diet and insufficient PA (Mokdad, Marks, Stroup, & Gerberding, 2004). Approximately 3.2 million deaths and 32.1 million illnesses per year are associated with physical inactivity (World Health Organization, 2014). Nowadays this is a worldwide issue, as 20% to 45% of the people are physical inactive and the percentage rises in rich and urban countries, especially among women and elderly individuals (Bauman et al., 2009; Dumith, Hallal, Reis, & Kohl, 2011).

On the other hand, regular PA can help individuals maintain an appropriate health level, since it is associated with reduced risk of breast cander, hypertension, coronary heart disease, type 2 diabetes, obesity, metabolic syndrome and osteoporosis, both in children and adults (Hallal, Victora, Azevedo, & Wells, 2006; Thompson et al., 2003; Thompson et al., 2007; van der Berg et al., 2016). Even a small increase in daily PA levels may have a positive impact on general population's health (Davis, Spence, Vandelanotte, Caperchione, & Mummery, 2012).

Despite the benefits acquired by exercise, the majority of people are not systematically involved in these activities, resulting in the underachievement of these beneficial outcomes (Brodersen, Steptoe, Boniface, & Wardle, 2007). In the last 15 years the percentage of physically inactive individuals has been increased significantly (WHO, 2009), due to the adoption of a sedentary way of living, motorized transportation, mechanical equipment, automatic appliances and screen-based (in)activities (Westerterp, 2013). In the U.S.A. only 38% participated in regular exercise programs, while 25% were entirely physically inactive (Adams & Schoenborn, 2006). The results were similar for the E.U. countries, with 42% not involved in regular exercise and 30% been physically inactive (European Commission, 2013).

A recent approach to increasing PA levels and improving health has been via technological advances, such as the Internet and mobile phones. Griffiths, Lindenmeyer, Powell, Lowe and Thorogood (2006) proposed that these approaches might be effective due to the reduced cost and users' social isolation, user-friendly environment and real-time information provided. Stephen and Allen (2013) reported that 71% of the intervantions through smartphone applications (apps) had positive outcomes in at least one of the parameters regarding weight loss, PA increase, improvement of eating habits, reduction of Body Mass Index etc. Finally, Rabin and Bock (2011) proposed that smartphone technology is able to provide remote exersice interventions and users prefer user-friendly apps which are able to track PA through pedometers and energy expenditure estimators, as well as those with integrated music capabilities.

SMARTPHONES' PENETRATION IN THE MARKET

Smartphones are mobile telephony devices with advanced features, such as camera, GPS, accelerometer, Wi-Fi, e.t.c., which have installed one of the following operating systems: iOS, Android, Blackberry or Windows Mobile, Ubuntu Touch and Firefox OS. These latest generation devices are usually used as personal computers rather than simple phones, due to the multiple capabilities, large memory, widescreen, increased storage and open-use software. The open-use software facilitates developers to create free and paid apps. Today there are apps for almost every social, education and recreational activity, since their programming is relatively easy for developers.

The last few years smartphone users have increased worldwide. It was estimated that, by the end of 2013, mobile phone subscribers were 6.9 billion. The Android operating system was the most widespread in the U.S.A. with a market share of around 45%, followed by iOS with 33%. Moreover, half of the young people aged 18 to 34 use Android equipped devices, compared to 32% of those who use an iPhone (Ruder Finn, 2013).

In 2014 Ericsson mobile company presented the findings of its last report (Ericsson, 2014), a comprehensive information source for the latest trends in mobile communications based on a large volume of data from worldwide commercial networks. This report revealed that the proliferation of mobile technology continues rapidly. Almost 90% of the global population over the age of six is expected to own a mobile phone by 2020. Furthermore, by 2020 smartphone subscriptions in mobile networks will be more than 6.1 billion, compared to 2.7 billion in 2014. Finally, smartphones' penetration in the market is on the rise, as 65-70% of the devices sold in the third quarter of 2014 were smartphones, compared to 55% for the same quarter in 2013. Despite the sales' rate increase (approximately 800 million new smartphone subscriptions by the end of 2014), the report esstimated that there is still significant space for further growth of the specific industry, since only 37% of the total mobile subscription owners had a smartphone (Ericsson, 2014).

In U.S.A. 45% of the participants in Fox and Duggan's (2012) study stated that owned at least one smartphone. Regarding the use for health purposes 31% in 2012, compared to 17% in 2010, reported that they had used their smartphones to find information about health issues, while 19% had installed in their devices at least one health app (23% females - 16% males). Between those interested in mobile health issues, 34% did not had any health problems and 26% had one or more chronic conditions, which suggests that they used the information retrieved mainly for preventive purposes. The majority of the apps used were exercise, fitness and PA apps and pedometers (38%), followed by dietary and calorie measurement (31%) and weight control apps (12%) (Fox & Duggan, 2012).

Most smartphones have an array of sensors including accelerometer, gyroscope, GPS sensors, vision sensors, audio sensors, light sensors, temperature sensors and direction sensors. The multi-sensor nature makes them better equipped than standard activity monitors for detecting and quantifying PA behavior. Taking into consideration their powerful computational capabilities, the development of valid and accurate customized apps that integrate monitoring and intervention has become feasible (Chen, Juen, Li, Prieto-Centurion, Krishnan, & Schatz, 2013; Lee, Kim, Kwon, Derrick, & Welk, 2015). Simple mobile devices and newly developed

smartphones may become an affordable, easy to use and effective solution for behavioral change regarding PA, reducing the need for overly complex and expensive devices (Foster, Linehan, Kirman, Lawson, & James, 2010). The major advantage of these devices is that they can provide users with instant results of exercise's duration and intensity, as well as indirect estimates of energy expenditure (Lox, Ginis, & Petruzzello, 2010).

In general, smartphones have the potential to provide both users and healthcare providers with the necessary tools to access information and data in real time, and to facilitate the monitoring of people with chronic health problems. The following are among advances in mobile products and services that could benefit the healthcare industry: '(a) greatly expanded memory and stronger processing capabilities; (b) geospatial tracking; (c) movement-enabled/accelerometers that track location and movement; (d) touch-screen technologies; (e) cheaper unit costs and cheaper connection/data plans; (f) extended functionality through the addition of apps; (g) immersive, full-screen apps; (h) remote monitoring devices with embedded cellular or fixed-line modems to transmit data directly without using a smartphone or computer' (Deloitte, 2012; p. 8).

REPORTS ON MOBILE HEALTH (MHEALTH)

Food and Drug Administration (FDA) issued specific guidelines regarding mobile medical applications (FDA, 2015). It defined the term *mobile app* as 'a software application that can be executed on a mobile platform (i.e., a handheld commercial off-the-shelf computing platform, with or without wireless connectivity), or a web-based software application that is tailored to a mobile platform but is executed on a server' (FDA, 2015, p. 7). They are usually available for download through digital distribution platforms, such as Apple App Store, Google Play, Windows Phone Store and Blackberry App World (European Commission, 2014).

A *mobile medical app* (mHealth) is 'an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including any component, part, or accessory that is intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or intended to affect the structure or any function of the body of man or other animals' (FDA, 2015, p. 7). These can be used as accessories to regulated medical devices or can transform mobile platforms into regulated medical devices (FDA, 2015).

Generally, mHealth refers to medical and public practices that are supported by mobile devices, i.e. mobile phones, patient monitoring devices and a variety of other types of wireless devices. The term also includes the use of voice and text messaging (sms), as well as more complex procedures, such as 3G-4G networks, GPS and Bluetooth technology (WHO, 2011). Within this context of mHealth, the use of smartphones is constantly gaining ground (Istepanian, Jovanov, & Zhang, 2004). The interface and ease of use of these new technologies, as well as the fact that smartphones have become an integral part of people's everyday life, highlights the value of these devices as a means of measuring and influences health through PA in real time (Intille, Lester, Sallis, & Duncan, 2012).

mHealth includes devices, sensors and apps (Liu, Zhu, Holroyd, & Seng, 2011) and is addressed to healthy, ill and individuals with chronic conditions (Norris, Stockdale, & Sharma, 2009). Furthermore, mHealth utility focuses on four main areas, namely wellness

and prevention, diagnosis, treatment and monitoring, and finally, the more specialized and complicated healthcare systems (Norris, Stockdale, & Sharma, 2009; Ruder Finn, 2013). Regarding medical apps, and according to the interpretation Blumenfeld and Garvin (2013) provided based on previous FDA reccomendations, there are three distinct categories of these apps: (a) apps that are medical devices subject to FDA oversight; (b) apps that do not qualify as medical devices and therefore are not regulated by FDA; (c) apps that are medical devices subject to FDA oversight, but for which the Agency will refrain from regulating for the current time. However, the new recommendations by FDA rephrased the third category into 'mobile apps for which FDA intends to exercise enforcement discretion (meaning that FDA does not intend to enforce requirements under the FD&C Act)' (FDA, 2015, p. 15), due to the fact that these apps pose a low risk to patients. This category includes apps which provide tools to promote or encourage healthy eating, exercise, weight loss or other activities generally related to a healthy lifestyle or wellness; track general daily activities or make exercise or posture suggestions; actively monitor and trend exercise activity; calculate calories burned in a workout, just to mention some (FDA, 2015).

Nowadays apps using technology that generates data derived from a single person about himself and the environment, known with the term *little data*, is the fastest growing sector of mHealth. This trend is driven by the growing number of technologies that track personal wellness and day-to-day health, i.e. Nike+ Fuelband, Fitbit and Jawbone UP. These devices collect small data sets that can help users monitor their health into managing it by providing targeted advice using information gathered. Additionally, due to the rise in popularity, mHealth providers are cooperating in order to enhance their offerings through collaboration with other platforms. For example, consumers can import their FitBit data to the MyFitnessPal app while Polar heart rate monitors allow users to upload data into the iPhone and Android across a variety of platforms. Little data represents an integral part of new technologies, turning consumers from passive to active managers of their health. Although utilization of little data is becoming more and more sophisticated, we are only in the beginning of understanding the benefits and opportunities it can offer in healthcare (Ruder Finn, 2013).

EVOLUTION AND DEVELOPMENT OF MHEALTH APPS

Analysts have predicted that in 2018 the global mHealth market will reach 10.2 billion dollars from 1.2 billion in 2012 (Transparency Market Research, 2013). In Germany, the mHealth market was 906 million in 2012 and is expected to reach 3 billion in 2017 (ATKearney, 2013). Although there are thousands of apps in this specific sector, few are the successful ones and they are mainly used by healthy and young individuals. The adoption by elderly people and patients will probably come as time passes by, with price reduction and usability improvements (Boulos, Wheeler, Tavares, & Jones, 2011).

Apps related to personalized health, wellness and fitness is the fastest growing sector in the U.S.A. the last few years, reaching the incredible 134% growth rate from 2010 to 2011 (Comscore, 2012). Also 9% of U.S.A. adults had downloaded at least one app in oredr to monitor their health and 38% had downloaded an app to check their everyday PA level (Fox & Duggan, 2012).

Today many apps related to wellbeing and people's lifestyle have been developed, which are able to connect with medical sensors and devices (i.e. smartwatches, wearables) and offer

personalized information and guidance on health issues. mHealth related apps cover a wide range of technological activities, including measurement of vital parameters of the human body, such as heart rate, blood glucose levels, blood pressure, body temperature and brain function. Through sensors, these apps collect medical, anthropometric, physical activity and lifestyle data. They have the potential to become the ground on which research and best practices for confronting individuals' everyday problems could be developed, through direct access to personal health data. In addition they could encourage users to improve their everyday life and develop healthier habits through personalized interventions. On the other hand it must be made clear that the main purpose of mHealth cannot be the replacement of health professionals, who will continue to have a key role in prevention and care, but to act as a supporting tool in health promotion (European Commission, 2014).

It has been estimated that 40.000 mHealth apps were availiable in all operating systems (West, 2012) and according to Research2Guidance report (2013) the number of mHealth and fitness apps in 2012 amounted to 97.000, of which 70% were associated to wellness and fitness (GlobalData, 2012), 31% with weight loss and 26% with exercise and PA (Verasoni, 2012). Furthermore, of the 300 most downloaded apps, the largest percentage, almost 33% (in total 102 apps), were exercise and PA apps (Dunbrack & Duffy, 2012). As it may be understood from the above data, mHealth has abandoned its initial pilot phase and has evolved into the commercial marketing phase. The following categories have been created in order to group these apps: (a) general healthcare and fitness; (b) medical information; (c) remote monitoring, collaboration and consultation; (d) healthcare management (Research2Guidance, 2013).

In a recent study on health apps only for iOS operating systems, it was estimated that in 2013 23.682 such apps existed, of which 7.407 were categorized as apps intended only for healthcare professionals and 16.275 for consumers and patients (IMS Institute for Health Care Informatics, 2013). The vast majority of these apps were designed in order to inform, guide and log users' data, while fewer apps were programmed to provide visual-graphical display and individualized guidance based on personal data. Most of these apps (8.786) were related to healthy living habits (i.e. diet, exercise, stress, sleep) and disease prevention, with over 5.400 apps aimed to measure calorie consumption, demonstrate exercises for fitness amelioration and control body weight (IMS Institute for Health Care Informatics, 2013).

Almost 16% of all smartphone owners in the U.S.A. use health related apps on a regular basis. Younger individuals are more likely to use them, especially till the age of 44, with the prevalent age been between 18 and 24 years (65%). Of those who use health apps, 49% represented healthy eating habits, 48% PA and fitness and 48% energy expenditure's estimation. However, they would prefer if the apps had also access to their health examinations' results (42%), could send alerts to health professionals and providers in cases of emergency (33%) and provide them access to their medical records through mobile devices (30%) (Ruder Finn, 2013). These results slightly changed in a recent study (Krebs & Dustin, 2015). Nowadays more than half of the U.S.A. mobile phone users have downloaded a health-related app, with fitness and nutrition apps been the most common ones used on a daily basis. Common reasons for not having downloaded apps were lack of interest, high costs and concern about apps collecting personal data. Individuals more likely to use health apps tended to be younger, have higher incomes, have a higher education level and have a body mass index in the obese range.

However, most of the previous conclusions came from studies in developed countries since few studies have been performed in low resource and developing countries, even though the use of mHealth in these settings may be extremely effective (Chakrabarti & Perera, 2013). Health systems in underdeveloped countries face many challenges in order to provide affordable, high quality healthcare. The main obstacles they face are the lack of infrastructures and insufficient access to information, so that health providers and policy makers have to adopt new methods in order to overcome these and mHealth is likely to be the solution. Increasing smartphones' use in these countries, healthcare in the near future can be improved significantly (Bastawrous, Hennig, & Livingstone, 2013). Nevertheless, there are many challenges to be overcome. India's example provides evidence that just the use of mHealth and technological advances in apps are not sufficient in order to challenge operational problems in low resource settings and underpriviledged societies. Illiteracy, wide range of dialects in thes same society, cultural and geographical differences and technological illiteracy are just few to mention (Skaria, 2013). Therefore there is a long way to go in order mHealth to become a reliable provider of healthcare services in low income countries.

The potential advantages of integrating mobile technologies into the healthcare services are clear: (a) new tools for consumers to manage their day-to-personal health; (b) better quality of care for a larger number of patients; (c) more easily standardized care through centralization and information technology developments; (d) new opportunities for physicians to monitor and provide care to patients remotely; (e) greater collaboration to provide integrated care by sharing patient data with all parties involved; (f) increased prevention and quality of life approach; (g) more efficient and sustainable healthcare; (h) more empowered patients (European Commission, 2014; Ruder Finn, 2013).

Of course there is an increasingly urgent need for more evidence on the validity, reliability and effectiveness of mHealth and many researchers suggest higher quality studies (Tomlinson, Rotherram-Borus, Swartz, & Tsai, 2013). The majority of randomized trials includes only sending and receiving text messaging which aim only to inform and remind health issues (Tomlinson, Rotherram-Borus, Swartz, & Tsai, 2013), with modest benefits (Free et al., 2013). Labrique and colleagues (2013) argue that even though there is some evidence to support the effectiveness of mHealth, the disruptive nature of this new technology creates new challenges.

The main problems for mHealth's integration in healthcare systems globally are various, such as integration and interoperability, privacy and security, technological obstacles, legislation, lack of governance and evidence, conservatice culture, just to mention some (Dehzad, Hillhorst, Bie, & Claassen, 2014). Furthermore, it may damage individuals' health due to misdiagnosis by healthcare professionals, faulty devices or apps, improper use of the apps, or even collection of inaccurate and invalid data. Therefore there is an urgent need for research and innovation in this sector in order to develop more advanced and effective mHealth solutions, which will ensure a high level of efficiency nad reliability, as well as secure data processing (European Commission, 2014). Also inconsistent rules in the development and production of these apps, the lack of well-designed clinical trials in order to demonstrate their effectiveness and to verify the accurate recording of data collected and the high cost of the devices, have a negative impact on the adoption of mHealth. As a result, it is necessary to for developers to better address consumer concerns in order to broaden apps' appeal and adoption (IMS Institute for Health

Care Informatics, 2013; Krebs & Duncan, 2015; Research2Guidance, 2013). Due to this high cost, mHealth apps will develop mostly in countries with a high rate of smartphone use and high expenditures on health (Research2Guidance, 2013).

Hswen and Viswanath (2015) have argued that for the promotion of this newely introduced health sector it is arguent need to enact government regulations, internationally certified research guidelines and convincing evidence based on clinical trials. They will also require specific strategic directions in order to serve the economically disadvantaged population groups, as these are the ones who can benefit the most from mHealth (Research2Guidance, 2013).

Despite the previous malfunctions, Hswen and Viswanath (2015) concluded that there are significant opportunities for mHealth in the present so that it can enact an important role in facing unequal opportunities observed in healthcare systems, but till now little attention has been given toward this direction. Nevertheless, Terry (2010) suggested that health evolution is to go mobile, as it is a practical and direct provision of health information and care.

FINAL REMARKS

This chapter has summarized the progression in mHealth care, specifically the development of smartphone apps. It can offer a baseline from which discussions can be started in order to examine possible advantages, limitations and complexities inherent in mHealth apps.

The smartphones' capability as a non-invasive health monitoring tool is developing rapidly. mHealth technology to manage everyday and chronic conditions and improve wellness is becoming ubiquitous, even though healthcare systems worldwide do not have accepted it as a viable and practical solution. Smartphones appear to be an acceptable alternative for estimating and delivering healthy lifestyles.

This is an initial attempt to deepen the understanding of the potential of mHealth for educators, researchers, health professionals and consumers. This new class of apps offers a considerable potential to advance both science and everyday practice of health and PA promotion. They can also become a valuable tool to help individuals monitor their health behavior and adopt more healthy and physically active lifestyles. The benefits of mHealth apps lie in their potential to overcome barriers between patients, clinicians and researchers through awareness of user's own actual health and PA levels. Of course, users should control their personal data in order to protect their privacy and let them decide the ones to be shared.

Future research regarding the smartphone apps' validity and usability are warranted, identifying both the accuracy and utility of downloadable programs, though keeping pace with the rapidly evolving mHealth market will be a challenge. Furthermore, measurable outcomes and well-designed clinical and randomized control trials are clearly needed to encourage healthcare providers, health professionals and funders to invest and adopt mHealth technologies on a wider scale. Measurable outcomes, mainly on validity and at a second level on sustained behavior change, will reinforce the apps' adoption and will bridge the gap between personal technology development and integration with the healthcare system. Maybe health evolution 'is to go mobile' some day in the future, however more evidence is needed in order to accomplish this prediction, taking into account the extreme protection which is necessary for personal health data. Until that day, many initiatives have to be taken by all stakeholders.

REFERENCES

1. Adams, P.F., & Schoenborn, C.A. (2006). Health behaviors of adults: United States, 2002-04. *Vital and Health Statistics, 230*, 1-140. [Medline:17069199]
2. ATKearney (2013). *Mobile health: Mirage or growth opportunity?* Korea: A. T. Kearney, Inc. Retrieved online from http://www.mobilehealthglobal.com/media/upload/pdf/mobile-health--mirage-or-growth--opportunity_editora_39_7_1.pdf
3. Bastawrous, A., Hennig, B., & Livingstone, I. (2013). mHealth possibilities in a changing world. Distribution of global cell phone subscriptions. *Journal of Mobile Technology in Medicine, 2*(1), 22-25. doi:10.7309/jmtm.78
4. Bauman, A., Bull, F., Chey, T., Craig, C.L., Ainsworth, B.E., Sallis, J.F., ... The IPS Group (2009). The International Prevalence Study on Physical Activity: Results from 20 countries, *International Journal of Behavioral Nutrition and Physical Activity, 6*(21). doi:10.1186/1479-5868-6-21
5. Blumenfeld, B.A.B., & Garvin, W.A. (2013). An update on mHealth regulations in the United States. *Journal of Mobile Technology in Medicine, 2*(3), 1-3. doi:10.7309/jmtm.2.3.1
6. Boulos, M.N., Wheeler, S., Tavares, C., & Jones, R. (2011). How smartphones are changing the face of mobile and participatory healthcare: An overview, with example from eCAALYX. *BioMedical Engineering OnLine, 10*(24). doi:10.1186/1475-925X-10-24
7. Brodersen, N.H., Steptoe, A., Boniface, D.R., & Wardle, J. (2007). Trends in physical activity and sedentary behaviour in adolescence: ethnic and socioeconomic differences. *British Journal of Sports Medicine, 41*(3), 140-144. doi:10.1136/bjsm.2006.031138.bjsm.2006.031138
8. Chakrabati, R., & Perera, C. (2013). The growth of mHealth in low resource settings. *Journal of Mobile Technology in Medicine, 2*(1), 1-2. doi:10.7309/jmtm.75
9. Cheng, Q., Juen, J., Li, Y., Prieto-Centurion, V., Krishnan, J.A., & Schatz, B.R. (2013). *GaitTrack: Health monitoring of body motion from spatio-temporal parameters of simple smart phones*. Proceedings of the International Conference on Bioinformatics, Computational Biology and Biomedical Informatics, Washington DC, USA. Retrieved online from http://healthit.illinois.edu/wp-content/uploads/2013/08/acmbcbhis2013_GaitTrack.pdf
10. Comscore (2012). *Mobile Year in Review 2011*. Retrieved online from: http://www.comscore.com/Insights/Presentations_and_Whitepapers/2012/2012_Mobile_Future_in_Focus
11. Davis, C.A., Spence, J.C., Vandelanotte, C., Caperchione, C.M., & Mummery, W.K. (2012). Meta-analysis of internet-delivered interventions to increase physical activity levels. International Journal of Behavioral Nutrition and Physical Activity, *9*, 52. doi:10.1186/1479-5868-9-52
12. Dehzad, F., Hillhorst, C., de Bie, C., & Claassen, E. (2014). Adopting health apps, what's hindering doctors and patients? *Health, 6*, 2204-2217. doi: http://dx.doi.org/10.4236/health.2014.616256
13. Deloitte (2012). *mHealth in an mWorld.: How mobile technology is transforming health care*. UK: Deloitte Development LLC. Retrieved online from http://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-lhsc-mhealth-in-an-mworld-103014.pdf
14. Dumith, S.C., Hallal, P.C., Reis, R.S., & Kolh III, H.W., (2011). Worldwide prevalence of physical inactivity and its association with human development index in 76 countries, *Preventive Medicine, 53*(1-2), 24-28. doi:10.1016/j.ypmed.2011.02.017
15. Dunbrack, L.A., & Duffy, J. (2012). *The second wave of clinical mobility: Strategic solution investments for mobile point of care in Western Europe*. Framingham, MA: IDC Health insights. Retrieved online from http://www.ehealthnews.eu/images/stories/pdf/idc_the_second_wave_of_clinical_mobility.pdf
16. Ericsson (2014). *Ericsson mobility report: On the pulse of the networked society*. Retrieved online from http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-november-2014.pdf
17. European Commission (2013). *Sport and physical activity (Special Eurobarometer 412)*. Brussels: European Commission. Retrieved online from http://ec.europa.eu/public_opinion/archives/ebs/ebs_412_en.pdf

18. European Commission (2014). *Green paper on mobile Health*. Brussels: European Commission.
19. Food and Drug Administration (2015). *Mobile medical applications: Guidance for industry and Food and Drug Administration staff*. Retrieved online from http://www.fda.gov/downloads/MedicalDevices/.../UCM263366.pdf
20. Foster, D., Linehan, C., Kirman, B., Lawson, S., & James, G. (2010). *Motivating physical activity at work: Using persuasive social media for competitive step counting*. Proceedings of the 14th International Academic MindTrek Conference: Envisioning Future Media Environments (pp. 111-116). New York, NY.
21. Fox, S., & Dugggan, M. (2012). *Mobile Health 2012*. Washington D.C.: Pew Research Center's Internet & American Life Project. Retrieved online from http://www.pewinternet.org/~/media//Files/Reports/2012/PIP_MobileHealth2012.pdf
22. Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., Patel, V., & Haines, A. (2013). The effectiveness of mobile-Health technologies to improve health care service delivery processes: A systematic review and meta-analysis. *PLoS Medicine*, *10*, e1001363. doi:10.1371/journal.pmed.1001363
23. GlobalData (2012). *mHealth: Healthcare goes mobile*. Retrieved online from: http://www.globaldata.com/PressReleaseDetails.aspx?PRID=294&Type=Industry&Title=Medical+Devices
24. Griffiths, F., Lindenmeyer, A., Powell, J., Lowe, P., & Thorogood, M. (2006). Why are health care interventions delivered over the internet? A systematic review of the published literature. *Journal of Medical Internet Research, 8*(2), e10. doi:10.2196/jmir.8.2.e10
25. Hallal, P.C., Victora, C.G., Azevedo, M.R., & Wells, J.C. (2006). Adolescent physical activity and health: a systematic review. *Sports Medicine, 36*(12), 1019-1030.
26. Hswen, Y., & Viswanath, K. (2015). Beyond the hype: Mobile Technologies and opportunities to address health disparities. *Journal of Mobile Technology and Medicine, 4*(1), 39-40. doi:10.7309/jmtm.4.1.9
27. IMS Institute for Health Care Informatics (2013). *Patient apps for improved healthcare: From novelty to mainstream*. Parsippany, NJ: IMS Institute for Health Care Informatics. Retrieved online from https://developer.imshealth.com/Content/pdf/IIHI_Patient_Apps_Report.pdf
28. Intille, S.S., Lester, J., Sallis, J.F., & Duncan, G. (2012). New horizons in sensor development. *Medicine and Science in Sports and Exercise, 44*(Suppl. 1), S24-31. doi:10.1249/MSS.0b013e3182399c7d
29. Istepanian, R., Jovanov, E., & Zhang, Y.T. (2004). Introduction to the special section on m-Health: Beyond seamless mobility and global wireless health-care connectivity. *IEEE Transactions on Information Technogy in Biomedicine, 8*(4), 405-414. doi:10.1109/TITB.2004.840019
30. Krebs, P., & Duncan, D.T. (2015). Health app use among US mobile phone owners: A national survey. *JMIR mHealth uHealth, 3*(4), e101. doi: 10.2196/mhealth.4924
31. Labrique, A., Vasudevan, L., Chang, L.W., & Mehl, G. (2013). H_pe for mHealth: More "y" or "o" on the horizon? *International Journal of Medical Informatics*, *82*, 467-469. doi:http://dx.doi.org/10.1016/j.ijmedinf.2012.11.016
32. Lee, J.M., Kim, Y.W., Kwon, Y.S., Derrick, T.R., & Welk, G.J. (2015). Feasibility of calibrating smartphone to access physical activity. *The Korean Journal of Measurement and Evaluation in Physical Education and Sport Science, 17*(3), 1-10.
33. Liu, C., Zhu, Q., Holroyd, K.A., & Seng, E.K. (2011). Status and trends of mobile-health applications for iOS devices: A developer's perspective. *Journal of Systems and Software*, *84*, 2022-2033. doi:10.1016/j.jss.2011.06.049
34. Lox, C., Ginis, K.M., & Petruzzello, S.J. (2010). *The Psychology of Exercise: Integrating Theory and Practice* (3rd ed.). Scottsdale: Holcomb Hathaway Publishers.
35. Mokdad, A.H., Marks, J.S., Stroup, D.F., & Gerberding, J.L. (2004). Actual causes of death in the United States, 2000. *JAMA, 291*(10), 1238-1245.
36. Norris, A.C., Stockdale, R.S., & Sharma, S. (2009). A strategic approach to m-Health. *Health Informatics Journal*, *15*, 244-253. doi:10.1177/1460458209337445
37. Rabin, C., & Bock, B. (2011). Desired features of smartphone applications promoting physical activity. *Telemedicine Journal and e-Health, 17*(10), 801-803. doi:10.1089/tmj.2011.0055

38. Research2Guidance (2013). *Mobile health market report 2013-2017: The commercialization of mHealth applications* (vol. 3). Research2Guidance.
39. Ruder Finn (2013*). mHealth Report*. New York, NY: Ruder Finn.
40. Skaria, G. (2013). mHealth in health information delivery; The Indian scenario. *Journal of Mobile Technology in Medicine, 2*(1), 26-29. doi:10.7309/jmtm.79
41. Stephens, J., & Allen, J. (2013). Mobile phone interventions to increase physical activity and reduce weight: A systematic review. *Journal of Cardiovascular Nursing, 28*(4), 320-329. doi:10.1097/JCN.0b013e318250a3e7
42. Terry, M. (2010). Medical apps for smartphones. *Telemedicine Journal and e-Health, 16*(1), 17-22. doi:10.1089/tmj.2010.9999
43. Thompson, P.D., Buchner, D., Pina, I.L., Balady, G.J., Williams, M.A., & Marcus, B.H. (American Heart Association Council on Clinical Cardiology Subcommittee on Exercise, Rehabilitation, Prevention, American Heart Association Council on Nutrition, Physical Activity, Metabolism Subcommittee on Physical Activity) (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: A statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation, 107*(24), 3109-3116. doi:10.1161/01.CIR.0000075572.40158.77
44. Thompson, P.D., Franklin, B.A., Balady, G.J., Blair, S.N., Corrado, D., & Estes, N.A. (American Heart Association Council on Nutrition, Physical Activity, Metabolism, American Heart Association Council on Clinical Cardiology, American College of Sports Medicine) (2007). Exercise and acute cardiovascular events placing the risks into perspective: A scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism and the Council on Clinical Cardiology. *Circulation, 115*(17), 2358-2368. doi:10.1161/CIRCULATIONAHA.107.181485
45. Tomlinson, M., Rotheram-Borus, M.J., Swartz, L., & Tsai, A.C. (2013). Scaling up mHealth: Where is the evidence? *PLoS Medicine*, *10*, e1001382. doi:10.1371/journal.pmed.1001382
46. Transparency Market Research (2013). *mHealth services (prevention, monitoring, diagnostic, treatment, information and reference, wellness, and healthcare strengthening services) market - global industry analysis, size, share, growth, trends and forecast 2014 – 2020*. USA: Transparency Market Research. Retrieved online from http://www.transparencymarketresearch.com/mobile-health-market.html
47. van der Berg, J.D., Stehouwer, C.D., Bosma, H., van der Velde. J.H., Willems, P.J., Savelberg, H.H., … , Koster, A. (2016). Associations of total amount and patterns of sedentary behaviour with type 2 diabetes and the metabolic syndrome: The Maastricht Study. *Diabetologia*, 1-10 [Epub ahead of print].
48. Verasoni (2012). *Mobile Health Applications: 2012 Study*. Retrieved online from http://verasoni.com/mobile-health-applications-2012-study/
49. West, D. (2012). *Issues in technology innovation: How mobile devices are transforming healthcare*. The Center for Technology Innovation. Retrieved online from http://www.brookings.edu/~/media/research/files/papers/2012/5/22%20mobile%20health%20west/22%20mobile%20health%20west.pdf
50. Westerterp, K.R. (2013). Physical activity and physical activity induced energy expenditure in humans: measurement, determinants, and effects. *Frontiers in Physiology, 4*, 90. doi:10.3389/fphys.2013.00090
51. World Health Organization (2009). *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks*. Switzerland: World Health Organization. Retrieved online from http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf
52. World Health Organization (2011). *mHealth - New horizons for health through mobile technologies, Global Observatory for eHealth series - Volume 3*. Switzerland: World Health Organization. Retrieved online from http://www.who.int/goe/publications/goe_mhealth_web.pdf
53. World Health Organization (2014). *Prevalence of insufficient physical activity: Situation and trends*. Switzerland: World Health Organization. Retrieved online from http://www.who.int/gho/ncd/risk_factors/physical_activity_text/en/

THE PORTABLE DEVICES AS MEANS TO PROMOTE CHILDREN'S ACTIVE LIFESTYLE: THE CASE OF A WALK TO SCHOOL ACTION IN ITALY

MONIA ARDUINI, ANTONIO BORGOGNI, GIOVANNI CAPELLI.
Department of Human Sciences, Society, and Health University of Cassino and Southern Lazio, Cassino, Italy

INTRODUCTION

Children's autonomy in European countries has sharply declined in the last decades in correspondence with the decrease of their daily physical activity as for example free play and walk to school. Moreover, the use of desktop computer and electronic devices has been often related (Laurson et al., 2008) to sedentary behaviours in children (the so-called screen time). Nevertheless, the development of portable devices, with which children play the same electronic games and applications they used to play at desktop computers, opens new perspectives in the relationship between the screen time and physical activity.

The hypothesis of the PhD research is that the implementation of walk to school actions, supported by the creation of an application prototype aimed at enhancing children's movements, could enhance active lifestyles.

RESEARCH PLAN

The literature review focused on children's lifestyles, physical activity and autonomy as unperceived rights (Borgogni, 2015) of the children to play and to move freely in the public space. A particular attention has been drawn on the use of portable ICT devices and the internet access in the light of social inequality and digital divide.

Furthermore, a three-years longitudinal research-intervention on a case of walk-to-school action in Cassino (IT) has begun in 2015 with the aim to define the criteria to promote active commuting to schools.

A selected group of fourth grade children (nine years old) involved in the walk to school action, will participate in the 2016/17 school year in the development of a prototype application for portable devices suitable for motivating them to be more active.

The literature review has been conducted through reading books, reports, and scientific articles selected by database (e.g. PubMed, Google Scholar) through key words (e.g. children and autonomy, children and active lifestyle, children and ICT devices). The literature materials had been clustered into three macro areas: active and sedentary lifestyles; walk to school routes, autonomy, and play; the role of ICT devices.

THE SCIENTIFIC BACKGROUND

Active and sedentary lifestyles

The literature review attests that the sedentary lifestyle is one of the main causes of obesity in children. These evidences led to carry out programs and actions to promote active lifestyles

on the frame of health prevention in several countries including Italy. The Italian Governmental Surveillance System "Okkio alla Salute" in 2014 shows that 20,9% of the children 8-9 y/o are overweight and 9,8% are obese, among the highest rates in EU. Data regarding physical activity and sedentary lifestyles shows that 18% of children 8-9 y/o practice sport no more than one hour per week, 35% spend more than two hours watching TV and/or playing videogames, and 28% go to school by walk or bike (Ministero della Salute/CCM, 2014).

The International Surveillance System HBSC (Health Behaviour in School-aged Children) remarks that Italian children 11 y/o in 2014 practice more physical activity[1] than in 2010 (boys from 47,6% to 57,3%; girls from 35,3% to 42,3%), spend less time watching TV[2] (boys from 26,3% to 22,2%; girls from 20,8% to 19,3%), and pass more time to play with pc, tablet and smartphone[3] (boys from 17,8% to 20,9%; girls from 8,7% to 16,5%) (HBSC, 2016).

Walk to school Routes, autonomy, and play

The international comparative research *Children's Independent Mobility*, promoted by the Policy Studies Institute in London, had been carried out in eighteen countries. In Italy had been conducted by the Institute of Cognitive Sciences and Technologies of Italian National Research Center (CNR). According to the preliminary data, emerges that the children's autonomy in walk to school routes in Italy (7%) is much lower than in England (41%) and Germany (40%) (Renzi, Prisco, & Tonucci, 2014).

Grize, Bringolf-Isler, Martin, & Braun-Fahrländer (2010) compared the transport's modality of the children 6-14 y/o in Switzerland in 1994, 2000 and 2005. According to their findings, the active commuting had been reducing (1994= 78.4%; 2000= 72.1%; 2005= 71.4%); the urban areas influence negatively the use of the bike and, particularly interesting finding opening the field to the study of cultural differences, German speaking children bike to school more (over 20%) than France and Italian speaking (less than 10%).

Concerning the policies to make the school-commuting safer, DiMaggio & Li (2013) studied the effectiveness of the programme "Safe Routes to School – SRTS" in New York, financed by the Municipality; the programme concerned the improvement of safety infrastructural measures on the main school-routes. After the interventions, the rate of students 5-19 y/o injured on the journey to or from school dropped by 33%. Even more significant is that the reduction in children 5-9 y/o was 42% and 35% in children 10-14 y/o.

Fjortoft (2004) studied the environmental characteristic influencing physical active play and motor development in children in Norway. The experimental group (n=46) played 1-2 hours per day in the forest while a control group (n=29) played in a traditional playground. The tools used were GPS, GIS, test EUROFIT and Motor Fitness Test. The results show that children playing in natural environment reached better motor skills respect the control group. According to the "Theory of Affordances", the environment influences play behaviours, learning and children's development.

Prezza, Alparone, Renzi, & Pietrobono (2010) studied the effectiveness of "go to school alone" program carried out in Rome (IT). The results were quite encouraging concerning the

1 The data concern those practicing at least one hour of activity for more than three days a week

2 Those spending three or more hours per day in front of TV

3 Those spending three or more hours per day playing with pc, smartphone or tablet

children's autonomy and free play outside school-hours; meanwhile, the results concerning children's autonomy in going to school alone were unclear. In fact, only the children attending one of the two primary schools involved in the study showed significant improvements after the program (+22%). Those who benefited more where older (9-11 y/o) and male children.

ICT devices

The advances in technology can encourage physical activity in children. The Zamzee Programme, designed for children 8-14 y/o, is a 3-axis accelerometer-based activity meter connected to a website. It's a collaborative project between Mayo Clinic, Zamzee Company, and the Rochester Public Schools. The objectives of the study were: to test the Zamzee Programme to define its usability and feasibility in the classroom setting; to measure, during the seven weeks' study period children activity levels and BMI changes. The students enrolled in the study were 11 of which 7 completed all study activities. The study demonstrated the usability of Zamzee but didn't establish significant changes in physical activity level or BMI. According to the authors of the study, the programme should be assessed in larger scale studies to ascertain the efficacy (Lynch et al., 2015).

According to Gao & Chen (2014), even if active video games are recommended to encourage sedentary children to be more active, they cannot substitute overall physical activity. Moreover, playing active video games do not increase physical activity, in fact, there is no evidence that children playing active video games are more active than children who play inactive video games (Baranowski et al., 2012).

For what concerns the use of ICT devices in Italy, the data of the last research carried out by the National Research Institute (ISTAT) show that the 52,8% of the children 6-10 y/o use personal computer (11,4% every day, 30,5% one or more times per week, 8,3% sometimes per month, 2,6% sometimes per year). The 44,4% of the children 6-10 y/o use Internet (9,0% every day, 25,6% one or more times per week, 7,2% sometimes per month, 2,6% sometimes per year). These data confirm that the prevalent use of the personal computer is linked to internet access. On the other side, the 45,6% never used a computer and the 52,0% never accessed the internet. Among those who never accessed the internet, the 17,3% do not know internet at all and for the 9,1% there are no available devices (ISTAT, 2014).

RESEARCH METHODS AND TOOLS

A questionnaire on the children autonomy validated by the Italian National Research Center (CNR-Institute of Cognitive Sciences and Technologies) had been used as mean research tool in the first year of the longitudinal research. The questionnaire had been administered to third, fourth, and fifth grade students (8-11 y/o) in May 2015 in three primary schools of Cassino (IT), two of which already involved in walk to school actions organized by our university. The students also received a questionnaire for their parents: 693 questionnaires were returned by children and 569 by parents.

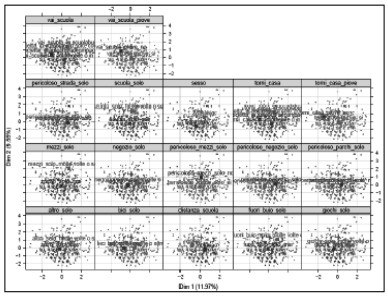
The parents' questionnaire is composed by four main parts: parents' socio-demographic data, children's autonomy, participation in sport, use of ICT devices and internet. The questionnaire will also be administered for the next two school-years.

Moreover, qualitative tools like interviews and focus groups with teachers and parents will be used for a more in-depth interpretation of the data. A first focus group with selected teachers had been administered in March 2016.

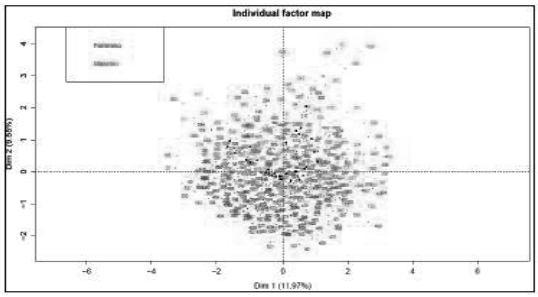
Concerning the development of the application to enhance children's active lifestyles, focus groups and application testing will be carried out in 2016/17 with a selected group children of fourth grade classes involved in the walk to school action.

RESULTS

The Factor Analysis with variables (Graph.1) shows as children answer homogeneously with few deviations that are currently investigated. The data represent a very compact cloud for almost all variables. This compactness indicates homogeneity in the responses with similar trends among the variables. The technique used had been the Performs Multiple Correspondence Analysis (MCA).

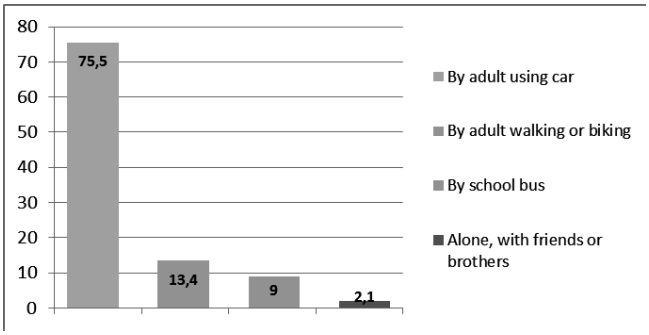


Graph 1 Factor analysis with variables



Graph 2. Factor analysis with distinction between genders (Green= Males; Red= females)

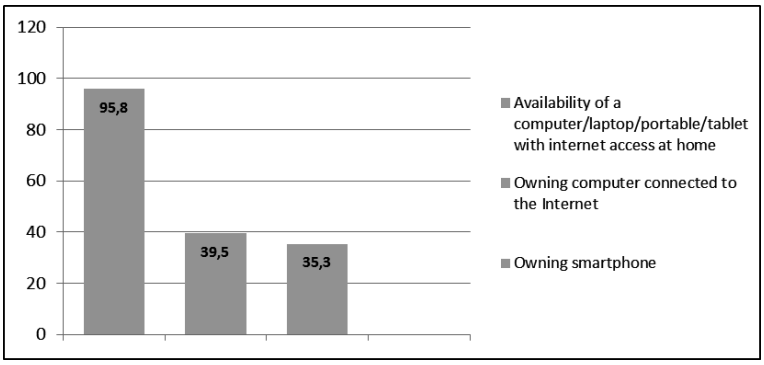
The first elaboration of the parents' results (Graph.3) shows that the 75,5% of the children go to school accompanied by an adult using the car (68,7% reported by the children in their questionnaire), the 13,4% by an adult walking or biking (18,9% for children), the 9% use school bus (7,8% for children), and the 2,1% alone, with friends or brothers (4,6% for children).



Graph 3. In this period, how your son usually go to school? – Source: Parental questionnaires, Pedibus 2015

The data concerning the sport practiced out of school time show that the 79,7% of the children play sport: the 28,6% swimming, the 22,2% dance, and the 19,4% football.

The data concerning technology (Graph.4) reveal that the 46,4% of the children have a cell phone; the 95,8% have a computer/laptop/portable/tablet with internet access at home, the 39,5% have their own computer connected to the internet, the 35,3% have a smartphone.



Graph 4. Use and ownership of technological devices and Internet (by children) – Source: parental questionnaires, Pedibus 2015

Concerning the qualitative part of the research, from the focus group with the teachers emerged their difficulties at school. According to their statements, several conditions do not allow the autonomy and physical activity of the children: bureaucracy, legislation, the lack of appropriate infrastructure, and above all the parents' overprotective mental culture. We can here refer to the concept of "helicopter parents" as mentioned by Shoup, Gonyea, & Kuh (2009). The parents accompany their sons by car "almost driving them into the classroom" programming their afternoon time in closed and protected places. The children don't manage their time and don't know any more how to play. During PE classes, children practice always in the gym and never outdoor. What it might be interesting to highlight is that, according to teachers, the two categories of children showing more autonomy are those from foreign families because of the different culture about autonomy and some disabled children encouraged by parents to take the initiative to cross the road. The schools have computers and interactive multimedia boards but do not deliver any program or subject to teach a safe use of internet and portable devices.

FUTURE DEVELOPMENTS

The second year questionnaires administration will be completed by the end of the 2015/16 school year.

The 2015/16 school year has also witnessed the first implementation of the walk to school program with the selected fourth grade classes increasing the frequency of the days in which the pupils go to school by walking.

In the school year 2016/17 the walk to school program will be made continuous, the questionnaires will be administered at the end of the year, focus groups with teachers and parents will be carried out.

Regarding the development of the prototype application for portable devices the following stages of the intervention research are planned: a) selection of a sample of fourth grade children; b) focus group aimed at understanding their behaviours related to ICT devices; c) installation of an application in their mobile devices; d) testing of the application; e) focus group aimed at assessing the application and installing a second application; the stages c, d, e will be repeated for two times thus testing three apps; a focus group to define the characteristics of a suitable app to be developed for future testing will be administered at the end of the testing. The applications that will be installed on the children's devices[4] will be chosen among those described in the literature review and freely accessible. The expected output of the intervention research concerning the ICT devices will be guidelines aimed to develop effective, easy-to-use and free applications for children useful to enhance their active lifestyles.

DISCUSSION, CONCLUSIONS

What emerges from the results at the present stage of the research is that the reasons explaining the lack of autonomy of the children studied in our research, are cultural and educational; the main reasons are the parents' attitudes, the teachers concerns, and the strict and oppressive regulations. Just as example, as far as we concern, Italy is probably the only country in which primary and lower secondary students cannot exit the school without being accompanied by an adult.

The meetings and focus groups with teachers and parents will deal with these factors trying to establish a common cooperative educational project, including the use of the prototype application, to enhance children' autonomy and, definitively, their level of physical activity.

We hypothesize that the results will derive from both branches of the research-intervention: the implementation of the walk to school action combined with the creation of the prototype app to be used by a selected sample of children. We assume that these two approaches will enhance children's motivation to be more physically active.

The overall purpose of the research is to show that a walk-to-school action in parallel with a participatory approach in building applications can play a scaffolding role for enhancing children's autonomy and physical activity.

REFERENCES

1. Baranowski, T., Abdelsamad, D., Baranowski, J., O'Connor, T. M., Thompson, D., Barnett, A.,… Chen, T. A. (2012). Impact of an active video game on healthy children's physical activity. *Pediatrics*, *129*(3), e636-e642. DOI: http://dx.doi.org/10.1542/peds.2011-2050.
2. Borgogni A. (2015). I diritti inavvertiti: i minori e la pratica sportiva, in Tomarchio A., Ulivieri S., *Pedagogia militante. Diritti, culture, territori. Atti del 29° convegno SIPED*. Pisa, ETS, 347-354.
3. DiMaggio, C., & Li, G. (2013). Effectiveness of a Safe Routes to School Program in Preventing School-Aged Pedestrian Injury. *Paediatrics*, 131(2), 290-296. doi:10.1542/peds.2012-2182.

[4] At the time of writing a negotiation with a company of mobile phones and internet provider to obtain free phones is on going

4. Fjortoft, I. (2004). Landscape as Playscape: The Effects of Natural Environments on Children's Play and Motor Development. *Children, Youth and Environments*, 14(2), 21-44. Retrieved from http://www.colorado.edu/journals/cye/. Last access 25th of April 2016.
5. Gao, Z., & Chen, S. (2014). Are field-based exergames useful in preventing childhood obesity? A systematic review. *Obesity Review,* 15(8), 676-691. DOI: 10.1111/obr.12164.
6. Grize, L., Bringolf-Isler, B., Martin, E., & Braun-Fahrländer, C. (2010). Research Trend in active transportation to school among Swiss school children and its associated factors: three cross-sectional surveys 1994, 2000 and 2005. *International Journal of Behavioral Nutrition and Physical Activity*, *28*(7), 1-8.
7. HBSC. (2016). *4° Rapporto sui dati HBSC Italia 2014*. Retrieved from http://www.hbsc.unito.it/it/images/pdf/hbsc/report_nazionale_2014.pdf. Last access 28th of April 2016.
8. ISTAT. (2014). *Cittadini e nuove tecnologie*. Retrieved from http://www.istat.it/it/archivio/143073. Last access 23rd of April 2016.
9. Laurson, K. R., Eisenmann, J. C., Welk, G. J., Wickel, E. E., Gentile, D. A., & Walsh, D. A. (2008). Combined influence of physical activity and screen time recommendations on childhood overweight. *The Journal of pediatrics*, *153*(2), 209-214. doi:10.1016/j.jpeds.2008.02.042.
10. Lynch, B.A., Jones, A., Biggs, B.K., Kaufman, T., Cristiani, V., Kumar, S., . . . Jacobson, N., (2015). Implementing Child-focused Activity Meter Utilization into the Elementary School Classroom Setting Using a Collaborative Community-based Approach. *Journal of Community Medicine & Health Education*, 5(6). doi:10.4172/2161-0711.1000379.
11. Ministero della Salute/CCM (Centro per il Controllo e la prevenzione delle Malattie) (2014). *Sistema di sorveglianza Nazionale Okkio alla Salute. Sintesi dei risultati*. Retrieved from http://www.epicentro.iss.it/okkioallasalute/ . Last access 26th of April 2016.
12. Prezza, M., Alparone, F.R., Renzi, D., & Pietrobono, A. (2010). Social participation and independent mobility in children: the effects of two implementations of "We go to school alone". *Journal of Prevention & Intervention in the Community*, 38(1), 8-25. DOI:10.1080/10852350903393392
13. Renzi, D., Prisco, A., & Tonucci, F. (2014). L'autonomia di movimento dei bambini: una necessità per loro, una risorsa per la scuola e per la città. *Studium Educationis*, 15(3), 105-119.
14. Shoup, R., Gonyea, R. M., & Kuh, G. D. (2009). Helicopter parents: Examining the impact of highly involved parents on student engagement and educational outcomes. In *49th Annual Forum of the Association for Institutional Research, Atlanta, Georgia. Retrieved from http://cpr. iub. edu/uploads/AIR*(Vol. 202009). Last access 25th of April 2016.

INTERACTION APS- SANTE, PRODUCTIVITE DU CAPITAL HUMAIN ET REDUCTION DES DEPENSES DE L'ETAT EN COTE D'IVOIRE

SERGE A. AYEKO
Université d'Abomey-Calavi (UAC), Abomey-Calavi, Benin

FULBERT G. AMOUSSOUGA.
Faculte De Sciences Economiques Et De Gestion, Abomey-Calavi, Benin

LIBERAT TANIMOMO
Université d'Abomey-Calavi (UAC), Abomey-Calavi, Benin

ABSTRACT

We tried to bring elements of answers to the question to know if the practice of physical and sports activity (PSA) by the population improvement the health, the productivity of the human capital and in turn generates economies of scale for the state concerning Côte d'Ivoire. To reach there we targeted through a survey with a sample of the working population witch practices a sport or regular physical activity in the district of Abidjan

Keywords: APS, health, human capital, economies of scale

INTRODUCTION

L'impact des activités physiques sur les dépenses de santé fait actuellement l'objet de recherches très actives menées notamment au niveau de l'OMS, aux USA[1], au Canada[2], en Australie, où les études et recherches permettent d'établir une relation solide entre la pratique d'une activité sportive régulière et modérée, sur l'amélioration du bien-être du capital humain et les économies d'échelle considérables qui en découlent au niveau des dépenses de santé de l'Etat (Rieu, 1995).

Dans les pays en développement, l'impact du sport sur la santé est bien connu, mais pour les pouvoirs publics, la politique de prévention de la santé à travers le sport fait encore l'objet d'un discours ambigu (Kemo Keimbo, 2004).

En Côte d'Ivoire, le sport fait partie du champ d'action publique. La politique sportive a favorisé l'explosion des disciplines sportives pratiquées, l'augmentation du nombre de fédérations sportives (moins de 30 en 2007, à plus de 42 en 2010), de licenciés sportifs (estimés à plus de 60.000 par le MJSL[3]) et des sportifs auto-organisés qui évoluent dans un cadre informel. Reste qu'à ce jour, les travaux académiques d'analyse économique en lien avec les

[1] US Surgeon Generals Report (1996), rassemble toutes les études scientifiques publiées au fil de plusieurs décennies de recherches sur l'activité physique et la santé au Etats-Unis

[2] Institut canadien de la Recherche sur la condition physique et le mode vie, 1997

[3] Ministère de la promotion de la Jeunesse, des sports et loisirs

questions épidémiologiques relatives à l'impact des activités physiques sur la santé du capital humain et la productivité de l'économie, sont quasi inexistants.

Dans ce papier de recherche, nous souhaitons apporter des éclairages nouveaux pour, d'une part, examiner l'effet du lien APS-santé sur la productivité du capital humain et d'autre part, quantifier l'incidence de la productivité individuelle et collective du capital humain sur la réduction des dépenses de l'Etat en matière de santé publique, auprès d'un échantillon de la population active qui pratique un sport ou une activité physique régulière dans le district d'Abidjan.

1. Revue de la littérature et développement des hypothèses

Pour aborder le rôle positif du sport et des activités physiques dans la société, nous allons nous attarder dans un premier temps sur les effets de l'activité physique sur la productivité du capital humain et la réduction des dépenses de l'Etat. Dans un deuxième temps, nous présenterons l'approche conceptuelle qui concoure à appréhender l'APS à la fois comme bien de consommation et comme un investissement alternatif intermédiaire, avant d'annoncer les hypothèses qui en découlent pour cette étude.

1.1. Effet de l'activité physique sur productivité du capital humain

Selon des études récentes, la pratique d'une APS allonge l'espérance de vie, diminue l'absentéisme au travail et augmente la productivité du capital humain, notamment sur le lieu de travail (Nys, 2006 ; Swanson et al. 2012).

Ainsi, aux États-Unis, plus de 12 000 entreprises de plus de 50 salariés, financent des programmes communs de promotion de la santé, et parviennent par conséquent à réaliser des économies d'échelle estimées à 272 $ par employé soit 26 milliards de dollars au total. Le rapport coût / bénéfice varie, selon les études, par 1 à 8 (Kaman et Patton, 1994).

Au Canada, en 1992, 48 % des entreprises de plus de 20 salariés encourager leur personnel à pratiquer une activité physique pour garder la forme et 53 % d'entre eux offrent la possibilité de participer aux compétitions interentreprises, aux vacances de ski ou aux tournois de golf (Katzmarzyk et al., 2000). Dans l'ensemble, les avantages économiques pour les entreprises représentent environ 1 % de leurs dépenses de personnel. Les entreprises ont un intérêt direct à améliorer la santé de leurs employés. La mise en œuvre des programmes visant à encourager les activités physiques et sportives se traduit par plus de gains que les coûts.

1.2. Activités physiques et réduction des dépenses publique

Plusieurs auteurs se sont intéressés aux retombées qu'engendrent la démocratisation des APS sur l'amélioration de la santé et les économies d'échelle qui en découlent en matière de dépenses de santé publiques pour l'Etat central (Stephenson et al, 2000 ; Cadilhac et al., 2011).

Pour Stephenson et al (2000), une augmentation du taux de pratique physique de 25% permet à l'Etat de gagner 2 à 5 milliards de productivités. Plus récemment, l'étude de Cadilhac et al. (2011) a permis d'estimer les bénéfices économiques et les coûts associés à l'activité ou l'inactivité physique dans la société australienne. Les auteurs parviennent à montrer que

l'inactivité physique a des impacts majeurs sur la santé et la productivité. Les retombées économiques ont été estimées comme ces coûts d'opportunité qui représentent une réduction des ressources destinées aux dépenses publiques dans le secteur de la santé.

Dans l'ensemble, la plupart des études revues montrent qu'un certain nombre de pathologies et maladies chroniques pourraient être évité par une pratique régulière d'activité physique et sportive, d'une part, et par conséquent générer des économies importantes pour les employeurs, les systèmes de soins de santé publique et les contribuables, d'autre part.

Finalement on peut conclure par mentionner que la démocratisation de la pratique des APS permet d'améliorer la santé de la population et contribue à réduire les dépenses de santé l'Etat. Ainsi, nous pouvons formuler l'hypothèse de notre étude de la manière suivante : la relation symbiotique APS- santé, contribue à la productivité du capital humain et génère des économies d'échelle pour l'Etat.

1.3. Approches conceptuelles

Au plan théorique, deux types de théories économiques concourent pour expliquer les raisons pour lesquelles les individus s'engagent dans la pratique d'une activité: la théorie «néoclassique» et un ensemble de théories alternatives, qualifié d'hétérodoxes.

1.3.1. Approches néoclassiques

Au plan théorique, Cawley (2004) propose un cadre économique pour expliquer l'utilité de l'activité physique considérée aussi comme activité de loisirs. Il suppose que l'utilité dépend de la masse corporelle, de la santé, de la nourriture et du temps consacré à dormir (S), au loisir (L), au travail (O), au transport (T) et à la production de tâches domestiques (H). L'auteur appelle cette approche, le modèle de SLOTH.

Une caractéristique intéressante de ce modèle est que la santé dépend directement et indirectement de la pratique de l'activité physique. Le modèle de SLOTH sert souvent de point de départ théorique pour tester les prédictions des modèles concrets, sur la motivation particulière de l'individu à s'engager dans une activité physique afin d'en tirer des bénéfices spécifiques. Toutefois, Cawley (2004) ne fournit pas un modèle définitif d'optimisation de la pratique d'une APS, en raison de tous les liens complexes indirects qui subsistent quant aux conséquences de la consommation d'une APS.

1.3.2. Approches économiques hétérodoxes

Humphreys et Ruseski (2011) s'inspire du modèle SLOTH, pour élaborer un modèle d'optimisation des comportements individuels liés à des déterminants sociaux plus large, décrit comme suit:

Max U = U (H, I, Y),

avec H = H (PA, I), sous réserve des contraintes suivantes:

i. Y = w * O,

ii. O + PA = 24 heures.

D'autres auteurs ont utilisé le modèle de SLOTH comme un point d'ancrage théorique, pour justifier du rôle de l'activité physique comme un bien intermédiaire dans l'amélioration de la santé et la production individuelle (Metzler et Jena, 2010). En nous appuyant sur la revue théorique et les études qui la sous tendent, nous nous sommes inspirés des travaux qui se sont intéressés à modéliser la pratique du sport, à la fois comme bien de consommation et comme un investissement alternatif intermédiaire, pour modéliser dans notre cas, l'effet de l'APS sur l'amélioration de la santé et la productivité du capital humain et son incidence sur la réduction des dépenses de l'Etat en matière de santé publique (Humphreys et Ruseski, 2011) .

2. Choix méthodologiques

Cette partie porte sur la construction du questionnaire, le choix de l'échantillon et sur l'estimation du modèle d'analyse.

2.1. La construction du questionnaire

Sur la base des acquis théoriques et des études réalisées pour conceptualiser le rôle positif du sport et des activités physiques dans la société, d'une part, mais aussi des résultats de l'enquête exploratoire, d'autre part, nous avons choisi d'élaborer un questionnaire de recherche. Les principales variables retenues (APS, SANTE, CAPITAL HUMAIN) pour les effets positifs d'une pratique sportive régulière par la population se ramènent aux économies d'échelle qui en découlent. Dans le cadre de la collecte d'informations, des questions factuelles fermées de plusieurs ordres ont été posées (sexe, csp, lieu d'habitation, etc). Les perceptions et les représentations de l'APS par les individus jouent ici un rôle fondamental. Dans cette perspective, nous avons retenu des questions d'opinion et des échelles de mesure typiquement associées aux questions fermées. Dans notre cas, l'échelle de Likert de trois à cinq niveaux déployée pour demander aux répondants d'indiquer son degré d'appréciation sur les effets positifs de l'APS, nous a semblé pertinente et efficace. Les phases conceptuelles et exploratoires ont permis de définir des construits, de les mettre en relation et d'aboutir aux hypothèses mises à l'épreuve.

2.2. Sources de données

Les données proviennent d'une enquête par questionnaire réalisée entre octobre 2014 et mars 2015 auprès de 125 individus issus de la population active du district d'Abidjan dont l'âge varie entre 25 et plus de 65 ans. Pour notre étude nous avons utilisé une méthode d'échantillonnage non probabiliste par quota, qui consiste à choisir les individus les plus accessibles et les plus disponibles de population active qui pratique un sport ou une activité physique régulière.

2.3. Estimation du modèle d'analyse

Les travaux de Humphreys et Ruseski (2011) fournissent des lignes directrices méthodologiques pour tester dans notre cas, l'hypothèse fondamentale que nous cherchons à tester, selon lequel lien interactif APS-santé exerce une influence sur la productivité du capital

humain, qui à son tour engendre des économies d'échelle pour l'Etat. Le test de cette relation causale permet d'examiner quatre conditions à l'aide de trois modèles de régression.

i. $Y = b_0 + b_1X + b_2Z + b_3 (X*Z)$

ii. $M = b_0 + b_1X + b_2Z + b_3 (X*Z)$

iii. $Y = b_0 + b_1M + b_2X + b_3Z + b_4 (X*Z)$

3. Purification des échelles de mesure

Pour traiter de la cohérence interne de l'échelle de mesure, nous avons choisi d'utiliser le logiciel SPSS 21.0. Cette analyse repose sur deux critères les plus retenus pour évaluer les recherches en sciences de gestion : la fiabilité et la validité de l'échelle de mesure (Evrard et al.,2009). La purification est faite tout d'abord à travers le test de Kaiser-Meyer- Oklin (KMO) .Sa mesure devra être acceptable et avoir une valeur supérieure à 0,5 traduisant ainsi l'inter-corrélation des variables. Dans notre cas, l'analyse factorielle montre que le test de Kaiser, Meyer et Oklin (KMO) 0,581 ≥ 0,500 est significatif au seuil exigé dans la littérature. Ce qui signifie que les données sont factorisables. L'analyse de la fiabilité détermine dans quelle mesure les éléments d'un questionnaire sont liés les uns aux autres. Le coefficient Alpha de Cronbach (α) est le plus couramment utilisé pour la procédure d'analyse de fiabilité sous SPSS. Il s'avère nécessaire de préciser que la valeur du coefficient Alpha est comprise entre 0 et 1. Le coefficient de fiabilité pour notre échelle est égal à 0,700. L'homogénéité de cette échelle peut-être considérée comme satisfaisante, fiable et utilisable pour les analyses ultérieures.

4. Tests des hypothèses et discussions des résultats

Notre modèle vise à démontrer que l'étude de la relation entre les économies d'échelles issues de la pratique d'une APS n'est pas directe et que plusieurs variables intermédiaires entrent en jeu dans cette relation.

4.1. Effet modérateur du lien APS-santé sur la productivité du capital humain et la réduction des dépenses de l'Etat (H1).

Pour la procédure de test de effet modérateur de la santé, deux équations de régressions sont alors testées :

(1) $Y = a + b_1.X + b_2.Z + b_3. (X*Z)$

(2) $M = a + b_1.X + b_2.Z + b_3. (X*Z)$

i) Pour l'équation (1), $Y = a + b_1.X + b_2.Z + b_3. (X*Z)$, le test de régression donne les coefficients suivants :

(1). $Y = -4 + 1.695.X + 3.073.Z - 0.882 (X*Z)$

(0.673) (0.202) (0.350) (0.105)

Dans cette première régression, on a examiné la validité et de l'ampleur des coefficients structurels, notamment le coefficient b_1 associé à la pratique de l'APS (X), qui est positif et significatif, ainsi que la statistique t de Student (t = 8.398 >1.96), qui présente une significativité nulle. La règle de décision est la suivante : si le coefficient de régression b_1 associé à l'APS

(X) est significativement différent de zéro et si le T de Student (t ≥1.96) est significatif à p = 0.05 : on ne peut rejeter l'hypothèse 1. On a déterminé aussi la validité des coefficients de détermination linéaire (R^2) qui rend compte de la part de la variance de la variable dépendante, expliquée par les variables indépendantes.

Tableau 7. Récapitulatif des modèles

Modèle	R	R-deux	R-deux ajusté	Erreur standard de l'estimation	Changement dans les statistiques				Durbin-Watson
					Variation de F Sig.	ddl1	ddl2	Variation de F	
1	0,651[a]	0,424	0,410	0,16082	29.673	3	121	0,000	1,728

Calcul de l'auteur

ii) Pour l'équation (2), $M = a + b_1.X + b_2.Z + b_3.(X*Z)$, le test de régression donne les coefficients suivants :

$$M = - 4.426 + 2.322.X + 3.427.Z - 0.991\ (X*Z)$$
$$(3.447)\quad (1.035)\quad (1.795)\quad (0.536)$$

Le coefficient de régression b1 associé à l'APS (X) est différent de zéro, positif et le T de Student qui lui est associé (t = 2.245>1.96) est significatif au seuil de 0.5%. L'hypothèse 2 ne peut être rejetée dans le cas dans notre étude. Nous déduisons donc que les données permettent de nous prononcer en faveur d'une influence des variables indépendantes sur la productivité du capital humain.

Tableau 9 : Récapitulatif des modèles

Modèle	R	R-deux	R-deux ajusté	Erreur standard de l'estimation	Changement dans les statistiques				Durbin-Watson
					Variation de F Sig.	ddl1	ddl2	Variation de F	
1	0,341[a]	0,116	0,095	0,82434	5.341	3	121	0,002	2,083

Source de l'auteur

4.2. Rôle médiateur de la productivité du capital humain dans la relation APS-santé et réduction des dépenses de l'Etat (H2).

L'hypothèse (H2) formulée comme suit : (3) $Y= a + c_1.M+ c_2.X+ c_3.Z + c_4.(X*Z)$, se subdivise en deux hypothèses secondaires

H2a : la productivité du capital humain (M) à un impact direct sur les économies d'échelle (Y), si l'effet interactif de l'APS (X) sur la sante (Z) est atténué

H2b : l'effet interactif de l'APS (X) sur la sante (Z) sur économies d'échelle (Y) disparaît, si l'impact direct de la productivité du capital humain (M) sur les économies d'échelle (Y) est atténué.

Le test de régression donne les coefficients suivants :

$$(3)\ Y= 0.489 + 3.156.M + 1.751.X + 0.121.Z + 0.001.(XZ)$$
$$(0.191)\ (0.354)\quad (0.205)\quad (0.034)\ (0.003)$$

La troisième condition est satisfaite car le coefficient c_1 (3.156) associé au capital humain (M) est positif, différent de zéro avec un t de Student (t = 8.909) significatif à p=.000. L'hypothèse H2a ne peut être rejetée.

La quatrième condition est satisfaite car le coefficient c_4 (0.001) est positive mais la statistique t de Student associée (t = - 2.0570) n'est pas significative (sig. = 0.708 > 0.05). L'hypothèse (H2b) ne peut être rejetée.

Tableau 12 : Récapitulatif des modèles

Modèle	R	R-deux	R-deux ajusté	Erreur standard de l'estimation	Changement dans les statistiques				Durbin-Watson
					Variation de F Sig.	ddl1	ddl2	Variation de F	
1	0,658[a]	0,433	0,414	0,16025	22.884	4	120	0,000	1,890

Source : de l'auteur

Le tableau récapitulatif du modèle montre que la part de variance expliquée par l'association entre les différentes variables peut être considérée comme intéressante. La valeur calculée de la statistique de Durbin-Watson est supérieure à la valeur critique (1.890 >1.65). Il n'y a pas d'autocorrélation entre les résidus du modèle. Plus de 43% de la part de variance de la réduction des dépenses de l'Etat est expliquée par les variables indépendantes (R2 = 0.433). Le coefficient beta associé à la variable CH (M) est positif avec une significativité nulle. Cependant, le coefficient du terme interactif (X*Z) n'est pas significatif (p = 0.708 > 0.05). L'hypothèse (H2a) est confirmée.

CONCLUSION

Cette étude avait pour objectif d'examiner la relation symbiotique APS-santé sur la productivité du capital humain et la réduction des dépenses de l'Etat en Côte d'Ivoire. Le modèle de régression structurelle proposée a permis de prouver l'existence d'un lien entre la pratique d'une APS et la santé, à un effet interactif sur la productivité du capital humain, qui a son tour engendre la réduction des dépenses de l'Etat en termes d'économie d'échelle. Les résultats obtenus s'avèrent robustes à divers points de vue. A l'image d'un grand nombre de preuve scientifique concernant l'impact positif du sport et de l'activité physique sur la santé (Humphreys et Ruseski, 2011), nos estimations font état de l'impact positif du sport sur l'amélioration de la santé, la productivité du capital humain et la réduction des dépenses de l'Etat en Côte d'Ivoire. Ils viennent appuyer les conclusions d'autres études sur la question de la prise en compte de valeurs économiques, sociales plus larges pour établir les effets d'entraînement dans les choix de consommation d'une APS (Nys, 2006).

Les résultats obtenus permettent de suggérer par extrapolation que la politique sportive de l'éducation physique sportive (EPS) obligatoire dans le système éducatif à tous les niveaux, a permis de conserver les bonnes habitudes de pratique des APS en dehors du cadre scolaire des jeunes et des adultes. Il évoque explicitement la dimension transversale de la problématique de

prévention de la santé et permet de combler partiellement le déficit de politique publique de prévention et d'amélioration du capital humain en Côte d'Ivoire.

Les résultats de l'étude peuvent être relativisés au regard de quelques limites qui méritent d'être soulignées. Les construits ont été modélisés en variables indépendantes et dépendantes, sur un échantillon relativement réduit (125 sujets) et la généralisation de l'étude rencontre des limites quand celle-ci se trouve réduite au district d'Abidjan.

BIBLIOGRAPHIE

1. **Cadilhac** D.A.**, Cumming T.B.**, **Sheppard L.**, **Dora C Pearce D.C.** , **Carter R.** et **Magnus A. (2011).** Economic benefits of reducing physical activity: an example from Australia. *International Journal of Behavioral Nutrition et activité physique* 2011, **8:** 99 doi: 10.1186 / 1479-5868-8-99
2. **Cawley J.,(2004).** The Impact of Obesity on Wages, The Journal of Human Resources, Vol. 39, No. 2. (Spring, 2004), pp. 451-474.
3. **Evrard Y., Pras B. & Roux E., (2009).** *Market, études et recherches en marketing*, 4ème édition, Dunod.
4. **Haskell W.L., Lee I-M., Pate R.R. et al. (2007).** Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Medicine and Science in Sports and Exercise, 39:1423–34.
5. **Humphreys B. R., & Ruseski J. E. (2011).** An economic analysis of participation and time spent in physical activity, The B.E. Journal of Economic Analysis and Policy, 11, 1-38.
6. **Kaman R.L. & Patton R.W. (1994**). 'Costs and benefits of an active versus an inactive society', in C. Bouchard et al. (eds), 134–44
7. **Katzmarzyk P.T., Gledhill N. & Shephard R.J. (2000).** 'The economic burden of physical inactivity in Canada', Canadian Medical Association Journal, 163 (11), 1435–40.
8. **Kemo-Keimbou D.-C. (2004).** L'état et le sport au Cameroun, rhétorique et réalité des politiques sportives en Afrique noire de 1960 à 1996, dans Patrick Bouchet & M. Kaach (sous la direction de), *Afrique francophone et développement du sport : du mythe à la réalité ?*. Paris : Edition l'Harmattan.
9. **Meltzer D. O., & Jena A. B. (2010).** The economics of intense exercise, Journal of Health Economics, 29, 347–352.
10. **Nys J.-F.** (2006). Physical activity, sport and health, Chap. 13, dans Wladimir. Andreff, Sthephen Szymanski (sous la direction de), *Handbook on the Economics of Sports*, Cheltenham, Edward Elgar
11. **OMS (2010).** Global Recommendations on Physical Activity for Health, WHO Press: Geneva, Switzerland.
12. **Rieu M. (1995).** Rôle des activités physiques dans une politique de Santé Publique. Bull. Accad. Natle. Méd, , 179, n°7, 1417
13. **Stephenson J., Bauman A., Armstrong T., Smith B. & Bellew B. (2000.).** 'The costs of illness attributed to physical inactivity, in Australia', Preliminary study of the Commonwealth Department of Health and Age and the Australian Sport Commission
14. **Swanson J.A. & al. (2012).** 'Leadership Characteristics and Title IX: A Possible Mechanism for the Impact of Sports Participation on Work Outcomes', BOOK REVIEW, 40.

PHYSICAL EDUCATION +PLUS: EXERGAMES WEB BASED FOR ACTIVE SCHOOL BREAK VERSUS INCLUSIVE AND HEALTHY LIFE STYLE

STEFANIA CAZZOLI
University of Torino, Torino, Italy; FIEP Europe International Sections President Adapted Physical Activities Section

THE BACKGROUND OF PHYSICAL ACTIVITY AND HEALTH

The "World Health Report" (WHO, Geneva, 2002) refers risk factors of morbidity and mortality of chronic non-communicable diseases (NCD) are hypertension ; the high concentration of cholesterol levels in the blood; inadequate amounts of fruit and vegetables in the daily diet; the high percentage of people overweight or obesity; the high frequency of physical inactivity; the high use of tobacco, in most countries.

Five of these risk factors are closely related to diet and physical activity.

WHO recognizing the growing development of non-communicable diseases worldwide, and required the development of a global strategy on diet, physical activity and health for improving the health and prevention in all countries of the world.

The global strategy was developed through six regional consultations office of World Health Organization (WHO).

The WHO is the United Nation specialized agency for health worked in cooperation with intergovernmental organizations, representatives of civil society and the private sector.

The final document was approved as "Resolution WHA57.17 of 2004 the World Health Organization". The resolution highlighted the trend of morbidity and mortality worldwide linked to chronic diseases related to lifestyle. The lifestyles are strongly linked to diet and to physical activity practice.

The WHO has called on states member to draw up guide lines to sensitize and orient the people versus quality and increase physical activity and diet practices. The scientific evidence showed leading NCD causes of death and disease in developed countries, and the same phenomenon is also being in many developing country. Globally, chronic non-communicable diseases (NCD) has rapidly increased: 60% of the 56 million deaths annually; 47% of the global disease.

The WHO Scientific Group on physical activity has produced "The global recommendations physical activity for health" (GRPAH) (2010). The document was prepared on the basis of scientific evidence and oriented in directions to plan of good practices of physical activity for health prevention by adopting active lifestyles. Physical inactivity has become the fourth risk factor for global mortality (6% of all deaths) worldwide: and co-factor with other risk factors.

The GRPAH was oriented at three age group: children and young people (aged 5-17 years); adults (aged 18-64 years); over 65 years old.

The activities for children and young group were play, game, sport, recreation, physical education, in family, school and community context. The active lifestyle, should be directed

to the improvement of the cardio-respiratory training and muscle strengthening, in order to implement the osteo-articular health (prevention of osteoporosis) and muscle tissue (prevention of sarcopenia); raising the metabolic energy consumption and to maintain the balance between the energy provided by food and body composition and weight control weight; reduced symptoms of anxiety and depression.

The volume of physical activity should be characterized by:

• at least 60 minutes of physical activity a day with moderate to vigorous intensity;

• physical activity for more than 60 minutes a day will provide additional benefits for the prevention and maintenance of health;

• Most daily physical activity should be aerobic and muscle-strengthening activities at least three times a week for training the correct posture, prevention of bone and muscle deterioration.

The sixty minutes daily of physical activity for young people may be recording daily and weekly agenda. The multi-system agenda taking into account different levels of quantity, quality physical activity and different physical activity contexts (formal setting / training institutions and education, non-formal / sports or social aggregative institutions; context for-ills / everyday life):

• every day: walking for travel related to daily routine (home-school; the time shearing house-places ...); use the stairs instead of mechanical equipment (elevators, escalators ...); actively participate in housework, gardening ...); use technological-device for physical activity (applications, exergame);

• 3-5 times a week to practice fine motor physical activities medium intensity (riding a bicycle with a speed of about 15 kilometers per hour; walk with variable speed, from 3 to 5 kilometers per hour; practicing sports such as swimming, tennis ...);

• 2-3 times a week to practice a specific strength training (with particular attention to the muscles that contribute to maintain the correct posture of the pelvis and core stability-(strengthening abdominal and buttocksand muscles), muscle flexibility and joints mobility, general coordination;

• reduce the time of inactivity (alternating sedentary and active time phases)

The physical activity daily sixty minutes should be to rebalance the sedentary lifestyle contemporary society. The time spent in static situations is increased in the workplace and in everyday life.

The innovative digital development changed the work organization versus daily sedentary and inactive life style. The preventive healthcare must be developed attitudes and active lifestyle programs in order to restore the balance between working physical inactivity and active time breaking spent in internal or external spaces (playground or walking) or virtual (exergame). (Cazzoli, 2015).

BACKGROUND DIGITAL TECHNOLOGIES IN THE PROCESSES OF FORMAL, NON-FORMAL AND INFORMAL LEARNING

The use of digital technologies are widely spread in contemporary life.

Those young "native digital" (Prensky, 2001; 2013) are always connected in hyper places and social net sharing web based. (Ortoleva, 2013).

The school formal education has the fulfill-to building bridges between the past, the present and the future in order to meet the needs of students and society. The school to fulfill its institutional role and maintain the centrality of citizens in the path of training must prepare students for the present and the future. E-skills are in agendas and national regulation (National Guidelines for the curriculum of all orders and Italian education degrees, Ministry of Education, 2010; 2012; 2013) and international, as indicated in the Learning European Key Competence of European Parliament (2006).

Media Education (ME) is a new educational activity. The ME research aims to study information and under-standing critical and aware of the nature and categories of the media, the techniques for build the messages. Students must be guided to-no understanding, reflexive decoding and active co-construct (computing) media. (MED, 2011).

The use of new technologies in education is an enrichment of teaching school: education based on multimedia computer and Intelligent Tutoring System (Wisher & Fletcher, 2004) and to advanced Distributed Learning (ADL) (Fletcher, 2005). The educational software, electronic resources, image and video archives, learning in technology environments are born in scientific and technological disciplines and now they are applied at teaching in humanities environment.

The technology, strongly present in the world of elite sport, has evolved versus physical education in according with digital device and applications (such as pedometers and heart rate controller). In the area of physical activity it is present, since the '80s, video games, where digital technology is designed to promote-the practice of physical exercise and improved fitness level. Examples of products are Foot Craz (Atari 2006, 1997); Power Pad, Nintendo Entertainment System (NES, 1988); Komani Dance Dance Evolution (PlayStation, 1998); Eye Toy (PSP and PlayStation, 2000); Microsoft Kinect, PlayStation Move and Wii Fit (2009).

The physical education teaching, has begun to explore the potential of digital technology oriented to the development of motor learning quality (motor control, motor learning and teaching performance evaluation systems) (Sgro, 2014) and the implementation of the volume of-physical activities in school routines (Cazzoli et all., 2014) (Cazzoli et all., 2015)

Another aspect of information technology is the implementation of physical activity through social networks. (Vollum, 2014). The use is widespread to orient decisions of young people and provide a new opportunity to informal peer education . Social networks can be an opportunity, and how to integrate with the school formal education of educational institutions.

Pedagogical strategies should be oriented to develop student life in order to consciously education use of new social network and access to knowledge. The formal physical education intervention through social networks can support the transition from passive use of the information on physical activity and health to one upper stage of use of resources in an active way by expert guide / teacher. Next, students can move to the third stage of autonomy in the choices and acquisition attitude and behavior of active styles in vertical continuity over the course of a lifetime.

The Active Gaming or Exergaming is derived from the English word composed of terms exercise+ game. It used to indicate the game based on images for encourage practice and motion games.

The exergaming were born with the technology of computing platforms-and the devices that allow the traceability of the movements of the body. (ACSM, 2013).

This system overcomes the stereotype of video games as a sedentary activity or limited to hand-eye coordination, becoming a tool for the promotion of active lifestyles and going to break the stereotype of the generation "couch potatos". The term was coined in the '70s by comedian R. Armstrong and is passed in the anthropological field to indicate the "sedentary" and, in science field.

The "sedentary lifestyle" is based on sit, read, watch television. The use digital device (personal computer , television, mobile, tablet, video-game…) involve persons for about four hours a day with short and medium-term negative consequently on the health effects (Janet et al., 2014).

The Exergaming use interface that involves the whole body with increased practice of movement skills (walking, running, climbing stairs / steps, go to bike / bicycle ergometer, paddling / rowing machine, the fon-do skiing / skate / glide, swim ...), sports (Golf, Bowling, Baseball, Tennis, Boxing-boxing, football ...), multiple activities (dance, marziali arts ...).

The range of motion is tracked and controlled by different systems in indoor situations: footrests with Dance Revolution (sensors, Lightspace; Makoto); video sensors with camera and motion-control remote (Sony Eye Toy, Playstation Move); Microsoft Kinetic for Xbox 360 (allowing the movement with his hands free, the sensor is in the console); Nintendo Wii Fit (board uses scales and traceability remotely); smartphones with apps for Android and iPhone (stabilometry, pedometer, GPS, frequency heart rate detection) enable, compared to other systems, the practice of physical activity and traceability in outdoor situations.

The exergamings are individually, in pairs or in small groups. For solutions with large groups and communities such as schools, workplaces, flash movie, using digital platforms where the video sends the image and the traceability of the movement takes place through the internal feedback of the individual subject (through the sense organs: sight, hearing, touch, proprioception) and external feedback from the tutor, in person or on video (through spatial directions, speed, intensity, motivation ...). The intensity of physical activity practiced with exergaming was measured ..

They allow the movement to interact with the game and the energy expenditures are measured: (Haddock, 2009)

Exergame	Energy expenditure in calories / minute	Energy expenditure in calories / 30 minute
Golf	3.1	93
Bowling	3,9	117
Baseball	4,5	135
Tennis	5,3	159
Danza/Ballo	5,3	159
Boxe	7,2	216

It was investigated the level of motivation of the kids in practice with Exergaming: a) are fun and exciting because it uses the already-technological; b) there is the social component, more players can replay, can interact with other ...; c) free choice in participation and in the

choice of the game, level, age, weight, can choose whether compe-tere with themselves, others ... d) is one of the most popular hobbies that permit to be active and healthy (ACSM , 2013).

Studies were also made on the effectiveness of the practice of the proximal Exergaming (console) and on the Internet in relation to cognitive working. The results showed the implementation of cognitive functions (Kooiman ,&Sheehan, 2014).

The Exergaming-Online and Physical Education (OLPE) are complementary tools to the practice of Physical Education and have as ef-fect increasing motivation to adopt active lifestyles. They can be included as active phases in the school routines. To-put to alternate sedentary sessions with active sessions recreational physical activity. The alternation of sedentary and active phases allow you to restore high levels of attention and motivation in the ap-learning processes (Kooiman J.B D.P & Sheehan, 2014)

OLPE and Physical Education are not in the presence to be seen as an alternative to another but as a complementary system to a lifestyle Active.

Both are necessary to create physical education programs meet the needs of society and of the third millennium culture. People must be trained to the technology through technology. This implies that the education and training processes of teachers must be based on this integrated system of techno-logy through technology. (Kooiman & all 2014)

The positive effects of Exergame have been studied and evidence showed the improvement of balance, the health and the level of fitness, rehabilitation after an injury. The increase of the active motor sessions provoke positive effects on the activation of cognitive function, increased motivation and attention and the development of interpersonal relationships.

The motor practice with exergames reduced relevance of injuries. Technology changes rapidly, so every 4-6 years end the life cycle of a exergame, and there is an evolution of the console every 2-3 years. The changes are aimed at improving the quality of video, multimedia access, increasing the number of reference points for tracing the movement, improving quality audio to make the experience more engaging and immersive.

The future innovations are geared toward exergames online massive (MMOSS Massive Multiplayer Online Games). They implement the social component of the widespread motor practice and the establishment of communities of practice. The research and studies showed the effectiveness of exergames massive open online (MOOEs Massive Open Online exergames).

The challenge is to improve the social, cognitive and entertainment accessible to the whole population relationships, of all ages and without economic limitations.

The Networking of games allows the practitioner to move in virtual environments but with real actions. The expected goal is the use of exergames not only as inconsistent access but become a constant part of daily routine.

Everyday life is facilitated by the evolution of technology that is shifting from the device console to smartphones and tablets. These allow a greater ductility and portability in different environments, both indoor and outdoor.

They are also creating two exergames lines with different levels of use: casual use and professional use. The former are characterized by simple activities available immediately without special training. The seconds are always simple and immediate physical-motor activities but require higher training levels. The practitioner's personality and the level of

training are criteria for exergame choice. The use of Global Positioning System (GPS) allows smartphone and tablet accurate readings compared to the distance traveled, speed of movement localization, uneven.

Global Mobile Statistic for-allows you to measure physical activities like archery and weight lifting.

The future evolutions are relative to the device that will be pre-sem more miniaturized, wearable and interactive like watches and glasses that allow hands-free movement and a constant give-logo in outdoor situations. The evolution of exergames be expected to have a non-stop duration in connection with the evolution of technology, the new knowledge in the field of exercise and programs to prevent and improve health. (Kooiman BJ, Shheehan DP, 2015) .

CONCLUSIONS

Physical education through digital platforms and international search can implement innovation in teaching practices, in order to actively involve young people in active lifestyles to health.

Some implications for the future:

• Innovation at the base of the formation of the teaching and educational staff;

• attention to sustainability with regard to the economic aspect, and financial aspect of ethics and morality;

• focus and personalized answers to the needs of the person, respecting the dignity and cultural differences in the processes of globalization;

• revolution and free access to digital content to ensure fairness in the knowledge and participation in the construction of shared-knowledge no differences in gender, culture, religion, social status

REFERENCES

1. Apperley T.H. *Genre and game studies: Toward a critical approach to video game genres* Simulation & Gaming March 2006 37: 6-23
2. Brian J. Kooiman J.B., Dwayne P. Sheehan, Michael Wesolek & Eliseo Retegui (2015): *Moving online physical education from oxymoron to efficacy*, Sport, Education and Society, DOI:10.1080/13573322.2015.1015978
3. Brian J. Kooiman & Dwayne P. Sheehan (2015) *Interacting with the past, present, and future of exergames: At the beginning of a new life cycle of video games?,* Loisir et société / Society and Leisure, 38:1, 55-73, DOI: 10.1080/07053436.2015.100696
4. Cazzoli S., Gatto S. *Physical education +plus: physical activity lesson breaking for improve life skills in inclusive school*, Sport Science for health, Springer Volume 10-Supplement 1- September 2014 ISSN: 1824-7490 print: ISSN: 1825-1234 electronic
5. Cazzoli S. Sebastiani C. *Physical Education +Plus: Physical Activity Breaking For Improve The Attention In The Learning School Process* Sport Science for health, Springer Volume 11-Supplement 1- September 2015 ISSN: 1824-7490 print: ISSN: 1825-1234 electronic
6. Cazzoli S. (2015) Educazione fisica +Plus: l'utilizzo delle piattaforme digitali nei break della routine scolastica per il miglioramento dell'educazione fisica e della salute (capter) and Exergame video web-based per i break di educazione fisica. l'esperienza italiana: "nella scuola secondaria

di secondo grado. (capter) in Parola A., Denicolai L, Tecnologie e linguaggi dell'Apprendimento, Roma, Aracne, 2015

7. Cisco, Multimodal Learning Through Media: What the Research Says © 2008 Cisco Systems, Inc.
8. Freedman R., Syed D. A, McRoy S. *What is an Intelligent Tutoring System?* Intelligence 11(3): 15–16 (Fall 2000)
9. Dale, E. (1946, 1954, 1969), *Audio-visual methods in teaching*. New York: Dryden
10. Fletcher, J. D. (2004). *The Advanced Distributed Learning (ADL)Vision and Getting From Here To There*, IDA Document D-3212 Log: H 05-002034
11. Freedman R., Syed D. A, McRoy S. *What is an Intelligent Tutoring System?* Intelligence 11(3): 15–16 (Fall 2000)
12. Gingold Janet A., Simon Alan E., Schoendor Kenneth C. f, *Excess Screen Time in US Children: Association With Family Rules and Alternative Activities,*Clinical Pediatrics 2014, Vol 53(1) 41–50
13. Haddock, B. 2009. *Active Video/Arcade Games (Exergaming) and Energy Expenditure in College Students.* International Journal of Exercise Science 2: 165-174.
14. Kooiman J.B., Brian J., Sheehan, Dwayne P.,*The Efficacy of Exergames Played Proximally and over the Internet on Cognitive Functioning for Online Physical Education*, *American Journal of Distance Education*, v28 n4 p280-291 2014
15. Kooiman J.B, Sheehan D.P, *Motivation to Move with Exergaming in Online Physical Education* International Journal of Physical Education, Fitness and Sports ISSN: 2277: 5447 Vol.3.No 2 June 2014
16. Ortoleva P. (2013*) Una bella città* pubblicato da Rino Genovese - http://www.leparoleelecose.it/?p=12808
17. MIUR, Indicazioni per il curricolo del primo ciclo, 2012; Indicazioni per il curricolo dei licei, 2010; Regolamenti per gli istituti tecnici e professionali, 2013; http://www.istruzione.it/archivio
18. Prensky M.(2013) *Brain Gain: Technology and the Quest for Digital Wisdom* (versione italiana: *La Mente Aumentata – Dai nativi digitali alla saggezza digitale*, Erickson, 2013. ISBN 978-88-590-0454-7.)
19. Raccomandazione Del Parlamento Europeo E Del Consiglio del 18 dicembre 2006 relativa a competenze chiave per l'apprendimento permanente(2006/962/CE)
20. Sgrò F. (2014) *Edu-Exergames. Tecnologie per l'educazione motoria***, Franco Angeli Codice ISBN:** 9788891709769
21. Vollum M.J (2014) *The potential for social media use in K-12 physical and health education* Computers in Human Behavior 35 (2014) 560–564
22. Wisher, R. A. and Fletcher, J. D. (2004). *The case for advanced distributed learning*,
23. Information and Security: An International Journal, 14, 17–25.
24. Zagal José P., *Ethically Notable Videogames: Moral Dilemmas and Game play*, © 2009 Authors & Digital Games Research Association (DiGRA).

Web publication (up date consultation 15 January 2016)
https://www.acsm.org/docs/.../**exergaming**.pdf,
www.apple.com/it/final-cut-pro/
http://www.globalpeforumgc.org/
http://www.icsspe.org,

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, ELDERLY AND TECHNOLOGIES: A LITERATURE REVIEW

MARICA CICCARELLI, ANTONIO BORGOGNI, GIOVANNI CAPELLI
Department of Human Sciences, Society, and Health, University of Cassino and Southern Lazio, Cassino, Italy

INTRODUCTION

The aging of the population is one of the most important phenomenon of the twenty-first century and one of the largest economic and social challenge for society. The relevance of this process and its consequences at global level are now clear: the study of demographic indicators, the data on living conditions and on population health, are important sources from which have a clear vision of the phenomenon and its trends. In 2015, on the occasion of the International Day for the elderly, the WHO presented the "World Report on aging and health" [WHO, 2015]. According to current estimates, the absolute number of elderly people in the World population has increased dramatically and continues to do so at an ever-increasing pace. Nowadays, in fact, the majority of people, globally, reaches and exceeds 60 years; this percentage is expected to increase significantly by 2050. In the same vein, Europe records a significant increase of the percentage of the population over 60. According to the Aging Index of the European countries, in 2007, Germany (146.4%)[1], Italy (142.8%) and Greece (130.6%) were the oldest countries in Europe [ISTAT, 2008], while in 2013, Germany (158.4%) and Italy (151.4%) were again the oldest countries in Europe, showing a significant increase of the percentages [ISTAT, 2014]. This rapid aging of the population has made the old age a dynamic and variable process that requires individual to age in good health, thanks especially to the increasing improvement of living conditions and medical advances. Quite the reverse, it can be witnessed an increase of the neurodegenerative and chronic-degenerative diseases, which are the main cause of the frailty and disability. Additionally, other aspects are inevitably correlated with health status and with the quality of life of the older people. We are talking about emotional, social and relational conditions bringing the elderly to consider himself incompetent, useless, excluded from a society that considers them as a burden, nurturing in such a way conditions like loneliness, isolation and depression. With the aim to promote aging in good health, it's important to put in place policies and strategies based not only on the needs of the person, that involving all the components of elderly's everyday life, i.e. health care, active lifestyle, community participation, social inclusion, lifelong learning, active participation, etc. The focus, therefore, should be on human rights and on the possibility of its participation in community life: only in this way the actions will be in favour of an "Active Aging" [WHO, 2002].

Physical activity is undoubtedly one of the factors that can positively influence the health and wellbeing. Bodily movements lead to an energy expenditure, including the actions and activities that characterize daily life, such as climbing stairs, walking or carrying the shopping bags. The positive impact and the benefits of physical activity on the aging process are evident.

[1] The percentages refer to the number of over65 every 100 young people belonging to the age group 0-14 years

Numerous scientific evidences show that even a moderate amounts of physical activity may exert a protective effect on health, confirming that the movement and an active lifestyle, are decisive factors for the purpose of a successful aging [Chodzko-Zajko et al., 2009]. The research on this topic and the enhancement of the knowledge about its social and personal implication, led to an increasing interest towards the creation of recommendations, guidelines, protocols, policies and networks implemented in favour of the welfare of people of all ages[2].

Even the *ICT (Information and Communication Technology)* is increasingly present in the area of the individual wellbeing. Recently, there has been an evolution of the developed technologies and, at the same time, an evolution of the users. We moved from the concept of traditional medicine to telehealth (or eHealth), from home assistance to telecare and to remote rescue, to new areas of use for technological systems such as Exergame, wearable devices, activity tracker. Similarly, we have witnessed a shifting from technologies reserved for a few users, to technologies for all age groups. As well as being in favour of the care and wellbeing of people, today ICTs are more and more age-friendly, thanks mainly to an increase in the percentage of elderly people able to use technological devices.

In this light, the purpose of this study is to investigate the relationship between ICT, physical activity and elderly, and understand the current state of research about these issues.

METHODOLOGY

In order to fulfil the purpose of the study, a literature review was conducted about topics related to technology for physical activity, health and the promotion of active lifestyles in elderly people. Particular attention was given to the study of the actions taken by the national and local authorities to develop programs that promote a healthy and active aging through the use of technological devices. By taking a systematic approach, the review process began with the definition of a working protocol and with a specific identification of the study variables:

Elderly: Although most countries of the world have accepted the chronological age of 65 years to define an elderly person, the United Nations decided that 60+ years can be generally referred to as the age of reference for the elderly population [WHO].

ICT: "Information and Communication Technology", are the set of methods and technologies that realize the systems of transmission, reception and processing of information. In particular, the research refers to portable devices.

Physical Activity: Any bodily movement produced by skeletal muscle contraction, automatic or deliberate nature that has the effect of energy consumption. It may be part of the free time and configured in organized activities (sports) or unorganized (walking, dancing), part of the working time (heavy manual work) or domestic (gardening, cleaning, movement games) or of the daily transport (using the bike, walking, taking the stairs) [Edwards & Tsouros, 2008; Pietrantoni & Prati, 2012].

The process of identification and selection of the studies was conducted through a previous definition of the *selection criteria* that were used as filters to include/exclude resources. The

[2] HEPA Europe - European network for the promotion of health-enhancing physical activity -; Active city Network; EUNAAPA -EUropean Network for Action on Ageing and Physical Activity-, to give some examples

study was conducted through queries on electronic databases (PubMed, Google Scholar) and in grey literature, by the use of different keywords as "elderly"**, "**older", "aged", and "senior" to define the target group of the study. We also used terms such as "physical activity", "movement", "lifestyle" and "walking" to capture article that addressed physical activity; while the terms "ICT", "technologies"; "smartphone" and "App", have been used to identify studies that addressed the topic of the technological devices defined ICT. We also searched for terms like "behaviour"**,** "motivation", "social inclusion", "barriers" and "participation in life community", to identify articles addressing the issue of motivation to physical activity. Moreover, we used terms such as "sustainable mobility", "smart city", "slow mobility", but also "municipality", "city", "policy", "guideline", and "action plan" to find articles dedicated to the actions and experiences put in place by municipalities.

Scientific papers, conference proceedings, project and reports, published between years 2000 - a period in history that is commonly to associate the true evolution of smartphones-, and year 2015 were selected. Finally, we selected studies published in English and Italian language, taking into account subjects aged 60 years or above, of both sexes.

The process of inclusion, based on the mentioned selection criteria, was implemented in two phases, (see fig. 1). In the first phase, articles have been identified through research on electronic databases and grey literature. *Texts research* led to the identification of 193 articles. The review excluded studies that have involved people under the age of 60 (including studies involving multiple age groups, i.e. 18-70 years, and those who considered "elderly" people over 55) and studies not addressing the topic of physical activity and / or ICT technologies. Finally, the reference to wearable devices and robotic systems represented further exclusion criteria. At the end of this first phase, 33 articles have been considered relevant, and further analysed. Considering the exclusion criteria that characterized the first phase, they were also excluded from the review studies based on the concepts of Healthcare, Telecare and Telehealth. Furthermore, studies targeting groups affected by diseases and/or in rehabilitation treatments, have represented a further exclusion criteria. Finally, duplicate records were excluded from the review. Thus, the analysis of full-text has allowed the inclusion of 19 articles.

The search for experiences, actions, programs and project activities, instead, pointed its attention on the European context. Our keywords included in this review all studies within Google Scholar and PubMed databases conducted between 2000 and 2015. The process of inclusion, represented in figure 2, based on the selection criteria indicated, excluded studies that didn't take into account the elderly, physical activity and technologies. Moreover, the reference to wearable devices, robotic systems, concepts of Healthcare, Telecare and Telehealth and the presence of disease states or rehabilitation treatments have represented a further exclusion criterion.

RESULTS

The deepening of the selected studies showed an increase, year by year, of the studies that refer to the investigated topic: just to consider that in this review have been incorporated one article published in 2006 and nine in 2014.

Texts analysis has certainly revealed a strong interaction between physical activity, elderly and ICT systems. In particular, the study conducted by Blazun et al. [2], shows how technology can be an important tool for promoting physical and social activity among the elders. Specifically, they report an association between computer use, levels of physical activities and social inclusion before and after the interaction with ICT devices.

Text analysis, therefore, showed the presence of *different types of approaches and applicative orientations*. Several studies focus their attention on the so-called "Home-based systems", solutions represented by web platforms for PC, TV or tablet, used in the home environment (private homes, nursing homes / rest, community centres, etc.). Albaina et al. [1], for example, suggest a virtual trainer that encourages older people to be more active. This technology based on persuasion, interaction metaphors and the principle of awareness, allows people to monitor their activities and be aware of their progress. Ghiani et al. [8], instead, describes the structure of a web-based platform, which aims to encourage the elderly to be physically active. It consists of a set of logical modules supporting user-oriented services: (1) Monitoring and Behaviour Analysis, (2) The Context Manager, (3) The Adaptation Module, (4) Social Features, (5) Persuasion Services. In the same way, the goal of the study proposed by Wijsman et al. [24] was to assess whether a web-based intervention able to increase physical activity and improve metabolic health in inactive older adults. To this aim, the study proposes a commercially available web-based physical activity program directed at increasing the amount of daily movement. The results of this intervention were exposed by Vroege et al. [23], which showed that 42% of the sample reached the expected level of daily physical activity, demonstrating the large potential of web-based interventions for improving health. Fan, Forlizzi, & Dey [6], instead, focus on the barriers to physical activity. With the help of the target group, the researcher have tried to understand which are the needs that technology can help to tackle and which are the characteristics that it must have in order to support the elderly towards the adoption of active lifestyles. The studies conducted by Silveira et al. suggests that the physical decline, typical of the old age, determines disorders, accidents (such as gait disorders that can lead to falls and their consequences) that limit the independence and autonomy of the person in performing daily activities. For this reason, it has been developed an application for tablet aimed to motivate people to move proposing customized plans of physical activity to be carried out autonomously in their own homes. In the first part of the study, Silveira et al. [18] have exposed the requirements and the principles through which develop their own application named "Active Lifestyle App". According to them, the points behind the design must include: (1) Design an interactive and friendly user interface to be easily understood; (2) Offer support for balance and strength training plans; (3) Collect, process, store and report information to allow healthcare experts to remotely monitor the users' performance; (4) Allow remote communication between elders and healthcare experts; (5) Support motivation. The aim of the second phase of the study, Silveira et al. [19], was to run a pilot study to investigate the feasibility of the app, the adherence of the participants and the effectiveness of a motivation tool. The pilot study involved 13 elderly people who, for two weeks, followed the workout plan proposed by the app. The outcome showed that without the app the participants didn't feel motivated to perform exercises; while with the support of the app they felt more motivated. The third part of the study, Silveira et al. [20], had three main objectives: (1) investigate which

IT-mediated motivation strategies increase adherence to physical exercise training plans in older people, (2) assess the impact of the app on physical activity behaviour change, and (3) demonstrate the effectiveness of the ActiveLifestyle training to improve gait speed. The last phase, van het Reve et al. [21], seek to compare 3 different home-based training programs with respect to their effect on measures of gait quality and physical performance, through planned comparisons between (1) tablet-based and brochure-based interventions, (2) individual and social motivation strategies, and (3) active and inactive participants. The tablet groups showed significant improvements in single and dual task walking, whereas there was no significant changes observable in the brochure group. Therefore, a tablet-based strength-balance training program allows monitoring and assisting autonomous-living older adults. Moreover, social or individual motivation strategies were equally.

Hong et al. [9] present iCanFit, a web application dedicated to the promotion of physical activity in older people. The app focuses on the functions that motivate seniors to exercise regularly, through setting goals, monitoring activities, and providing feedback about the activities, progress and achievements. Finally, the objective of Romero et al. [17] was to design technological solutions able to motivate older people to move more and to maintain or increase their social activity. Romero describes the development of compelling playful solutions that help older people to be aware and proactive in maintaining an adequate level of physical and social activity.

Several studies, instead, focus on technologies for mobile devices, designed to be used even outdoor. Rodriguez et al. [16] describe the system CAMMInA (Calm Application for Motivating elders to Move by Interacting with their Age group), an application for mobile phones that aims to motivate the elderly to move more through the use of factors having a positive impact. The created system, in fact, follows a user-centered approach and supports four persuasive strategies (abstraction, historical information and reflection, trigger the physical activity and positive and playful reinforcement), through which encourages people to adopt healthy lifestyles and more suitable behaviours. It is worth noting that the system provides sound and text notifications to remind the elderly to take a walk; once started the activity, the user sees a copper coin that turns to gold when he reach the goal. Finally, a report of the activities carried out during the last recent weeks and the achievements, make the elderly aware and satisfied with his own progress and workout. Recio-Rodriguez et al. [15], focus their interest on the psychological theories of behavioural change and propose an app for smartphones to promote healthy lifestyles. Through the principle of awareness, the user leads an assessment of life habits, both in terms of physical activity and eating behaviour. Finally, also Vankipuram, McMahon, & Fleury, [22] present an app for Iphone, which allows the user to set his own goals and to monitor the level of activity. To achieve this, the app provides a motivational feedback based on the concepts of Wellness Motivation Theory, which "promotes the emergence of positive health patterns by conceptualizing motivation as a complex and dynamic process of individual growth based on personal values and resources" (p.1).

The contents analysis showed, moreover, the presence of *different types of intervention.* Some of these are represented by exercise programs or plans of physical activity that require the execution of physical exercises (Hong et al. 2014, Recio-Rodriguez et al. 2014, Wijsman et al. 2013, Vroege et al. 2014) addressed to training, for example, specific motor skills (Silveira

et al. 2012, Silveira et al. 2013, van het Reve et al. 2014) or aimed at the achievement of specific objectives (Albaina et al. 2009, Rodriguez et al. 2012). Another type of intervention is represented by a game setting: the persuasiveness action of the technology, as a means to support the adoption of healthy and active lifestyles, in fact, is achieved also through a playful approach. The "Exergames", virtual games for older users, have been the subject of numerous reviews. In their articles Gerling, & Mandryk; Larsen; and Brox & Hernandez have faced a literature review about these games, trying to explain their connection with elderly users. Gerling, & Mandryk [7] provide an overview of active virtual games for older people, by classifying the case studies addressing the issue of Exergames for the elderly, paying particular attention to evaluation routines and their implications regarding the deployment of such games in the daily lives of older adults. Larsen et al. [12], have tried to explain how the Exergames may represent an effective and innovative approach to increase the levels of physical activity in the elderly. Brox & Hernandez [3], instead, in dealing a description of persuasive games developed in order to encourage physical activity in older people, stresses the importance, for the achievement of this objective, of the playful, motivational, social and relational components. Finally, Planic, Nake, & Kampel [14] suggests guidelines for designing Exergames able to enhancing physical and social activities for the elderly.

The analysis of the experience gave way to understand how the national and local authorities are activated to develop programs to promote a healthy and active aging through the use of technological devices. The study conducted during this review analysed 26 case studies of cities, but it has not detected programs and initiatives specifically aimed at supporting physical activity and active aging through the use of ICT.

The initiatives and programs put in place by municipalities consist of interventions, aimed in the first place, to sustainable urban mobility, and to the reduction of CO_2 emissions. Indeed, the addressed issues relate to the concepts of smart city, smart mobility, green city, etc., without directly taking into account the issues related to physical activity, inclusion and social participation, autonomy and overcoming barriers, for the elderly. Certainly, these issues have been largely addressed, through initiatives and interventions implemented by the municipalities, but nevertheless, the actions based on the joint use of technology in favour of the active lifestyle and independent mobility of the elderly in urban context, are still limited. These issues were, however, deepened by other institutions (universities, companies, research groups), through the participation in national and / or European projects.

Among the identified project activities, two categories of projects were taken into account. In the first case, the analysis of European project: Smart Move, Street Life, SuperHub, My Way, Move Us, allowed the identification of work plans aimed at the design, implementation, evaluation and dissemination of a series of new ICT tools for smart mobility in the urban context. These studies, propose solutions aimed primarily at sustainable urban mobility and reducing of CO_2 emissions, not taking, however, directly and exclusively into account the issues related to physical activity, inclusion, social participation and autonomy in favour of the elderly. The above projects, in fact, relate to the citizen in general, with the aim of encouraging behavioural and habits changes, directing people towards more sustainable urban mobility choices. For this purpose, the developed technology is represented, in all the cases, by an open-source web platform and an application for portable devices that combines, in real-time, the available

options of mobility and the possibility to plan personalized routes. The topics addressed, relate mainly to the concepts of smart city, smart mobility, "zero" emissions and sustainable mobility.

In the second case, however, a number of projects of the European Programme "Active and Assisted Living Programme" (AAL) was identified. The analysis of project initiatives enabled the analysis of some projects, selected on the basis of the key study variables and the selection criteria of the items defined above, whose themes are related to those we reviewed. The project proposals are characterized by different approaches and applications: in correspondence to the findings of the analysis of texts, also in this case we can recognize different types of technologies developed. Some projects, in fact, offer fixed solutions for use at home according to the concepts of '' home-based system " -Motion, Safe Move, Pamap, Gameup, Elf@home, Is Active, Ageing in balance -; while others suggest solutions for the mobile devices – Com'on, Dossy, Happy walker, Mobecs, Virgilius, Wayfis, Trinutri -. Consequently, also the types of intervention are different: some of these projects, in fact, are based on the monitoring of the person, the promotion of physical exercise and the use of virtual games; others are focused on the outdoor environment, referring in particular to the issues of independent mobility, active mobility, safe movement in the environment or through transport. However, what we want to emphasize is that these projects take into consideration the various areas and objectives, in particular in regard to the issues of social inclusion, autonomy, social participation and how to overcome barriers to physical activity.

To conclude, both *text and experiences analysis* has allowed to show the constant presence of a number of common variables (see Tab. 1) that characterize and unite the technology and the proposed interventions, through which is possible to expand the knowledge of concepts and notions that represent the theoretical basis through which to develop this type of technology.

Study Variables	
1. Awareness	Awareness of performed activities Awareness of the progress Awareness of their own limits
2. Pervasive technology	Accessibility Fun Interaction Behaviour
3. Motivation	Motivational messages Intrinsic motivation (Comparison, competition, cooperation)
4. Social connection	Social connections Community Interaction
5. Self monitoring	Monitoring of their current behaviour progress.
6. Positive reinforcement	Rewarding strategies delivered to seniors when they perform the desired behaviour.
7. Goal Setting	Encourage behaviour change

Table 1: Common variables

DISCUSSION

The literature review examined the use of ICT as a tool to support the elderly in adopting active lifestyles and positive behaviours for their own health. Studies were conducted with particular attention to the characteristics that a technology needs in order to motivate the elderly to move more. Motivation, the characteristics of project as well as the design (such as ease of use, colour, notifications) represent the basis through which develop this type of technology. By referring to the type of intervention proposed, what is clear, however, is the near absence of actions that go beyond the concepts of programmed plan of physical activity or Exergame. In fact, despite the technology represents an increasing presence in elderly's everyday life, the studies based on the development of devices motivating the adoption of an active lifestyle are still limited. Moreover, studies aiming at investigating the achievements in the fields of social inclusion, autonomy, and social participation, are uncommon in the scientific literature.

CONCLUSION AND FUTURE WORKS

The study gave the opportunity to investigate the relationship between ICT, the elderly and physical activity and understand the current state of research about these issues. The information obtained represent the theoretical basis of a larger study, which aims to elaborate guidelines through which develop a prototype of app able to motivate and support the elderly toward the acquisition of healthy and active lifestyle. To this aim, we think that only technologies developed together with the elderly can be really effective for achieving the expected objectives. As demonstrated by several studies, only the direct involvement of the elderly is regarded to generate awareness, feeling of participation and learning and therefore only tools projected in this way will be really useful in supporting their everyday physical activity. So, in talking about professionals involved in the development of strategies in favour of the elderly it is important to take into account the point of view of the elderly, which in this case, are in the same way competent and professional.

REFERENCES

1. Albaina, I. M., Visser, T., van der Mast, C. A. P. G., Vastenburg, M. H. (2009). Flowie: A persuasive virtual coach to motivate elderly individuals to walk. *International ICST Conference on Pervasive Computing Technologies for Healthcare*, 1–7. doi:10.4108/ICST.PERVASIVEHEALTH2009.5949
2. Blazun, H., Saranto, K., Kokol, P., & Vosner, J. (2012). Information and communication technology as a tool for improving physical and social activity of the elderly. *NI 2012 : 11th International Congress on Nursing Informatics, June 23-27, 2012, Montreal, Canada. International Congress in Nursing Informatics (11th : 2012 : Montreal, Quebec) Author*, *2012*, 26.
3. Brox, E., & Hernandez, J. E. G. (2011). Exergames for elderly: Social exergames to persuade seniors to increase physical activity. *2011 5th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth) and Workshops*, 546–549. doi:10.4108/icst.pervasivehealth.2011.246049
4. Chodzko-Zajko, W. J., Proctor, D. N., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *Medicine and Science in Sports and Exercise*. http://doi.org/10.1249/MSS.0b013e3181a0c95c

5. Edwards, Peggy; Tsouros, A. (2008). *A healthy city is an active city: A Physical Activity Planning Guide*. *World Health Organization*.
6. Fan, C., Forlizzi, J., & Dey, A. (2012). Considerations for technology that support physical activity by older adults. *Proceedings of the 14th International ACM SIGACCESS Conference on Computers and Accessibility - ASSETS '12*, 33. doi:10.1145/2384916.2384923
7. Gerling, K., & Mandryk, R. (2014). Custom-designed motion-based games for older adults: A review of literature in human-computer interaction. *Gerontechnology*. doi:10.4017/gt.2013.12.2.001.00
8. Ghiani, G., Manca, M., Paternò, F., & Santoro, C. (2013). Towards an architecture supporting social, adaptive and persuasive services for active elderly. In *CEUR Workshop Proceedings* (Vol. 1013, pp. 36–41).
9. Hong, Y., Goldberg, D., Dahlke, D. V., Ory, M. G., Cargill, J. S., Coughlin, R., Peres, S. C. (2014). Testing usability and acceptability of a web application to promote physical activity (iCanFit) among older adults. *Journal of Medical Internet Research*, *16*(10), e2. doi:10.2196/humanfactors.3787
10. Istat (2008). Indice di vecchiaia dei Paesi europei. Noi Italia. 100 statistiche per capire il Paese in cui viviamo.
11. Istat (2014). Indice di vecchiaia dei Paesi europei. Noi Italia. 100 statistiche per capire il Paese in cui viviamo.
12. Larsen, L. H., Schou, L., Lund, H. H., & Langberg, H. (2013). The Physical Effect of Exergames in Healthy Elderly—A Systematic Review. *Games for Health Journal*, *2*(4), 205–212. doi:10.1089/g4h.2013.0036
13. Pietrantoni L., Prati G. (2012), Attivi e sedentari. Psicologia dell'attività fisica. Bologna. Il Mulino.
14. Planic R., Nake I., Kampel M. (2013). Exergame Design Guidelines for Enhancing Elderly's Physical and Social Activities. AMBIENT 2013: The Third International Conference on Ambient Computing, Applications, Services and Technologies, pp. 58–63; 2013.
15. Recio-Rodríguez, J. I., Martín-Cantera, C., González-Viejo, N., Gómez-Arranz, A., Arietaleanizbeascoa, M. S., Schmolling-Guinovart, Y., García-Ortiz, L. (2014). Effectiveness of a smartphone application for improving healthy lifestyles, a randomized clinical trial (EVIDENT II): study protocol. *BMC Public Health*, *14*(1), 254. doi:10.1186/1471-2458-14-254
16. Rodriguez, M. D., Roa, J. R., Moran, a L., & Nava-Munoz, S. (2012). Persuasive strategies for motivating elders to exercise. *Pervasive Computing Technologies for Healthcare (PervasiveHealth), 2012 6th International Conference on*, 219–223. doi:10.4108/icst.pervasivehealth.2012.248774
17. Romero, N., Sturm, J., Bekker, T., De Valk, L., & Kruitwagen, S. (2010). Playful persuasion to support older adults' social and physical activities. *Interacting with Computers*, *22*(6), 485–495. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0 78149466667&partnerID=40&md5=8cac3c58b25fcbbee373c85aa8634742
18. Silveira, P., Danie, F., Casati, F., Reve, E. van het, & Bruin, E. D. de. (2012). Active Lifestyle: an application to help elderly stay physically and socially active. *FoSIBLE Workshop at COOP2012*.
19. Silveira, P., Reve, E. van het, Daniel, F., Casati, F., & De Bruin, E. D. (2013). Motivating and assisting physical exercise in independently living older adults: A pilot study. *International Journal of Medical Informatics*, *82*(5), 325–334. doi:10.1016/j.ijmedinf.2012.11.015
20. Silveira P., van de Langenberg R., van het Reve E., Daniel F., Casati F., de Bruin E.D. (2013). Tablet-Based Strength-Balance Training to Motivate and Improve Adherence to Exercise in Independently Living Older People: A Phase II Preclinical Exploratory Trial. J Med Internet Res. 2013 Ag; 15 (8): E159. doi: 10.2196/jmir.2579.
21. Van Het Reve, E., Silveira, P., Daniel, F., Casati, F., & De Bruin, E. D. (2014). Tablet-based strength-balance training to motivate and improve adherence to exercise in independently living older people: Part 2 of a phase ii preclinical exploratory trial. *Journal of Medical Internet Research*, *16*(6). doi:10.2196/jmir.3055
22. Vankipuram, M., McMahon, S., & Fleury, J. (2012). ReadySteady: app for accelerometer-based activity monitoring and wellness-motivation feedback system for older adults. *AMIA Annual Sym-*

posium Proceedings / AMIA Symposium. AMIA Symposium, *2012*, 931–9. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3540520&tool=pmcentrez&rendertype=abstract

23. Vroege, D. P., Wijsman, C. A., Broekhuizen, K., De Craen, A. J. M., Van Heemst, D., Van Der Ouderaa, F. J. G., Mooijaart, S. P. (2014). Dose-response effects of a Web-based physical activity program on body composition and metabolic health in inactive older adults: Additional analyses of a randomized controlled trial. *Journal of Medical Internet Research*, *16*(12). doi:10.2196/jmir.3643
24. Wijsman, C. A., Westendorp, R. G. J., Verhagen, E. A. L. M., Catt, M., Slagboom, P. E., De Craen, A. J. M., Mooijaart, S. P. (2013). Effects of a web-based intervention on physical activity and metabolism in older adults: Randomized controlled trial. *Journal of Medical Internet Research*, *15*(11). doi:10.2196/jmir.2843
25. World Health Organization (2002). Active Ageing. A policy framework. WHO, Geneva, Switzerland. A contribution of the World Health Organization to the Second United Nations World Assembly on Ageing, Madrid, Spain, April 2002.
26. World Health Organization (2015) World Report on Ageing and Health. WHO publications.

Web Sites

1. AAL Programme (Active and Assisted Living Programme): http://www.aal-europe.eu/, consulted 01/2015
2. Ageing in Balance: http://aib.vtt.fi/, consulted 01/2015
3. Com'on: http://www.comon.lu/, consulted 01/2015
4. Dossy: http://dossy-aal.iwi.unisg.ch/, consulted 01/2015
5. Elf@home: http://www.elfathome.eu/, consulted 01/2015
6. Gameup: http://www.gameupproject.eu/, consulted 01/2015
7. Happy walker:
   http://www.happyassistedliving.com/, consulted 01/2015
8. Is Active: http://www.is-active.eu/, consulted 01/2015
9. My way: http://myway-project.eu/, consulted 04/2015
10. Mobecs: http://www.mobecs.eu/, consulted 04/2015
11. Motion: http://motion-project.eu/en/, consulted 04/2015
12. Movesmart: http://www.movesmartfp7.eu/, consulted 04/2015
13. Move us: http://www.moveus-project.eu/, consulted 03/2015
14. Pamap: http://www.pamap.org/, consulted 03/2015
15. Safe move: http://www.safemove-project.eu/, consulted 03/2015
16. Steet Life: http://www.streetlife-project.eu/index.html, consulted 04/2015
17. SuperHub: http://www.superhub-project.eu/suprhubhealth/about-the-project/, consulted 02/2015
18. Trainutri: http://trainutri.planetmedia.es/, consulted 03/2015
19. Virgilius: http://www.virgilius.eu/home/, consulted 03/2015
20. Wayfis: http://www.wayfis.eu/, consulted 03/2015
21. World Health Organization - WHO, Definition of an older or elderly person:
    http://www.who.int/healthinfo/survey/ageingdefnolder/en/ consulted 07/2015

THE CONTRIBUTION OF TECHNOLOGY TO THE TEACHING OF PHYSICAL EDUCATION AND HEALTH PROMOTION. MOTOR COMPETENCES AND PHYSICAL ACTIVITY LEVELS

DARIO COLELLA
Department of Clinical and Experimental Medicine-Motor activities and sport sciences, University of Foggia, Foggia, Italy

INTRODUCTION

Within the context of motor sciences and sports, the use of technology has changed and enriched decisively the teaching-learning processes, methods, assessment instruments and data archiving concerning students' physical activities and performances. The epistemology of physical education has changed and enlarged but has requested an update of the teachers' competences and continuous training (*media literacy*).

Using tools and applications in physical education as well as by the Internet, can implement a dual perspective for students and teachers: promoting a conscious physical activity, favouring an extension of the educative effects of the intervention in physical activities and sports even after periods of activities in gyms (self-assessment of performance, levels of physical activity and related behaviours); increasing the effectiveness and the quality of the educational process from its planning to the implementation of the intervention-assessment and communication among students, parents, managers, colleagues, and researchers.

In the following work, we will analyse the new and current educational opportunities offered by technologies in physical education promoting not only health, but an educational and didactic perspective, taking into consideration the educational programming for learning motor competences and the increased levels of physical activities.

THE TECHNOLOGY *IN* AND *FOR* PHYSICAL EDUCATION

Technologies, especially in the last twenty years, have enriched school education, expanded contents, tools, methodologies and changed the relationship between disciplinary knowledge, teachers and students. Rapid developments in electronic technology have made important effects on the education systems in the world.

The use of technology is an important effect of mediation between the discipline and the student, helping to change the ways of learning, developing the intrinsic motivation and the metacognition. The most important technologies used in schools (video recording and personal computers) have determined a re-setting of knowledge and have emerged new areas of intervention in each areas in relation to the essential disciplinary themes (Kretschmann, 2015).

Rosen (2011) warns us that children born in the first decade of this millennium are known as "*iGeneration*". This category of people has access to forms of technology unknown until two decades ago. The implications of these rapid changes by the access to technology among children and young people, should be highlighted in all the areas of learning (Chin & Edginton, 2014).

The applications in the domain of health and physical education, are available and can be used to enrich and improve curricular offerings in most schools. Numerous technological applications regarding the promotion of physical activities and fitness are available and easily accessible.

Today, the application of various technologies by students and teachers requires new competences. Students must demonstrate motor competencies and use technology mainly through a self-learning process. It is essential to learn to manage the organization of the activities together with the use of different equipment.

Teachers, on the other hand, need to become more aware about styles and teaching strategies and should always support the use of technological applications in physical education (Herring et al., 2012).

In fact, the study of Gibbone et al. (2009) examines the attitudes, the training of PE teachers, the integration of technology and the relationship between attitudes and practice.

The results show that teachers have positive attitudes but still a limited use of technology. The limits that affect the use of technology are: the school's budget, the large number of classes/ groups and the permanent teacher training process. Physical educators are willing to apply technology in teaching only if training is offered and the appropriate financial resources are available.

In the US NASPE (2009), guidelines have been published on how to appropriately use teaching technologies in Physical Education:

Guideline1: Educational technologies in physical education aim at increasing the effectiveness of teaching;

Guideline2: Educational technologies in physical education aim to supplement, not replace, the effectiveness of teaching;

Guideline3: Educational technologies in physical education should provide learning opportunities and education for all students;

Guideline4: Educational technologies in physical education should be an effective tool to store student's data relating to his/her curriculum objectives.

It is important for teachers to learn and understand the technological tools before using them in gyms so that their students may use these tools effectively.

The use of equipment and instruments must not interfere with the achievements of lesson objectives.

Subsequently, Sanders & Witherspoon (2012) have summarized the important processes that have to be conducted when using technology in physical education. The authors argue that (1) technology can be a challenge; (2) you need to design continuing education for the physical educators to develop skills in the use of technology; (3) the availability of a budget to buy technological tools in schools and a priority in physical education; (4) standards must be defined for using technology safely in all areas of sports and physical education for students of all ages; (5) periodic updating of software has to be included in the budget; (6) the physical education programs for teachers should include technological applications; (7) technologies should be used in the evaluation process and for sharing information with teachers, principals, students and parents.

Studies warn that technology is innovative in the way that students learn and teachers teach. Physical education curricula and health promotion programs are developed to offer students better opportunities instead of the traditional way of learning in gyms (Castelli et al.,2014; Kretschmann, 2015).

STUDY DIRECTIONS

In reference to the use and relationship between physical education and technologies, it is possible to identify different directions and complementary studies: epistemological, psycho-pedagogical, and socio-cultural.

The *Epistemological* perspective is basically a didactic one based on scientific evidence. The physical education areas are re-structured and the interdependent aspects are highlighted: a. technology *into* and *for* physical education (ie the contribution made for an effective teaching-learning of skills and motor competences at school; the integration of new methods for the assessment of motor developments, the processing and data storage, etc.); b. *physical education and technology* (namely the relationship between the physical activities and the use of some tools and equipment, eg., heart rate monitors, accelerometers, stereo systems, video cameras, digital cameras, projectors, i-pads or online education, including different teachings such as Physiology, Neuroscience, History, Science, through interactive videos, web pages, and the effects on learning etc.); c. *technologies for health promotion through physical activities* (the use of pedometers and accelerometers to assess the levels of physical activity, the use of GPS to assess and customize, the use of web platforms to record performances and parameters and compare its performance reference values, preparing training plans, etc.).

Physical education becomes richer than in the past and each domain (*expressive activities, games, sports, outdoor education, motor and interdisciplinary learning*) receives a significant contribution and is revised and expanded. Through the use of different instruments, physical education establishes closer links between scientific fields and stronger "bridges" between different fields of knowledge emerge.

The *Psychopedagogical* perspective. The use of technology in physical education promotes an effective learning process of motor competences allowing the student to evaluate the accomplished experience by comparing it in different time periods. Teaching motor competences (skills, knowledge, motivations, attitudes and mutual relations), through different styles and teaching strategies (Schmidt & Wrisberg, 2000; Mosston & Ashworth, 2002), along with technological tools, not only broadens and specifies the teaching -educational directions, but introduces new ways to teaching skills and knowledge in different contexts. In this direction, technologies promote the learning and the revision of the motor skills, the psychological factors related to practice, the perception of competence, the reciprocal-assessment, enjoyment, the mental and the meta-cognition processes (Fiorentino & Castelli,2005; Dillon,2008).

The *Socio-cultural* perspective. Technologies support curriculums in schools, produce reticular knowledge, and expand/connect the learning environments. Computers and video cameras allow you to share data and experiences of physical and sports activities (simultaneously and/or at different time) among users and develop interpersonal relationships. The student can participate in physical activities and fitness programs online, analyse, and share video-analysis

data relating to physical education classes and training sessions, compare experiences and activities carried out in different geographical locations. The effects for teaching and learning have been extended. With the use of smartphones in physical education and sports, you can compose and send texts, data, photos and videos, participate in social media on the issues of health promotions or sports, receive real-time information on the conduct of demonstrations, events, as well as acknowledge the availability of facilities and use of equipment for physical activities and sports.

Learning motor competences, developing motor skills, assessing levels of physical activities for health promotions and prevention of sedentary habits are all essential directions for teaching.

MOTOR LEARNING AND TECHNOLOGY, A QUALITATIVE APPROACH.

The learning processes of motor skills (physical literacy) are developed according to the successive-interdependent stages and constitute qualitative aspects essential in physical education teaching. In any motor learning phase, teachers apply different and complementary teaching styles to facilitate the execution of motor tasks, according to the different levels of variability, difficulties and organizational modalities.

The systematic observation is the fundamental method to assess the motor skills (and the motor coordination) of the student through lists of skill-criterion, in accordance with the criterial evaluation (criterion-oriented assessment) model that gives value to the individual progress and context in which learning develops (Burton & Miller,1997; Davis & Broadhead,2007).

Video analysis is included in the tools of qualitative assessment. It is an effective tool for monitoring the levels of learning and encourage the perception of competence of the student. Thus, the psychological factors and the relationships with motor abilities are solicited: it is possible to analyse the motor task, compare the evolution of learning at different time of year varying the teaching styles, compare the performance of different students, disassemble and reassemble motor sequences to detect errors and appreciate the learning outcomes; elaborate combinations of motor sequences (Anderson et al.,2001).

Video analysis allows the teacher to communicate systematically precise feedback on the task (Schmidt & Wrisberg, 2000; Darden, 1999), in order to provide the students with the most necessary information on the effectiveness of the learning-teaching process (Jambor & Weekes, 1995). The feedback, through video analysis, allows you to: identify the differences between performance required and realized; isolate the most difficult aspects of specific motor skills; promote a useful "cognitive effort" in the learning process; increase motivation, enthusiasm, and perseverance in learning through the documentation of progress; compare and evaluate progress or the changes of a previous error.

A pilot study of Dillon (2008) has shown the effects of the subsequent feedback on the learning performance of children in the skill of throwing and catching a ball through cognitive learning measures. Those children who had received video feedback in addition to verbal information, showed higher scores than the ones who had only received verbal instructions from the teacher.

The implementation of technology in teaching physical education is motivating for students. It contributes to the monitoring of the students' progress, to identify gaps in the repertoire of motor skills and to reinforce the perceived physical self-efficacy (Fiorentino & Castelli,2005).

THE LEVELS OF PHYSICAL ACTIVITY AND ASSESSMENT TOOLS, A QUANTITATIVE AND QUALITATIVE APPROACH

The decline of physical activity levels during childhood and adolescence in various countries (Hallal et al., 2012) and the interventions favouring health promotions through physical education and extracurricular physical activities, has directed our attention on the instruments to measure physical activity levels and its related factors (Sirard & Pate, 2001; Trost, 2007; Heyward & Gibson, 2014) respecting the guidelines (WHO, 2010). Using various measuring and integrated instruments, many studies have shown that you can increase the MVPA during the hours of physical education at school by changing the organization and the activities (Lonsdale et al., 2013; Clapham et al., 2015).

Among the objective instruments to measure the physical activity levels in schools, you can also use: the pedometer, the heart rate monitor, the accelerometer, and the combination of objective and subjective methods and tools. For example, the heart rate monitor and the pedometer (Clapham et al., 2015), the accelerometer and self-reports, etc. In particular, accelerometers are small receivers (at a sustained cost) and accessible to everyone, eg., in laptops and mobile phones. The accelerometer provides integrated information: heart rate, energy expenditure, the number of steps and it also allows you to define the individual behavioural profiles related to the physical activity because it measures the total amount and the intensity (MVPA).

The data obtained with these tools are quantitative and qualitative and should be interpreted in relation to different and complementary factors: task duration, difficulty and intensity, organizational modalities, and the teaching styles in physical education. In particular, the instruments of assessment develop the intrinsic motivation for physical activity in students and the relationship with knowledge concerning the functioning of the body systems. In addition, the systematic monitoring and interpretation of personal information are essential factors for the change of sedentary behaviours and free time management.

Another instrument that integrates all of the tools is the GPS-*Global Positioning System and the Geographic Information System*, a global positioning system (GPS) which uses satellites and ground stations as reference points to calculate the geographic position and accurately monitors specific activities. For example, portable GPS unit provides information on altitude, distance, time, and the average speed while hiking.

The graphic processing, through the GPS data, represents the characteristics of a territory: the portions of the ascent and descent of the ground or street views of a particular area of the city. The GPS can be used in conjunction with accelerometers to measure and monitor the physical activity individually and in groups. The instrument can be more widely used to evaluate and promote physical activity, to structure a quantities-qualitative data archive referred to a group or a population. The data obtained support the transverse learning knowledge to other disciplines of the curriculum, enrich, and reinforce the students' learning processes.

Among the prevention and the intervention programs for children, it is very interesting the study of Van Kan et al (2015). The purpose of the project was to increase physical activity and reduce the sedentary behaviour of children at primary school (in the Netherlands) developing and implementing the customized and multifactorial interventions. The interventions included a combination of physical activities in the socio-cultural context to meet the local needs of schools (schoolyard and neighborhood).

The main expected results concern the changing levels in physical activities. Mainly, the reduction of the sedentary behaviour in favour of a light physical activity to a moderate-vigorous one (MVPA) in a defined time period. Its strength lies in its being an almost-experimental study in which we use a combination of objective measuring instruments such as accelerometers, GPS, self-reports, questionnaires, diaries, and observations of neighbourhoods.

DO EXERGAMES INCREASE THE PHYSICAL ACTIVITY LEVELS ?

The games that require interaction with participants have a double value. That is, they increase the levels of physical activities and promote motor learning. Their rapid market uptake has highlighted the benefits and the effects on increasing the physical activity levels (to be still confirmed) but also the gradual reduction of time dedicated to spontaneous play and the interpersonal relationships typical of children and young people.

At present, not all scholars agree on the active video game effects on the educational process of a child.

Papastergiou (2009) conducted a literature review on the use of video games in physical education in order to: (a) identify the contribution of introducing video games as educational tools in health promotion programs during physical education, (b) to present a summary of the empirical evidence available on the effectiveness of education (c) to define future directions of research on the educational use of computer games as part of the physical education teaching.

34 relevant articles have been identified. The review suggests that electronic games have many potential benefits as educational tools in health and physical education. They may improve knowledge, skills, attitudes and young people's behaviour concerning health and exercises. In addition, the new electronic games which are physically interactive, may also improve the physical activity levels, the physical fitness of children and young people, their motor skills and their motivation for physical exercise. The results show a generally favourable context and the methodological implications for teachers and researchers are positive.

Though a limit is necessary to highlight: in addition to the positive effects on the increasing levels of physical activities and the motor learning processes, games are mainly practiced at home without offering the opportunity to interact with the socio-cultural context.

An interesting review on the effects of active video games (AVGs) on the levels of physical activities was accomplished by Biddis & Jrwin (2010). They showed how the energy used in games was significantly lower for those who used the top part of their bodies compared to those who engaged the lower part. The active video games (AVGs) allow moderate physical activity but evidence in drawing conclusions about the long term and on the promotion of physical activity, are limited .

Physical inactivity among children and young people remains a significant public health problem. It could only be solved through a multifactorial approach including daily interventions that are structured and enjoyable thus increasing their daily dose of physical activities (quality and quantity). The AVGs are a new generation of technology, also assessed as health measures. The studies must show whether or not AVGs can be used effectively in long terms to help motivate a greater daily physical activity and decreased sedentary pastimes. Many AVGs are designed to engage the upper and lower part of the body. The opportunity to use these games can increase the fun and the options for physical activities at home and even to overcome possible barriers for those with special educational needs.

Hansen & Sanders (2011) show that childhood obesity is on the rise and children's participation in physical activities is a goal to counter this phenomenon. Technology is often blamed for increasing sedentary lifestyles, but may also be the cure. Active play is a modern approach that allows children to perform daily physical activities; it is in accordance with adolescent's cultural models and a fun alternative to traditional exercises. Through virtual games, children have fun and benefit physical exercises.

Nevertheless, benefits and concerns emerge concerning physical activities that are today studied in order to clearly see the impact of active play on children and adolescents' lifestyles.

The authors, through a literature review, have classified the various categories and types of *active games*: Exergames (*Rhythmic Dance Games*: Dance Dance Revolution; iDance; BluFit; ReRave; Virtual Bicycles: GameCycle; Expresso; XDream e Xerbike; Balance Board Simulators: Tony Hawk; Ride; Wii Fit; Virtual Sport Simulators: Wii Sports; XaviXPort8; Microsoft Kinect; Gamercize Pro-sport);

Interactive Fitness Activities **(**HopSports; Sportwall XerTrainer; Martial Arts Simulators: 3Kick; Makoto); Active Learning Games **(**FootGaming; Brain Bike; Gamercize PC-Sport**)**.

The availability of equipment for active play at school, in classrooms and in physical education curriculums, together with the parents' consent, can have a positive effect on increasing physical activity levels.

What benefits? Active play in physical education at school and at home shows that: a) it is fun and motivating; b) you can choose which games to practice; c) they are easy to use; d) promote socialization; e) increase physical activities.

We must not overlook that socializing requires interaction and communication with the peer group through body experience and an enjoyable environment rich of different and variable opportunities. The AVGs, in this sense, are a limit and not an educational contribution.

LeBlanc et al (2013) analyzed 52 articles (published between 2006 and 2012), included in the review and related to different samples aged 3-17 from 8 countries. Overall, the video games (AVGs) are associated with an increase in energy expenditure but the effects on the habitual physical activity are not well understood.

It is not clear whether video games are effective in reducing sedentary habits of children and adolescents as well as their exposure to the internet or whether they help to increase energy expenditure. The AVGs show positive effects when used for learning and the rehabilitation processes for people in need.

The AVGs contribute to the development of physical literacy (George et al., 2016): the active video games (AVGs), such as the Nintendo Wii, have become established as alternatives to traditional physical activities, providing an environment where one can develop physical literacy without moving around the house. The study examined the impact of AVGs on children (6-12 year olds, n = 15; M n = 7; F n = 8) of physical literacy. The kids played with one of the four AVGs preselected for six weeks (minimum 20 minutes, twice a week).

Tests and retests were carried out to measure motivation, enjoyment, self-esteem and motor developments with the M-ABC protocol and an endurance test. The results showed a significant improvement in manual dexterity in males and females (the improvements of girls only affected the games they played). Overall, it seems evident the positive impact of the AVG intervention on the physical literacy factors, on the intrinsic motivation and on enjoyment. Girls, unlike boys, are more likely to participate in games for fun and social interactions. Instead of playing to win, girls generally prefer engaging themselves for intrinsic motivations. The AVGs are considered as a good alternative, for many children, to fundamentally develop the physical literacy because they take place in a safe environment.

IMPLICATIONS AND METHODOLOGICAL PERSPECTIVES

Certainly the use of technology in teaching physical education at primary and secondary school constitutes a significant opportunity to enhance the motor teaching-learning processes, particularly the motivation and the perceived self-efficacy. Also, they allow you to interact with other groups / schools and to share motor and sports experiences. An additional contribution to the development of the awareness of values and meanings of physical activities is achieved when students measure the amount of daily physical activity by performing a physical effort, in a structured and unstructured way, at school and during his/her leisure time. In this direction there are interesting hypothesis concerning the developmental age in order to: a) assess the effects of using one or more technological tools for learning other subjects and the overall academic success; b) assess the results of the video analysis on self-assessment in motor learning; c) assess the levels of physical activities combined with tools in certain environments and through different motor tasks (eg., *outdoor education*); d) evaluate the effects of feedback on the perception of competence, in the motor learning process; e) evaluate the learning-development stages of motor skills in different age groups and according to gender differences, body mass index, socio-cultural context of origin, through tools that allow you to measure the relationship between energy expenditure and the development of motor coordination in different activities. Technologies provide an essential contribution not only in terms of education and learning, but also for public health. Programming, evaluation, processing and the storage of data, are necessary steps for the promotion of education based on scientific evidence. Technologies are of great support to structure a regional observatory for archiving the longitudinal and the cross-sectional analysis of data regarding the motor developments and lifestyles of children and young people. They also allow you to compare and to evaluate, in subsequent periods, the results of intersectoral and multifactorial interventions.

CONCLUSIONS

Physical education receives a significant contribution from technologies in order to elevate the quality of teaching and learning. Though, the equipment and the instruments, even the most advanced ones, should not replace the motor and the sporting experience of children and adolescents. In addition to the teaching methodologies, technologies are tools that enhance physical education by implementing the educational-learning process and contrast to the sedentary lifestyle measures (*physical education and motor experiences vs screen time*). An emerging contribution concerns the use of social media for the interaction between different subjects and the value of motor and sports experiences carried out in different socio-cultural contexts.

The quality of physical education involves the integration of environments, activities, methods and tools and not their separation or exclusion.

REFERENCES

1. Anderson, M., Mikat, R.P. & Martinez, R. (2001) Digital video production in physical education and athletics. Journal of Physical Education, Recreation, & Dance*, 72,* 19-21.
2. Biddis, E., Jrwin J. (2010). Active video games to promote physical activity in children and youth. Archives of Pediatrics and Adolescent Medicine, 164(7),664-72.
3. Burton, A.W., & Miller, D.E. (1998). Movement skill assessment. Champaign, IL, Human Kinetics.
4. Castelli, D.M.,Cenetio, E.E., Beighle,A.E., Carson, R.,L., Nicksic, H.M. (2014). Physical literacy and comprensive school physical activity programs. Preventive Medicine,66,95-100.
5. Chin, M.K. & Edginton, C. (2014). Physical Education and Health- Practices Around the World. In Physical education and health – Global perspectives and best practices – (Chin M.K. & Edginton C Eds.), Urbana, IL, Sagamore Publishing, 1-14.
6. Clapham, E.D., Sullivan, E.C., Ciccomascolo, L.E. (2015). Effects of a physical education supportive curriculum and technological devices on physical activity. The Physical Educator. 72(1), 102-116.
7. Darden, G.F. (1999). Videotape feedback for student learning and performance: A learning-stages approach. Journal of Physical Education, Recreations & Dance, 70(9), 40-47.
8. Davis, W.E. & Broadhead, G. D. (2007). Ecological task analysis and movement, Champaign, IL, Human Kinetics.
9. Dillon, S.R. (2008). Time-Delayed Video Feedback in Physical Education: A Pilot Study. Poster presentation presented at the 2008 AAHPERD National Convention and Exposition. Fort Worth, TX: April 8-12.
10. Fiorentino, L.H. & Castelli, D. (2005) Creating a Virtual Gymnasium. Journal of Physical Education, Recreation & Dance, 76(4), 16-18.
11. George, A.M., Rohr, L.E., Byrne, J. (2016). Impact of Nintendo Wii Games on Physical Literacy in Children: Motor Skills, Physical Fitness, Activity Behaviors, and Knowledge. Sports, *4*(1), 3, doi:10.3390.
12. Gibbone, A., Rukavina, P., & Silverman, S. (2010). Technology integration in secondary physical education: teachers' attitudes and practice. Journal of Educational Technology Development and Exchange, 3(1), 27-42.

13. Hallal, P.C., Andersen, L.B., Bull, F.C., Guthold, R., Haskell, W., Ekelund, U.(2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet, 380,247-257.
14. Hansen, L. & Sanders, S. W. (2011). Active gaming: A new paradigm in childhood physical activity. Digital Culture & Education, 3:2, 123-139.
15. Heyward, V., & Gibson, A. (2014). Advanced Fitness Assessment and Exercise Prescription (7th Edition), Champaign, IL, Human Kinetics.
16. Herring, M. C., Edginton, C. R., Geadelmann, P. L., & Chin, M. K. (2012). Emerging perspectives on learning and technology in physical education: Policy implications. In S. Sanders & L. Witherspoon (Eds.), Contemporary uses of technology in K–12 physical education: Policy, practice and advocacy (pp. 21–53). Charlotte, NC: Information Age
17. Jambor, E. & Weekes, E. (1995) Videotape feedback: Make it more effective. Journal of Physical Education, Recreation, & Dance. 66(2), 48-51.
18. Kretschmann, R. (2015). Effect of Physical Education Teachers' Computer Literacy on Technology Use in Physical Education. The Physical Educator, 72, 261-277.
19. LeBlanc, A.G., Chaput, J.P., McFarlane, A., Colley, R.C., Thivel, D., Biddle, S.J.H., Maddison, R., Leatherdale, S.T., Tremblay, M.S. (2013). Active Video Games and Health Indicators in Children and Youth: A Systematic Review. PLOS ONE, 8,6, 1-20.
20. Lonsdale, C., Richard R. Rosenkranz, R.R., Peralta, L.R., Bennie, A., Fahey, P., Lubans, D.R. (2013). A systematic review and meta-analysis of interventions designed to increase moderate-to-vigorous physical activity in school physical education lessons. Preventive medicine, 56, 152-161.
21. Mosston, M. & Ashworth, S. (2002). Teaching physical education (5th edn). London, Benjamin Cummings.
22. National Association for Sport and Physical Education (2009). Appropriate use of instructional technology in physical education. Reston.V.A.
23. Papastergiou, M. (2009). Exploring the potential of computer and video games for health and physical education: A literature review. Computer &Education, 53,3,603-622.
24. Rosen, L. D. (2011). Teaching the iGeneration. Educational Leadership, 68 (5), 10-15.
25. Sanders, S., & Witherspoon, L. (2012). Policy implications and future directions for the use of technology in physical education. In S. Sanders & L. Witherspoon (Eds.), Contemporary uses of technology in K–12 physical education: Policy, practice and advocacy. Charlotte, NC: Information Age.
26. Schmidt A., R., Wrisberg C., A. (2000). Motor Learning and performance. Second edition. Human Kinetics, Champaign, IL, USA.
27. Sirard, J.R., Pate, R.R. (2001). Physical activity assessment in children and adolescent. Sports Medicine,31,6,439-454.
28. Trost, S.G. (2007). State of the Art Reviews: Measurement of Physical Activity in Children and Adolescents. American Journal of lifestyle medicine,1,4,299-314.
29. Van Kann, D.H.H., Jansen, M.W.J., de Vries, S.I., de Vries, N.K., and Kremers, S.P.J. (2015). Active Living: development and quasi-experimental evaluation of a school-centered physical activity intervention for primary school children. BMC, 15,1315.
30. WHO (2010). Global recommendations on physical activity for health, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland.

PHYSICAL EDUCATION AND ICT: AN UNSTOPPABLE COMBINATION

CARLES GONZÁLEZ ARÉVALO,
National Institute of Physical Education of Catalonia (INEFC), Barcelona Branch, Barcelona, Spain
MERITXELL MONGUILLOT HERNANDO,
Vall d'Hebron Institute, Barcelona, Spain
CARLES ZURITA I MÓN
Virolai School, Barcelona, Spain
LLUÍS ALMIRALL BATET
Diví Pastor School, Barcelona, Spain
MONTSE GUITERT CATASÚS
Universitat Oberta de Catalunya (UOC), Barcelona, Spain
Supported by the National Institute of Physical Education Catalonia (INEFC), Generalitat de Catalunya

THE INCORPORATION OF ICT IN PHYSICAL EDUCATION

Transforming the classroom

The use of technology for teaching and learning requires a paradigm shift at all levels: in the relations and roles of the stakeholders, in the educational contents, and in the form of teaching, learning and assessing. To incorporate ICT into education, we must first consider the challenges and objectives of current education, and then decide how ICT tools can contribute to attaining them (Marchesi, 2009). In new methods, students take the leading role in the educational activity, whilst teachers become guides and designers of learning situations (Monguillot, et al. 2015).

Challenges of integrating ICT into the classroom

Some educational challenges in the next five years focus on the personalization of learning, collaborative work, the changing role of the teacher, and the creation of authentic learning opportunities. Technological developments, such as those on which "bring your own device" (BYOD), makerspaces and 3D printing are based, can help us to face these new challenges (Horizon Report: 2015 K-12 Edition).

The appropriate use of ICT in physical education helps to develop certain skills among students, including collaborative work, independence, critical ability, responsibility, and information search and selection (Capllonch, 2005). The incorporation of ICT in physical education to encourage exercise is still in its early stages (Prat and Camerino, 2013). However, there are already many examples of how the use of ICT in physical education can stimulate the

practice of physical activity among students. In fact, when social networks are used correctly, they become a powerful tool for promoting healthy lifestyles among adolescents (Monguillot et al., 2015). For example, the #tuitactiu the project (Nieto, 2012) uses Twitter in physical education to spread the practice of exercise among students. The #quesepegue project (Herrero, 2012) uses Twitter to enliven break times with healthy physical activity. Finally, the use of m-learning or mobile learning (Monguillot et al., 2014) opens the way for new forms of teaching and learning that are useful and functional, and facilitate interaction, collaboration, knowledge generation and the combination of formal and informal learning environments. In this way, learning tends to become more personalized, and extends beyond the classroom walls.

The TPACK model in the physical education classroom

The use of ICT in physical education is a reality that reflects needs and changes in current society. The introduction of ICT in new learning situations should be accompanied by a change in methodology that, in turn, requires new teaching skills. This can be achieved by means of Koehler and Mishra's (2009) TPACK model, which links three elements of teaching knowledge: technology, pedagogy and content. According to Valverde et al. (2010), teachers must focus on students' diversity and learning needs before they introduce the TPACK model in the classroom. Consequently, it is essential to plan and design learning environments and experiences using teaching strategies that address student diversity in the technology classroom. The following diagram shows Koehler and Mishra's (2009) TPACK model.

The overlap between pedagogical and content knowledge (PCK) represents how a subject is transformed to be taught, taking into account aspects related to good practices in education, such as the connections between content and teaching strategies.

The incorporation of ICT into physical education is no guarantee of change and educational innovation on its own. Three elements must be combined to produce change and improvements: technological, pedagogical and content knowledge. In addition to the combination of these three elements, teachers should have an active, open attitude and encourage constant searching for information, collaboration and learning.

MOBILE APPLICATIONS AND HEALTHY RUNNING: THE *"CORREM CAP A PARÍS"* (WE RUN TOWARDS PARIS) TEACHING UNIT

Jogging is one of the most common free-time physical activities in our society. The use of mobile applications and gadgets to track how much exercise has been done is increasingly common among runners. Students can learn about these tools if they are introduced into a school environment, and they may motivate students to do an activity such as jogging that is not very attractive during adolescence. To meet both objectives, a teaching unit was designed that consisted in creating a collaborative challenge for third year students of physical education at compulsory secondary education (ESO) level in various schools: to run 1023 kilometres between Barcelona and Paris. The aim was to motivate students in aerobic endurance training, practice different methods and systems of training, and use applications designed to track running. The starting point for the unit was the assesssment criteria for Year 3 of secondary education (Decree 143/2007):

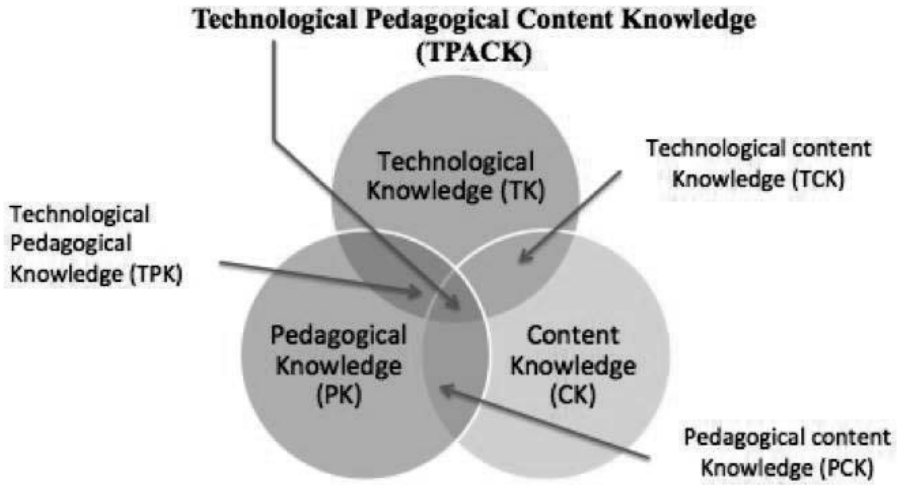


Figure 1. Diagram of the TPACK model by Koehler and Mishra (2009, p.63)

- *Increase the individual level of physical fitness to improve health by participating in the proposed activities and identifying a quality that could be improved.*
- *Determine the intensity of the exercise that has been undertaken by measuring heart rate.*

The unit was taught over twelve, one-hour classes during which the students choose to run for 8', 10' or 15', depending on their fitness level and working within the limits of a healthy heart rate. In the first classes, the teachers presented different methods and systems of aerobic endurance training. In the following classes, students were put into groups to design their own sessions, according to their characteristics, needs and interests. Students could use smartphones during the sessions, either to listen to music whilst they were running or to use GPS applications (such as Endomondo, Runtastic or Runkeeper) to determine how far they had run. At the end of the classes, the distances were recorded, as well as the heart rate. The metres and kilometres that students had run were added up and illustrated using a group marker for all the schools. To achieve this, a virtual environment such as Google Sites was essential to support the face-to-face sessions and act as a meeting point between schools. Google Sites was used to monitor the progress of the challenge, and was organized with specific pages for different items of the curriculum: objectives, skills, indicators, contents and assesssment criteria. In addition, two special pages were designed for two questionnaires created using Google Forms. One of them enabled students to enter their daily record (distance, heart rate and time of each session), whilst the other was for final evaluations of the unit. Another page was designed with a Padlet to gather students' brief subjective, qualitative evaluations of the unit through their responses to the phrase: *"This unit has been like a… because…"*.

Finally, a special page was created for students to post daily images illustrating their efforts to meet the challenge. Once the unit had been completed, a final video was embedded in this page that showed the work carried out by the students in the different schools.

EVALUATION OF THE EXPERIENCE

Very satisfactory results were obtained and demonstrated by the students using the assessment instruments. Students met the initial challenge and managed to "run to Paris" in a healthy, cooperative way. In addition, they developed aerobic endurance within healthy limits, and learnt different methods for working on this quality on their own.

The students' evaluations in the final questionnaire show that they enjoyed the experience of working towards a common goal with other schools. In addition, students were very positive about the fact that they could listen to music whilst they ran in each class.

A very positive result associated with the skills and purposes of secondary education was obtained in students' evaluations of the usefulness of what they had learnt, and whether this knowledge could be transferred to real life. Specifically, students learnt basic tools for independently developing aerobic endurance for health, and discovered that endurance training could be an enjoyable resource and something active to do in their free time. Some students made comments in personal evaluation forms such as: *"I liked it because it was enjoyable. With the music, we worked much better and running with our friends motivates us more. It's very good. We got fit as well."* In addition, students showed their motivation to improve their personal level of physical fitness, and reflected on their limitations and challenges as follows: "*In this unit, what I will try to do is increase the number of minutes I run, that is, first do 8 minutes, then the 15 that I want to reach".* In the daily record form, students noted how much they had enjoyed the activity and their motivation for the unit, with comments such as: "*I think it is a very enjoyable activity that helps us improve more all the time. Thanks to the teachers for doing something different and helping us to see our endurance. :)".*

In the implementation of this unit, students' motivation to run was promoted through activities designed as group challenges, with the use of smartphones and the support of technology. These factors, together with the independence given to students, represent an innovative, motivating approach which contributed to the success of the unit. Taking into account that schools should prepare students for life (Perrenoud, 2012), it is vital to design meaningful situations and activities and can be transferred to students' real life. For this reason, the *"Correm cap a París"* unit promoted activities that incorporate physical activity as a tool to improve the health, quality of life and the active use of free time (González Arévalo, 2008). Students played a leading role in the experience, and participated in their own learning. They were involved in decision-making and their independence was increased. The web 2.0 tools were of great use, as they enabled virtual interaction between students, and the inclusion of ICTs in physical education. As an aspect that could be improved, teaching staff highlighted the need to promote interaction between students from different schools. The following project, which used QR codes, boosted this interaction between students.

QR CODES AND STRENGTH TRAINING: THE *"JUNTS/ES FINS L'EVEREST"* (TOGETHER TO EVEREST) TEACHING UNIT

"Junts/es fins l'Everest" (Together to Everest) was based on the results of *"Correm cap a París"* on the use of mobile applications and technologies as a way to motivate students in

the practice of healthy physical activity. In this teaching unit, there was a particular focus on promoting direct interaction between students from the different participating schools, through the information contained in QR codes.

The main aim of the unit was to simulate a collaborative ascent of Mount Everest as a group of students from two schools by adding up repetitions of strength training exercises. This unit was taught in the second year of secondary school, and was designed on the basis of a prescriptive evaluation criterion (Decree 143/2007):

- *Increase the individual level of physical fitness to improve health.*

The unit was taught in twelve one-hour classes, in which students had to complete as many repetitions of strength exercises as possible, using the correct technique. To simulate the ascent of Everest, 35 repetitions were taken to represent a climb of approximately one metre. The challenge was divided into four stages that took students from the base camp to the 8850 metres of the peak of Everest. In each stage, the influence of altitude on the physical activity was taken into account.

- Stage 1: 35 repetitions are equivalent to a climb of 1 metre.
- Stage 2: 35 repetitions are equivalent to a climb of 0.9 metres.
- Stage 3: 35 repetitions are equivalent to a climb of 0.8 metres.
- Stage 4: 35 repetitions are equivalent to a climb of 0.7 metres.

To meet the challenge, students were grouped into teams of 4 people. In the first classes, they learnt strength exercises for the main muscle groups. They then used these exercises to begin to add up their first repetitions, through the Tabata training method. This method consists in carrying out 4 minutes of muscle work, broken down into exercises carried out for 20 seconds, with 10 seconds rest in between. The Tabata method enabled teams to use their smartphones to track how much exercise they had done, and even create their own music for Tabatas with Audacity, audio editing software.

In subsequent classes, students designed their own strength exercises using QR codes. Each team chose a format for the information associated with the code (text, image or video), and organized it according to the criteria established by the teaching staff. Finally, the codes were shared between students in the same class, between students in the same school, and between students from different schools.

During the challenge, students recorded the repetitions that they achieved in each class. A Google Form was used to enter the number of repetitions into a shared Excel on Google Drive, which was embedded into the project's website. The Sites (Web) environment was an essential mechanism for monitoring the challenge, and enabled teachers to provide information for students on aspects of the curriculum: objectives, contents, skills, criteria and assesssment indicators. The website was also used to demonstrate applications or programs for reading and designing QR codes. It became a means of virtual interaction, where students from the different schools shared the QR codes and Tabatas they designed throughout the unit. Finally, a Google Forms questionnaire was created to gather students' final evaluations of their satisfaction with the project and its usefulness.

EVALUATION OF THE EXPERIENCE

The project results were very positive. Together, the students managed to reach the peak of Mount Everest. They learnt to carry out strength exercises for the main muscle groups, using the correct techniques.

The students' participated fully in the group throughout the unit, regardless of their level of physical fitness or motor skills. Some of their comments are given below: "*We all did the activities and even if we didn't contribute many repetitions, we felt that they were important"*.

The results show that students were aware of the usefulness of what they learnt in their real lives. In the comments gathered on the usefulness of the teaching unit, students highlighted what they had learnt about looking after their bodies, carrying out strength exercises independently, and reading and designing QR codes. Some of the comments were as follows: "*This unit was useful because I learnt to carry out physical activity and look after my body*".

One important aspect was students' high participation in a different, innovative teaching unit that incorporated technology, the use of mobile phones in the classroom and music as motivational elements. Some of the students' comments were: "*I prefer new ways of learning to pen and paper*" or "*I liked it because I would never have thought that we would use mobiles in a class, and even less in a physical education class*".

In addition, students were very positive about working collaboratively, and about the opportunity to interact with peers from other schools by exchanging QR codes*: "This unit was a new experience, as we never collaborate with other schools"*.

The results show that *"Junts/es fins l'Everest"* contains various aspects that increase students' motivation and the relevance of what is learnt. First, strength exercises, which are expected to be repetitive and not very motivating, were made meaningful using an argument based on a collaborative, inclusive challenge, in which physical ability and motor skills were not determining factors. Students' independence was promoted through learning that was close to their reality, taking into account different paces and possibilities. Mobile technology was incorporated into the physical education classroom as a motivational tool for the practice of healthy physical activity. However, this did not have an impact on the amount of motor activity during the class.

Collaborative learning environments were created at different levels, from cooperation in small groups to interaction between students from different schools. Technology in general and QR codes in particular offered educational opportunities that supported the creation of such environments.

Finally, a project of this kind would not be possible without the collaboration of teachers. Although teachers appreciated that it took longer, more dedication, and greater coordination and planning to design the experience, they considered that the results were much more enriching than those of a more traditional teaching unit.

ICTS ARE KEY TO TEACHER COLLABORATION

Collaboration between institutions and a combination of flexible learning environments are key trends in education that have guided innovation. In this scenario, technology based on

"bring your own device" (BYOD) and the flipped classroom has facilitated mobile and online learning (Horizon Report Europe: 2015 Higher Education Edition, p.1).

Towards collaborative, virtual teaching

Guitert and Giménez (2000) define collaborative work as the process in which each individual learns more than they would learn alone, as a result of interaction between the members of a team. Collaborative work focuses on a way of teaching in which interaction is key to collective knowledge generation.

According to Pérez-Mateo (2010), collaborative learning is based on students working together to meet a common goal. When this concept is transferred to virtual environments, it creates new opportunities for collaboration, team work and knowledge generation (Monguillot, et al., 2013). Learning to work collaboratively involves developing certain skills related to training, such as organizing and planning work, making decisions, working in interdisciplinary teams and developing relationship and communication skills (Guitert, et al., 2008).

Collaborative teaching facilitates peer learning, and enables knowledge of content to be constructed jointly, as described in Romeu (2015). Teachers consider that online collaboration through ICTs has two main benefits: it helps them to improve their professional practice and update their teaching skills. ICTS have great potential for collaboration between teachers. They increase the opportunities for professionals to train and learn from each other, and lead to the creation of innovative educational experiences (Monguillot, et al., 2013).

As a result of our experience, we can state that ICTs facilitate collaboration between physical education teachers to design, implement and assess learning situations in the classroom. This form of working and planning teaching opens up new ways of experiencing teaching and feeling about it (Monguillot, 2015).

Some tools used for teacher collaboration on the design, implementation and evaluation of learning situations in physical education are as follows:

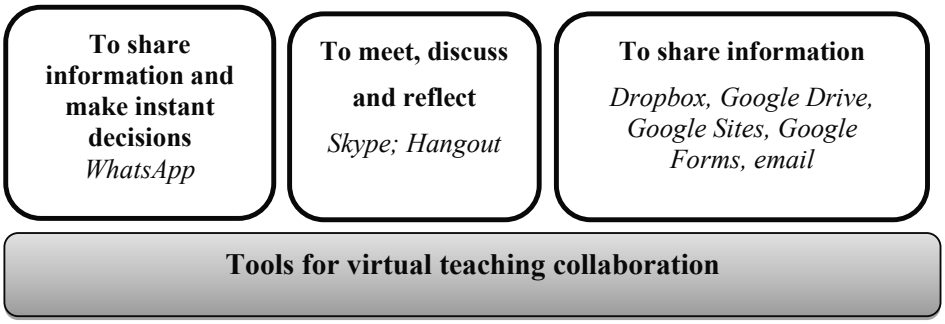


Figure 2. Tools used for virtual teaching collaboration

Technology opens up new ways of collaborating, learning and working that physical education teachers should take advantage of. Open, personalized, collaborative training with no space or time barriers is a favourable environment for physical education teachers to create their own learning ecology.

Barron (2004, p.6) defined a learning ecology as: "the set of contexts found in physical or virtual spaces that provide opportunities for learning. Each context is comprised of a unique configuration of activities, material resources, relationships and the interactions that emerge from them." If we take this definition, we can see that ICTs facilitate relationships of participation, information access, and even joint construction of learning.

CONCLUSIONS

From an analysis of the two projects, we can draw the following conclusions, which could be extrapolated to other educational situations that are all characterized by a change in methodology:

- Project work is a method in which students are put into groups to explore, research and analyse problems related to real life (Area, 2005/06). According to the Buck Institute for Education (BIE), in project-based learning (PBL) students carry out a search process whose aim is to respond to a question, problem or challenge.
- New roles for teachers and students. As Freire states (2009:2), "education, as a process based on knowledge, communication and social interactions, has been dramatically affected by the emergence of digital culture." In turn, this has "transformed agents, teachers and students, leading to the need for changes in the educational institutions themselves". Students should be put at the centre of the learning process, and teachers should be guides who advise, organize and manage the students' learning process.
- Collaboration considered from the perspective of Guitert (2013). This is a shared, coordinated, interdependent process in which students work together to reach a common goal using digital technologies. Collaborative learning is based on a process of activity, interaction and reciprocity between students, which facilitates the joint construction of meaning and individual progress towards higher levels of development (Network for Collaborative Learning in Virtual Environments, RACEV).
- The use of ICTs as a medium, given that the process of learning involves technological tools that facilitate communication and access to information.

A key element in these physical education learning experiences is collaborative project work using ICT on two levels: for teachers to design, implement and assess the projects; and for students to carry out the projects together, with intensive use of ICT. The strategies that help teachers to improve their teaching practice and update their skills are those implemented so that students can learn collaboratively and independently, using the most suitable technologies for each situation and transferring what they learn to other situations.

Collaboration between teachers is a key tool for updating knowledge and improving educational practice, and thus also for promoting ecologies of learning as interactions, actions and resources that favour learning processes.

REFERENCES

1. Area, M**.** (2005/2006). Hablemos más de métodos de enseñanza y menos de máquinas digitales: los proyectos de trabajo a través de la WWW. *Cooperación Educativa, 79*, 26-32. Available at: http://webpages.ull.es/users/manarea/documentos/metproyectos.pdf

2. Buck Institute for Education (BIE). Consult the webpage at: http://www.bie.org/
3. Carneiro, R., Toscano, J., Díaz, T. (2012). Los desafíos de las TIC para el cambio educativo. Madrid: *OEI &Fundación Santillana.*
4. Castañeda, L. y Adell, J. (Eds.). (2013). *Entornos Personales de Aprendizaje: claves para el ecosistema educativo en red*. Alcoy: Marfil. Obtained from: http://www.edutec.es/sites/default/files/publicaciones/castanedayadelllibrople.pdf
5. Castells, M. (2001). Internet y La Sociedad Red. Lección inaugural UOC. *La Factoría*. Febrero-Septiembre 2001. Nº 14-15. Obtained from: http://www.cabuenes.org/03/documentos/cursos/globalizacion/bloque2/glob_blq2_08.pdf
6. Cobo, C. & Moravec, J. (2011) Aprendizaje Invisible. Hacia una nueva ecología de la educación. Col·lecció Transmedia XXI. Laboratori de Mitjans Interactius/ Publicacions i Edicions de la Universitat de Barcelona. Barcelona. Obtained from: http://www.aprendizajeinvisible.com/download/AprendizajeInvisible.pdf
7. Coll, C. (2013). El currículo escolar en el marco de la nueva ecología del aprendizaje. *Aula de innovación educativa, 219*, 31-36.
8. Freire, J. (2009). Presentación "Monográfico cultura digital y prácticas creativas en educación". *RUSC.Revista De Universidad y Sociedad Del Conocimiento, 6*(1)
9. Fundación Telefónica. (2012). *Aprender con tecnología. Investigación internacional sobre modelos educativos del futuro.*
10. Guitert, M,. Perez-Mateo, M.(2013) La colaboración en la red: hacia una definición de aprendizaje colaborativo en entornos virtuales. Education in the Knowledge Society (EKS) 14 (1), 10-31
11. Guitert, M. and Giménez, F. (2000) "Trabajo cooperativo en entornos virtuales de aprendizaje". En Sangrá, A. Aprender en la virtualidad. Spain: Gedisa.
12. Guitert, M., Lloret, T., Giménez, F., & Romeu, T. (2008). El treball i l'aprenentatge cooperatius en entorns virtuals: El cas de la universitat oberta de Catalunya (UOC). *Coneixement i Societat 08*. Articles, 44-77
13. Herrero Serrano Gloria (2012). *Resumen del proyecto #quesepegue*. [Online] Obtained from: http://gloriaherreroserrano.blogspot.com.es/2012/05/resumen-del-proyecto-quesepegue.html.
14. Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.
15. Marchesi, A. (2009). Las Metas Educativas 2021. Un proyecto iberoamericano para transformar la educación en la década de los bicentenarios. *Revista CTS, nº 12, vol. 4.* April 2009.
16. Monguillot, M., Guitert, M. and González, C. (2013). El trabajo colaborativo virtual: herramienta de formación para el profesorado de Educación Física. *Retos. Nuevas tendencias en Educación Física, Deporte y Recreación.* 2013, no. 24, pp. 24-27
17. Monguillot, M., González, C., Guitert, M., Zurita, C. (2014). Mobile learning: a collaborative experience using QR codes. Aplicaciones para el aprendizaje móvil en educación superior [Monográfico]. *Revista de Universidad y Sociedad del Conocimiento (RUSC).* Vol. 11, no 1. págs. 175-191. doi http://doi.dx.org/10.7238/rusc.v11i1.1899
18. Monguillot, M. (2015). *La colaboración docente: una forma de vivir, hacer y sentir la docencia.* En Magazine INED 21. Obtenido de http://ined21.com/la-colaboracion-docente-una-forma-de-vivir-hacer-y-sentir-la-docencia/
19. Monguillot, M., González, C. and Guitert, M. (2015). Diseño de situaciones de aprendizaje mediadas por TIC en Educación Física. *Revista iberoamericana de educación / revista ibero-americana de educação* vol. 68, no. 2 (15/07/15), pp. 63-82, ISSN: 1022-6508 / ISSNE: 1681-5653.
20. Nieto Tó, N. (2012). *Presentación #tuitactiu al FIEP 2012, Barcelona*. [Online] Available at: http://www.slideshare.net/nurianietoto/presentacin-tuitactiu-al-fiep-2012-barcelona.
21. Pérez-Mateo, M. (2010). *La dimensión social en el proceso de aprendizaje colaborativo virtual: El caso de la UOC*. Doctoral thesis.

22. Romeu,T Guitert, M & Sangrà, A. (2015): Teacher collaboration network in Higher Education: reflective visions from praxis, Innovations in Education and Teaching International, DOI: 10.1080/14703297.2015.1025807
23. The NMC. Horizon Report: 2015 K-12 Edition.
24. The NMC. Horizon Report Europe: Edición Educación Superior 2015.
25. Trujillo, F. and Giráldez, A. (2013). Uso didáctico de las TIC. *Aula 219*. February pp.12-14.
26. Valverde Berrocoso, J., Garrido Arroyo, M. del C. and Fernández Sánchez, R. (2010). Enseñar y aprender con tecnologías: un modelo teórico para las buenas prácticas con TIC. *Teoría de La Educación. Educación y Cultura en la Sociedad de la Información.* Universidad de Salamanca, *11*(3), 203–229. ISSN: 1138-9737. Obtained from: http://www.redalyc.org/pdf/2010/201014897009.pdf

DIDACTIC TECHNOLOGY FOR THE TRAINING PROCESS OF SOCCER PLAYERS IN U8 AND U9 CATEGORY

MIROSLAV HOLIENKA
Faculty of Physical Education and Sports, Comenius University, Bratislava, Slovakia

The training process is a long and systematically controlled process. The substance of the training process consists of a system of training initiatives (training exercises), through which we influence the formation and creation of performance preconditions of individual players as well as of the whole team for repeated presentation of game performance during the match.

The training process (sports training) is aimed at:

- the support of the natural development of an individual on the principle of universality,
- the development of specialized sports performance on a broad base of general performance, respectively universality (Choutka and Dovalil 1991).

The achievement of objectives (effects) of the training process at the highest possible level by formulating binding procedures is provided by the **training process technology**. The training process technology involves knowledge about the optimal configuration of conditions for the training process (Dobrý and Semiginovský 1988). Within the training process technology the authors set aside the biotechnology of the training process and the didactic technology of the training process.

The didactic technology of the training process sets out binding procedures to the development and stabilization of the skill potential. The decisive moment in the didactic technology is the concept of the gaming performance, which is reflected in the content and organizational aspects of the training process.

The principal condition for the training of children and youth is the **adaptation of the training content** to particular age groups (periods) in which they are formed and developed in the game. Training units will be much more effective when soccer coaches will have opportunities, but also interest in carefully studying new information and knowledge about the training process and the courage to implement them in this process.

Despite the prior many progressive steps in the training process of young soccer players, voices calling for **innovation of its training methods and forms** have been heard increasingly more. Methodological recommendations with the priority on game-oriented training and with incorporated elements of the former "street soccer" are being emphasized. It is noteworthy that in re-introducing the elements of the street soccer the most significant progress has been made in western European countries (the Netherlands, Germany, Spain, and Italy) through their soccer youth schools.

Our **didactics of youth soccer also emphasizes the significant representation of games**. According to Kačáni (2005), the current soccer preparation of youth must have a character of **game-oriented training**, i.e. "situational preparation of the game". It understands actions of the player as a comprehensive element of learning, in which particular technical, tactical, physical and psychological factors occur at various stages of their development always integrated - comprehensive.

When working with young soccer players we have to take into account that children are not miniatures of adults and the training process must have a different structure of training units than in the case of older (adult) players.

From the point of view of the needs of this paper as well as from the point of view of the innovative focus of the training process of young soccer players it is necessary to define **new age groups of children and youth** in sports preparation in soccer.

Children's soccer:	**Age groups**	
	- 6-7 years	- U6, U7
	- 8-9 years	- U8, U9
	- 10-11 years	- U10, U11
Youth soccer:	**Age groups**	
	- 12-13 years	- U12, U13
	- 14-15 years	- U14, U15
	- 16-17 years	- U16, U17
	- 18-19 years	- U18, U19

For coaches of U8 and U9 it is important to be aware of the great differences between eight-year and nine-year old children in this age group and to know **their characteristics.**

1. Some children are already able to concentrate on an activity and consciously practice - repeat many times the same activity. This is the start of the "golden age of learning soccer" (Plachý and Procházka 2014).
2. Children still do not understand some coach's descriptions of gaming activities but are able to imitate (repeat) coach's demonstrations.
3. Among children there are very big differences in height and weight parameters, in the level of motion abilities as well as in playing skills that are manifested mainly in match conditions.
4. In physical terms, children are quite frail with underdeveloped muscles but their motion activity is very high.
5. Children have not developed much the control of the speed in the motion activity performed and their functional systems are not yet developed.
6. The knowledge of the characteristic features of psychological and physical development of children in this age group allows the coach to organize and plan training mainly based on different games.
7. In this age period it is very difficult to influence the temperamental difference of children.
8. Children are highly dependent on adults and particularly the coach is a dominant figure for them.

Technical readiness

In the U8 and U9 category we include in the training process mainly 7 basic game (technical) skills (SoccerTutor.com 2001).

1. **Ball control (running with the ball)**

   Ball control allows players to move with the ball along the field. In the initial stages we train them in isolated conditions since the speed increase in ball control is very difficult with regard to the presence of the opponent and limited space. This basic gaming activity is often combined particularly with passing, shooting and receiving the ball. In this age group it is associated mainly with shooting at goal.

2. **Passing the ball (kicking the ball)**

   Kicking the ball is taught by the coach in order to teach children to pass the ball to a teammate or to shoot at the goal. The shooting skill of children is at very different levels and the coach is often required to approach them individually.

3. **Receiving the ball**

   Receiving the ball is a skill that allows players to get the ball under control. Passing and subsequent receiving the ball is the "communication" between the two teammates. However, receiving the ball can also occur when capturing opponent's passes.

   Ball control, passing and receiving the ball are closely related to the level of kinetic-differentiation abilities of children - to the 'feeling' of the ball and intensity of hitting the ball.

4. **Heading (playing with the head)**

   Playing with the lead in the U8 and U9 category is a very challenging activity closely linked to the level of coordination abilities (especially rhythmic) but also the courage of children. We develop the technical aspect of this gaming activity from the beginning with balls of various sizes and weights. The most commonly used method is heading with the forehead with their feet on the ground, while more advanced players can later head the ball in the jump.

   Heading the ball in this category is trained as a pass to a teammate or "shooting" using the head at goal.

5. **Throwing the ball (throw-in)**

   Throw-in is the only gaming activity, when the player can play with the hand. Nevertheless, this "unique" gaming activity belongs to fundamental gaming activities of children in this category.

   The ball is often off the playing field during the game (match), which is why the act of throwing is paid attention to. Many children have major problems with this seemingly simple gaming activity and its proper execution and it requires patience from the coach.

6. **Stealing the ball**

   The aim of stealing the ball is the effort of the player to get the ball under his control again (into his possession). Stealing the ball requires to feel the right moment when it is appropriate to carry out the stealing. The coach pays constant attention to this moment and the appropriate position of the player. Among more skillful players, the coach develops the options of constructive stealing the ball since among children in this age group the prevailing way to steal the ball is to kick it away.

7. **Gaming activities of goalkeeper**

   Goalkeeper's gaming activities are markedly different from gaming activities of the player in the field, since, as the only one he can use his hands in the game. From the point of view of this particularity already in this age group, a part of training units of goalkeepers must be managed separately. Children's relationship to this player's role frequently changes. The great interest gradually declines - children prefer shooting goals to being given goals. The adjustment of the rules about how the goalkeeper should play after back passing has significantly changed the amount of defensive and offensive gaming activities of goalkeepers in favor of the offensive. This should also correspond to the involvement of goalkeepers in other parts of training units.

Tactical readiness

Individual tactical actions of a player are manifested **through the tactical aspect of game activities of an individual** by purposeful choice of a solution to the situation by an individual game action (Kačáni 1982). In this part of the paper we present some suggestions for the training process, which coaches might use in their most difficult period for the coaching job in the early years of the soccer development of a young player. The suggestions are not meant to define what players need to know, but what coaches should teach them. When drafting them we base our suggestions on the Czech soccer school for young soccer players (Buzek and Procházka 1999, Plachý and Procházka 2014), which is close to our country but also on the successful and already quoted Western European soccer schools.

Suggestions for the training process

In offensive activities:

1. We support directness and courage to penetrate with the ball, we emphasize the use of free space in the field and we teach children to enter free space. The choice should be left up to the player, we prefer their own decisions.
2. Children are more able to distinguish excessive ball control (dribbling) and they more frequently resolve game situations with a pass. When controlling the ball, it must be stressed that the ball must be kept under one's control.
3. We teach children that the pass must always be targeted to a teammate - intentional, so that they would ask for the pass by yelling and would run into free space.
4. While shooting we want children to try to place the ball next to the goalkeeper, and not just to shoot as strong as possible.

In defensive activities:

1. We teach defending players to understand and to take the right position between the ball and their goal.
2. We teach children not only to kick away the ball, but if it is possible at all, to steal the ball from their rival and obtain it back.
3. We teach children to immediately run into free space after obtaining the ball - stretching the field.

4. Starting from the U9 category we develop the defensive principle - "not to start at the offensive player with the ball but to turn to his side and connect to his movement".

In the training process in the **U8 and U9** category we apply **3 more important principles:**

1) **All players are supposed to both defend and attack -** some children play more at the front, others more at the back. But this is not yet a permanent division into defenders and forwards.
2) **Playing with both feet -** individual training gaming activities should be organized so that players performed them with both feet.
3) **Versatility -** we change players on individual players' positions. We thus develop their gaming versatility and thus build greater plasticity of the game thinking.

Organization and planning of the training process

Children's unorganized spontaneous motion activity should be used every day among children in the U8 and U9 category. In terms of organizing the training process we recommend **3 training units per week** for this category. They can be altered and supplemented with other activities depending on the conditions of the club, for example, gymnastics, jumping on trampoline, swimming, or various motion and ball outdoor games. It is necessary to realize (including parents) that only the **soccer training cannot be a substitute for any motion activity.**

In terms of efficiency of the training unit, we recommend leading the training unit in exercises aimed at individual gaming activities **in two groups with 8 to 10 children at maximum** per coach. This allows the coach to better draw children's attention to the correctness of the exercise performed, better correcting of shortcomings, sufficient number of attempts to carry out gaming activities and removal of lots of non-training children. Children do not have to be divided according to their performance.

On the contrary, in games we recommend mixing more skilled children with less skilled. **The game is the best training for children.** Competitive matches are organized in the number of 6 + 1 players. However, as part of the training process we also apply preparatory games from one-on-one to four-on-four, where each game activity is carried out more intensively and with greater frequency of repetition than in the match. Gaming activities carried out within **a training unit (70 to 80 minutes)** should be **altered** after about **10 to 15 minutes**. However, if children obviously enjoy the activity performed, we can carry them out longer (greater number of repetitions). Within the **main part of the training session** we plan **2 to 3 exercises and games** for children. Over the **entire duration of the training unit** we recommend altering a maximum of **6 types of exercises and games. The game is essential.** Children want to play first of all. Through the game we try to explain the correctness of performing gaming activities and to improve technical and tactical readiness of children.

The structure of the training unit

Training units in the U8 and U9 category should contain the following three parts:

1/ Introductory part - warm-up (30 percent)

The introductory part of the training unit should be generally very varied and should induce among children a joyful and competitive atmosphere. In it we include:

- various complicated speed-coordination exercises,
- movement games,
- combative games,
- relay competitions,
- trained as well as new game activities with the ball.

The introductory part of the training unit should ensure general as well as soccer development of children through an entertaining way (Plachý and Procházka 2014, Snow 2011).

2/ Individual game activities with the ball (30 percent)

A prerequisite for this part of the training unit is that every child had a ball and that one coach supervised no more than 8 to 10 children. We force children to perform gaming activities, which they learn and have not yet mastered, at a slower pace and with an emphasis on the correctness (accuracy) of the execution. Such organization of the training unit ensures a sufficient number of repetitions in carrying out gaming activities.

Coaches should repeatedly demonstrate to children all gaming activities as best as they can with a very individual approach. For the U8/U9 category, even despite the aforementioned seven basic game skills, it is a priority to focus on different **ways of ball control** with changes of the direction (ball control on the ground) connected with basic **ways of evading an opponent.** We gradually increase the number of ways of controlling the ball and evading an opponent with the intention that children would be able to use them in the game itself. However, for the gradual acquisition of particular ways of evading an opponent, we start with the simplest conditions. First freely in space, then against a passive obstacle (cone, stick, coach) and later against a defending opponent.

It is appropriate to teach **passing and receiving** the ball in this age group in a slight movement with the emphasis of moving sideways. We demonstrate to children receiving with the inner side of the foot, later with the sole of the foot and the outside of the foot. The basic requirement for receiving the ball moving on the ground is an active movement of the foot against the ball when moving sideways or forward (in the direction of the subsequent movement). We teach children to perform receiving with the foot, which the ball is heading to. In this activity, repeated demonstrations and individual approach represent a prerequisite for improving the performance of children. To develop the feeling for the ball in receiving we use different forms of juggling - juggling with hitting the ground, one foot juggling, juggling without hitting the ground, juggling while alternating feet, etc.

It is equally necessary to pay a lot of attention to training to **kick the ball - shooting** in the U8 and U9 category. A proper demonstration, a detailed description, an individual approach and a large number of attempts to kick the ball is essential for successful kicking techniques in the future. In their first shooting attempts, children make a number of mistakes. In many cases:

- at the beginning they kick with the toe,
- when kicking the ball they start running under a wrong angle,
- when shooting they crouch - they do not shoot with a loose swing,
- when shooting they often lean back and hit the ball at the bottom - the result is the ball flying over the goal. A typical sign of shooting in that period is the effort to make the strongest possible kick at the expense of accuracy.

3/Soccer games (40 percent)

Games in any form have a great emotional charge for players in the category of U8/U9. Especially those **with fewer players one-on-one and two-on-two, enable to maximize the involvement of children in offensive and defensive activities.** We lead them to the activity of evading an opponent, to cover the ball, and after stealing the ball to get it under control and not just to kick it away. We emphasize to players from the youngest beginners the efforts to steal the ball using the permitted **body contact**. When applying body contact we have to be very patient and systematically address it in training exercises so that children would be able to use it in the game. This effort is significantly limited by big height and weight differences between children. Even despite the gradual increase in the number of players in the preparatory games, we still give priority to the improvement of individual gaming activities (skills).

Examples of games and exercises for the U8 and U9 category are included in the separate Methodical Annex.

REFERENCES

1. Buzek, M., & Procházka, L. (1999). *Česká fotbalová škola*. Praha: *Olympia.*
2. Choutka, M., & Dovalil, J. (1991). *Sportovní trénink*. Praha: *Olympia.*
3. Dobrý, L., & Semiginovský, B. (1988). *Sportovní hry. Výkon a trénink*. Praha: *Olympia.*
4. Kačáni, L. (1982). *Základy stratégie a taktiky vo futbale*. Bratislava: *Šport.*
5. Kačáni, L. (2005). FUTBAL. *Herná príprava(2). Teória a prax.* Bratislava: *SFZ.*
6. Plachý, A., & Procházka, L. (2014). *Fotbal. Učebnice pro trenéry dětí (4-13 let).* Praha: *Mladá fronta*.
7. SNOW,S. (2011*). Coaching youth soccer. Champaign: Human Kinetics.*
8. www.SoccerTutor.com

METHODICAL ANNEX

Ball control:

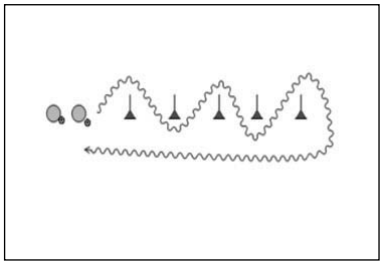


Figure 1 | We make more accurate the ways for controlling the ball. The distance between cones is 3 meters.

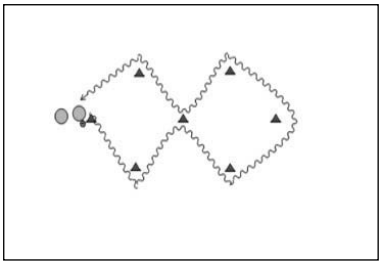


Figure 2 | We make more accurate the ways for controlling the ball. The distance between cones is 10 meters.

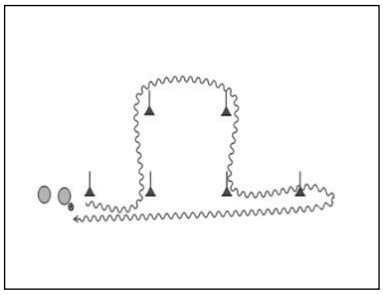


Figure 3 | We make more accurate the ways for controlling the ball. The distance between cones is 10 meters.

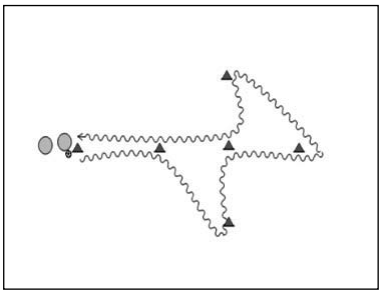


Figure 4 | We make more accurate the ways for controlling the ball. The distance between cones is 5 a 10 meters.

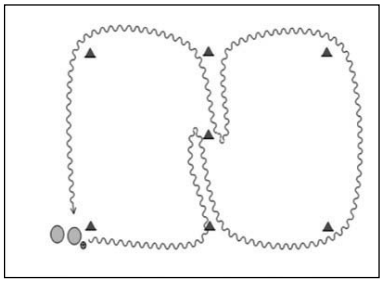


Figure 5 | We make more accurate the ways for controlling the ball. The distance between cones is 5 a 10 meters.

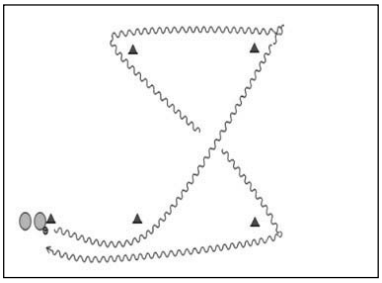


Figure 6 | We make more accurate the ways for controlling the ball. The distance between cones is 10 meters.

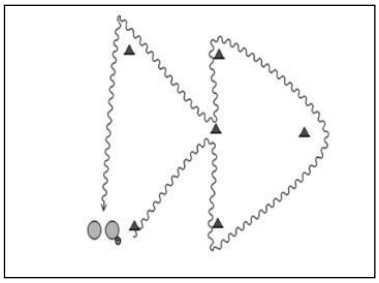


Figure 7 | We make more accurate the ways for controlling the ball. The distance between cones is 5 a 10 meters.

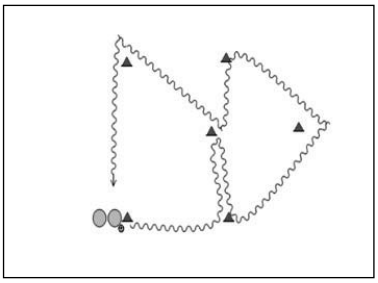


Figure 8 | We make more accurate the ways for controlling the ball. The distance between cones is 5 a 10 m.

Ball control and evading:

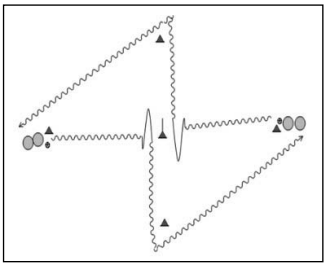


Figure 1 | We make more accurate the ways for controlling the ball and evading. Four players with two balls. The distance between cones is 10 meters.

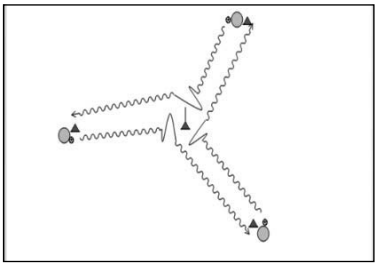


Figure 2 | We make more accurate the ways for controlling the ball and evading. Three players with balls. The distance between cones is 7 meters.

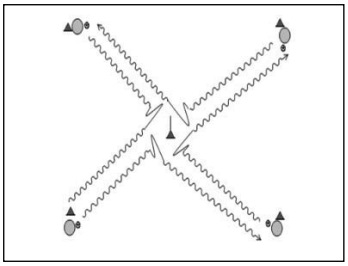


Figure 3 | We make more accurate the ways for controlling the ball and evading. Four players with balls. The distance between cones is 7 meters.

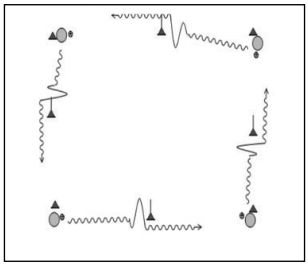


Figure 4 | We make more accurate the ways for controlling the ball and evading. Four players with balls. The distance between cones is 5 a 10 meters.

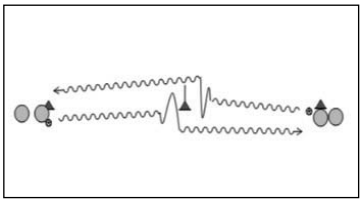


Figure 5 | We determine the ways for controlling the ball and evading. Four players, first two with balls. The distance between cones is 10 meters.

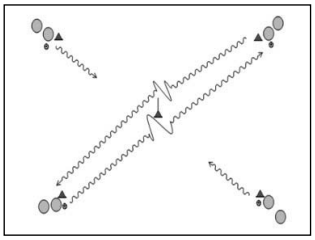


Figure 6 | We make more accurate the ways for controlling the ball and evading. Four players, a pair of players against each other at the same time. The distance between cones is 7 meters.

Chains of individual gaming activity ended with shooting:

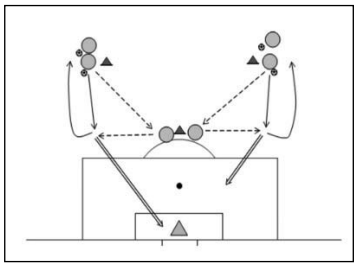


Figure 1 | We determine the ways for shooting from L and R side. We do not change passing players.

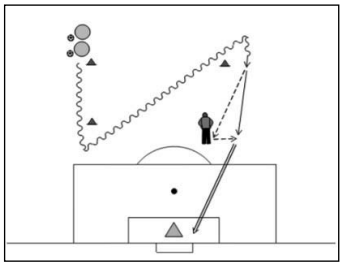


Figure 2 | We determine the ways for shooting from L and R side.

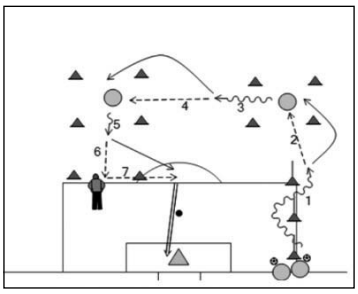


Figure 3 | We determine the ways of shooting and movement of players.

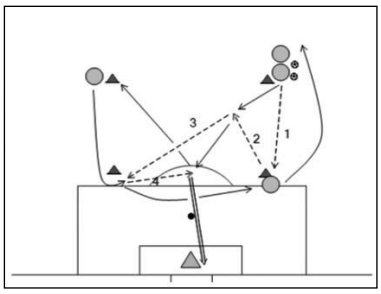


Figure 4 | We determine the ways of shooting and movement of players .

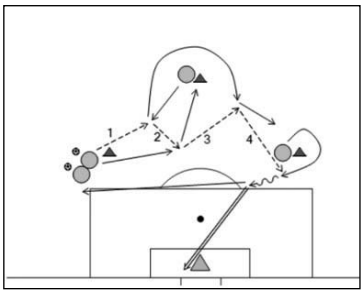


Figure 5 | We determine the ways of shooting and movement of players.

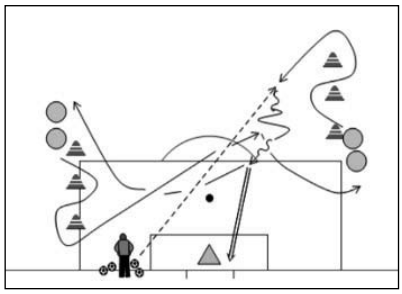


Figure 6 | We determine the ways of shooting.

Preparatory games:

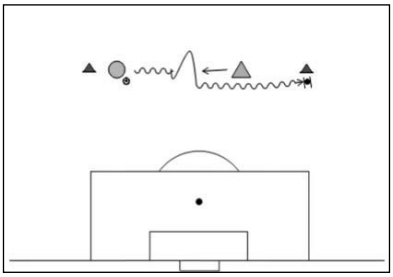


Figure 1 | PG 1 on 1. We will shoot goal by stepping on the ball within the distance of 1 meter from the cone.

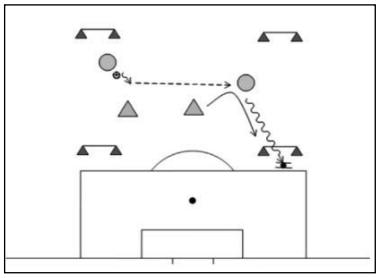


Figure 2 | PG 2 on 2. We will shoot goal by passing the ball across the line.

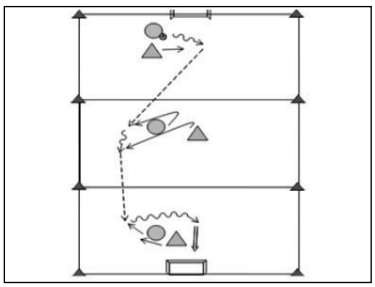


Figure 3 | PG 3 on 3. Players play in zones 1 on 1 with an objective to pass the ball from one zone to the other and subsequently to shoot at the goal.

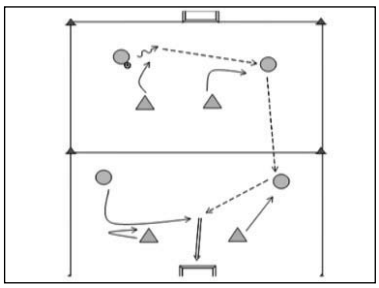


Figure 4 | PG 4 on 4. 2 on 2 play on each half with an objective to pass the ball to the other half and to shoot a goal. We change the positions of players.

THE EFFECT OF USING PROGRAMMED LEARNING STYLES TO IMPROVE SOME CAPACITIES RELATED TO THE EFFECTIVENESS OF TRIPLE JUMP AMONG SECONDARY SCHOOL PUPILS

BENZIDANE HOUCINE, MOKRANI DJAMEL, SEBBANE MOHAMED, BENSIKADDOUR HABIB, AHMED BENKLAOUZ TOUATI
Institute of Physical Education and Sports, University of Mostaganem, Algeria

INTRODUCTION

Education is humanitarian process depends primarily on the interaction between teacher and learner, meaning that a strong human influences teacher, learners, as a result of direct interaction in learning formal position. The education process with existence of a teacher named teaching, while teaching process organization chart includes three components: teacher, learner and instructional materials that lead to learning, learners, and develop various learning aspects of informatics and the psychomotor and compassionate soul, (Abu Salem, 2007).

So the teacher takes the positive responsibility in order to explain the lesson taught and the role of the learner becomes the listener, such as learning, discovering, educational program and computer learning within the second type in which the learner is central to the learning process. Where the learner assumes during most of these roads are in the learning process, and the role of the teacher is the only orientation and guidance.

Thus, the first educators increased attention in recent years with events and activities that make the student at the Centre for teaching and learning. The most notable of these activities use the programmed learning style as one of collective learning strategies this style which means arranging students into groups and assigned to the work they do together collaborators. This style returns benefits to students to talk on various topics, and that learning occurs in a relaxed atmosphere free of tension and stress, high student motivation.

The problem that may arise in the collective work is the adoption of group members on the student or two students to lead to the cooperative learning styles is to create an organizational structure for student group work, so that all members of the group indulges in learning according to a clear and definite roles with each member of the group learn instructional (Taufik, 2008).

This agrees with the definition of Smith (1999) educational use of small groups of students to work together, to upgrade their learning and the learning of others (smith, 1999) referred to Walter Chyzawych that self learning makes learning more interesting material for the student. It is also helpful in overcoming the problem of increasing the number of students, or players during training taking into account individual differences among them.

The teaching events as athletics triple jump in the present situation is found that has not kept pace with the interest and development of skills among learners, so most of teachers in the physical education and sports teaching practices still focused on giving skills using traditional teaching methods. This requires students to save the information or knowledge by the teacher memorizing without understanding. The current teaching methods in schools encourage competition between aberrant pupils in order to get the best position among their friends.

According to the previous results studies that addressed the impact of cooperative learning, educational program in physical education and sports such as, the study of Mohamed Khalil (1999) study, and the study of Benzidane Houcine (2010) about the effect of some types of programmed teaching and education to learn skills in sports team, the study of Rania Mohamed (1999), Fouad Faik and Mohamed Hussain (2009), Ali Obid (2011), which they confirmed the effectiveness of using programmed learning and improving capacities related with the functional steps in athletics.

Through some surveys and contact some professors and students, the debate noted the absence of the use of the educational program in teaching individual games such as jump, shooting events as a result of certain factors, including the number of students in the group, courier planned for article size and other factors, so we found the hiring method of modern ways of learning for students, the impact of using programmed learning style and improving capacities are related with the effectiveness of triple jump among secondary school students.

RESEARCH OBJECTIVES

- To know the impact of using programmed learning styles in education, and improving capacities related with the effectiveness of triple jump among secondary school students.
- Detect the difference between sample control and experimental sample in learning, and improving capacities related with the effectiveness of triple jump among secondary school students.

RESEARCH METHODOLOGY AND PROCEDURE FIELD

Research methodology

The researchers used experimental method with the nature of the problem of searching, posting and pretesting of measurement.

Community and the sample search

The sample included purely experimental sample of 20 pupils and 20 pupils of control sample, and a sample survey of 10 students constituting 16.66% of the research community in Mostaganem city- Algeria

Search engines

Using researchers in research methods and tools:

* Sources and references
* Tests associated with the triple jump.
* programmed learning using the handbook.
* Statistical methods.

-Tests applied

✓ **Broad jump test of stability:**

Objective: measuring the explosive force of the muscles of the legs.

Figure N° 01: Broad jump test of stability

✓ **Test 10 partridges to both men from running** (10 partridges with right leg partridges 10 left leg)

Objective: measurement of force with speed

Figure N° 02: Test 10 partridges to both men from running

✓ **Test triple jump of streaming**:

Objective: to measure the level of achievement in the triple jump**.**

Figure N° 03: Test triple jump of streaming

Principal experience: After preparing the Handbook for learning and mastering the technical steps in the triple jump by using programmed learning styles in order to ensure the credibility of the research, researchers follow a simple method using modern scientific method in learning steps, where the educational seance were given 08. The first tests the experimental

group and the control sample was trained in the traditional method. After applying programmed seance search, then remot testing for both samples to determine the percentage of collections and know the effectiveness and feasibility of the proposed handbook. The steps have been made in the basic experience of the period between January, 07th 2014 until March, 11th 2014.

The content of the proposed manual to learn:

- Jump exercises with move one foot right/left;
- Running jump exercises with one foot right/left;
- Partridge exercises with walking;
- Partridge exercises of streaming light, and medium jump;
- Exercises and Partridge together walking;
- Partridge exercises and jumping together from the brisk;
- Partridge exercises and jumping together from the streaming light;
- Partridge exercises and jumping together from walking with the landing pit sand Partridge exercises and jumping together from the brisk with the landing pit sand;
- Partridge exercises and jumping together running with land in the sand pit.

VIEW AND ANALYZE THE RESULTS

❖ **View and analyze test broad jump test of stability**

Table No (01): a comparison of post-test and post-test search samples measuring in broad jump test

Statistical measurements / Sample	Post-test		Pre-test		T Tabular	T Calculated	Statistical significance
	X1	**Y1**	**X2**	**Y2**			
Experimental sample	2.24	0.13	2.41	0.19	5.97*	2.09	Significant
Control sample	2.19	0.15	2.28	0.14	4.35*		Significant

Level of significance 0.05 and the degree of freedom (n-1) =19

Through the table (01), both the experimental and the control research samples made differences between post-test and anti-test with values calculated T amounted to 5.97 experimental sample and sample control 4.35 and is larger than the value of the T tabular estimated at 2.09, the 0.05 significance level, and the degree of freedom 19, this means that the difference between post-test and post-test measurement in the broad jump test of stability is statistically significant difference and is in favor of post-test.

❖ **View and analyze test 10 partridges with his right foot from running**

Table No (02): compared measurement of post-test and anti-test samples search test 10 partridges with right leg of streaming

Statistical measurements / Sample	Post-test		Pre-test		T Tabular	T Calculated	Statistical significance
	X1	**Y1**	**X2**	**Y2**			
Experimental sample	22.78	1.94	25.59	1.74	3.52*		Significant
Control sample	22.87	1.98	23.88	2.07	2.10*	2.09	Significant

Level of significance 0.05 and the degree of freedom (n-1) =19

From the table (02), the experimental and the control research samples made differences between post-test and anti-test with values calculated T amounted to 3.52 experimental sample and sample control 2.10 is greater than the value of the T tabular estimated at 2.09, the 0.05 significance level, and the degree of freedom 19, this means that the difference between post-test and post-this measurement test 10 partridges with right leg is statistically significant difference and is in favor of post-test.

❖ View and analyze test 10 partridges with his left foot from running

Table No (03): compared measurement of post-test and anti-test samples search test 10 partridges with left leg of streaming

Statistical measurements / Sample	Post-test		Pre-test		T Tabular	T Calculated	Statistical significance
	X1	**Y1**	**X2**	**Y2**			
Experimental sample	22.74	2.30	25.81	0.98	5.43*		Significant
Control sample	22.78	2.55	24.21	2.11	3.55*	2.09	Significant

Level of significance 0.05 and the degree of freedom (n-1) =19

Through the above table (03), the experimental and the control research samples made differences between post-test and anti-test with values calculated T amounted to 5.43 experimental sample and sample control 3.55 is greater than the value of the T tabular estimated at 2.09, the 0.05 significance level, and the degree of freedom 19, this means that the difference between post-test and post-this measurement test 10 partridges with left leg is statistically significant difference and is in favor of post-test.

❖ View and analyze test triple jump of streaming

Table No (04): compared measurement of post-test and anti-test samples search test triple jump of streaming

Statistical measurements / Sample	Post-test		Pre-test		T Tabular	T Calculated	Statistical significance
	X1	**Y1**	**X2**	**Y2**			
Experimental sample	9.41	0.51	10.11	0.51	5.63*		Significant
Control sample	9.20	0.45	9.71	0.45	6.61*	2.09	Significant

Level of significance 0.05 and the degree of freedom (n-1) =19

The table (04) shows, that the experimental and the control research samples made differences between post-test and anti-test with values calculated T amounted to 5.63

experimental sample and sample control 6.61 is greater than the value of the T tabular estimated at 2.09, the 0.05 significance level, and the degree of freedom 19, this means that the difference between post-test and post-this measurement test triple jump of streaming is statistically significant difference and is in favor of post-test.

❖ **View remote test results for samples of research.**

Table (05): shows the differences between the control and the experimental sample test results post-test using T student

Statistical measurements / Tests	Control Sample		Experimental sample		T Calculated	Difference significances
	X1	y1	X2	y2		
Board jump of stability	2.28	0.14	2.41	0.19	2.06*	Significant
10 partridges with his right foot from running	24.21	2.11	25.81	0.98	2.57*	Significant
10 partridges with his left foot from running	23.88	2.07	25.59	11.74	2.36*	Significant
Achievement in triple jump	9.71	0.54	10.11	0.51	2.20*	Significant

Significant level 0.05 and degree of freedom (2n-2) =38, T tabular 2.04

The last table (05), and when compared the tests in remote measurements among samples of experimental and control sample to each of the values obtained were limited between 2.06 as the lowest value and the highest value of 2.57 as a whole is greater than the value T tabular estimated 2.04 at 0.05 significance and degree of freedom 38. This means that differences and statistical function and is for the benefit of the experimental sample that achieved the highest values in arithmetic in the tests.

DISCUSSION OF THE RESULTS

Through the above results of the table (01), which shows the difference between the arithmetic post and anti-test with search samples in broad jump test of stability, whereas the experimental group achieved the best evolution. We interpret this to the attention of researchers, emphasizing physical side skills particularly, the skill jump, the partridge and the gain crucial role to learn the technical steps in triple jump. This has been highlighted in the proposed handbook to learn the skills of triple jump which confirmed the effectiveness of using educational program and compared the traditional method. We noted that through educational program style helps more mobility of students and makes it more accountable, by the way, helps them to learn how to achieve a new set of objectives according to the level and motor abilities.

This study agree with the analysis of Khalid Nabil (1996), Fouad and Mohamed Hussain (2009) study, Ali Obid (2011) and Benzidane Houcine (2010), which confirmed the effectiveness of using programmed learning in learning and improving technical steps in the athletics events.

Through the results of the table (02) and (03), test the Partridge (10 partridges with right leg of streaming, 10 left leg of streaming), it appears that the experimental group achieved the best evolution as a result of interest in learning and capacity development of the Partridge

during the experimental group received for the booklet program explaining how to perform and master the skill of Partridge.

The researchers explained that skill of Partridge with right leg and left leg lead to access to the target service and it is also the focus here is to use the speed in this skill to be effective performance, giving some instructional steps in learning this skill, because the style of programmed learning education based on dividing steps ranked logically sequential arrangement, makes learning more interesting material for the student taking into account individual differences among them.

Education program includes a range of knowledge and skills related to the article subject's process (tutorial). This helped student in the rapid absorption of the technical steps to be effective by teaching himself using booklet (brochure). This agrees with Khaled Nabil (1996), Ali Obid (2011) and Safwat Hassanine (1988) by using Educational program, as well as its effectiveness in comparison with the conventional method.

Through the results of table (04) on completion test in the triple jump, the experimental group had made the best offer by using programmatic education handbook, which explains how to master the Partridge and step and jump sand pit.

Researchers justified the rate of progress of the experimental sample on the control sample that skill Partridge is one of the key components in the effectiveness of triple jump. The focus was on perfecting this skill through the use of the booklet program. The role of the teacher was taking shape in helping students to rely on feedback, using the standard fixed in order to reach a self-perception process.

This study agree with the papers of Rania Mohamed (1999), Ali Obid (2011) and Benzidane Houcine (2010), which confirmed the effectiveness of using a program to improve education and learning technical steps in individual games like jump in athletics events.

And through the table (05) that notes a significant differences between the remote measurements for each of the experimental group and the control group for the performance level of capacity related with the effectiveness of triple jump in favour of experimental booklet program based. This result indicates that the education program style more effective in learning and mastering the technical steps of triple jump as compared to conventional method that relies on indoctrination and form performance in the control group.

This confirms that education program is an important principle of coder to achieve effective educational position, and it is the principle of respect for individual differences among students. It also gives an additional motivation for learning the use of projectors (graphics) and book coder to connect the scientific article in the tutorial to the learner, which resulted in attracting the attention of the learner and suspense to see article practical, and opportunities for creativity expressed by the student during the course of the lesson.

This agreed with Slavin (1994), that the cooperative education provides employment opportunities for students during the lesson helps to achieve the advanced stages in the educational process. He showed the results of the tests of individual differences of remote measurements between two samples search, as shown in the table (05) for viewing remote test results (board jump, Partridge of streaming, digital achievement in the triple jump).

The researchers attributed the achievement of the best results in the tests, because the style is used in the fact that when the learner realizes better performance through perceptual motor development through observation of his performance and then rectified depending on standard or test result required to accept mistakes within his capabilities, further individual decision-making process during the lesson. This has been confirmed by previous studies and similar researches confirmed the effectiveness of education program to learn the sport.

It is evident in current research that the use of programmed learning styles has a positive impact on learning and improving capacities related with the triple jump. In other words, education program has more effective than the traditional method of education.

CONCLUSIONS

In the light of the findings and processed statistically reached:

- The use of programmed learning styles positive impact on learning and improving capacity related with triple jump among secondary school students.
- There are differences between the experimental sample and the control sample in learning and improving some capacities in the triple jump to high school students for the benefit of the sample used programmed learning styles.
- There are differences between measurements of fingerprinting search samples and in the benefit of remote measurements of capacity related with the triple jump to high school students.

REFERENCES

1. Ali Abid. (2011).The impact of the use of cooperative learning method in learning some technical stages to effectively jump higher among students in the Faculty of physical education. Journal of the science of education sports number 02 volume 04 Mustansiriyah University. College of physical education, p97
2. Benzidane Houcine.(2010). Effect of the method of programming on the development of motor skills in basketball. Algeria: University of Mostaganem, Institute of Physical Education and Sports, p77.
3. Buchner, C.(1994).Teaching children movement concept and shield. Becoming a laster teacher. Champaign. Human kinetics.
4. Edrgarithill Raymond Thomas José.(1993). Manual of sport education. Paris: Ed Vigot.
5. Khaled Nabil Mahmud khudair. (1996). The impact of education programmer to develop certain physical attributes and learn the motor skills to the lesson of physical education for secondary school students. Port Saeed. Suez Canal in physical education.
6. Mauston Muska & Ashworth, Sara.(1994). Teaching Physical Education. Fourth Edition. Macmillan College.
7. Miller, B. S. Bower. (1981). Developing in athletics through the process of depth jumping. Track and field quarterly. Review.(81)4.
8. Moore Christopher & Schilling Brian K.(2005). Theory and Application of Augmented Eccentric Loading. National Strength and Conditioning Journal, 27(5), 20-27.

9. Rania Mohamed Hassan.(1999).The effect of using curriculums to teach students the triple jump competition. Egypt: Menia University. College of physical education.
10. Safwat Hassanine. (1988). Effect of the method of programming on the development of physical attributes and learn motor skills in physical education class in high school. Egypt: Zagazig University. College of physical education.
11. Slavin, R. (1995). Cooperative learning: Theory, research, and practice (2nd). Needham Heights, Mass: Allyn and Bacon.
12. Smith Karl.(1991).Cooperative learning effect team work for engineering classroom .university of Minnesota cooperative learning center Microsoft internet . P1.
13. Wathen Dan.(1993) Literature Review: Explosive, Plyometric Exercises. National Strength and Conditioning Journal, 15(3), 17-19.
14. Wilson, G, Murphy, A & Giorgi, A. (1996). Weight and plyometric training: Effects on eccentric and concentric force production. Canadian Journal of Applied Physiology, 21, 301-315.

AQUA AEROBICS WITH ACCESSORIES AND ITS INFLUENCE ON SUBJECTIVE WELL-BEING OF STUDENTS

HANA JANOŠKOVÁ
Faculty of Education, Masaryk University, Brno, the Czech Republic

INTRODUCTION

The option to attend physical education as an optional class during university studies is not commonly offered by every university in today´s university environment. With this research, we attempted to contribute to the confirmation of the influence of physical activities on health and quality of life of university students. We decided to deal with this issue at the Mendel University in the 2006-2010 period, by extending the range of optional physical education of university students who do not have compulsory physical education in their study programs. We offered the students a variety of physical activities, one of them being aqua aerobics.

During the research, we focused on the changes of current mental states of female university students that could be caused by the effects of regular exercise. Aqua aerobics was chosen for the research as it is current and well-attended.

"Aqua aerobics is a form of fitness exercise in the water, performed to music, taxing both the heart and the respiratory systems, as well as the movement system, by the stay and locomotion in the water. It includes exercise in various depths of the water with the use of music as a motivation." (Janošková, Muchová, 2002)

According to Janošková and Muchová (2002), aqua aerobics has a number of positive effects, e.g. the unique characteristics of water make the exercise safe, effective and available to everyone; aerobics in water is entertaining; besides immersion, it provides a sense of privacy while allowing to be a part of a group; the water buoyancy factors in the lightening of joints and the spine; the water resistance enables development of muscle strength, endurance and flexibility. Aqua aerobics is an ideal exercise for posttraumatic states, it is also suitable for non-sportsmen and older people. It can be attended by people who are severely overweight because it has positive effects due to low risk of injury as the buoyancy force of the water significantly reduces the body weight.

There is a greater risk of improper execution in the water than on the ground. It is caused by the instability of the stance or position. Achieving balance is more difficult in the water. The demands on balance and balance skills are high and they require a practice of balancing moves during greater shifts of the gravity centre.

New technologies and methods have been used in these classes. Specifically, new elements of aqua zumba, aqua kickbox, aqua combat and step aqua aerobics have been added to these classes. Also, to increase the appeal of the physical activity, new equipment has been used – step boxes, frisbee discs, etc. A lot of the new equipment being created is financially unfeasible for the classes.

Regular step aerobics is defined as a form of aerobics made more effective by stepping up on a step box. Aqua aerobics is not about stepping up and down but about jumping onto and off

of the step box. Every step in the water is done with a bounce. Certain exercises of step aerobics are undoable in the water environment (e.g. stepping up to step tap, kick, knee- up, etc.) while some exercises not allowed in regular step aerobics are doable in the water (e.g. frontal step down off the step box).

Aqua zumba is based on water dance and it puts emphasis on entertaining movement in the water. Aqua kick box is a fitness exercise in water consisting of kicks, punches and their combinations. Aqua combat is a physical activity in a water environment which uses some elements of box, kick-box, karate, etc., such as punches, kicks and their combinations. "Aqua step aerobics multiplies the effects of the regular aqua aerobics as it forces the movements to be more precise and the core to be tighter during the jumps onto and off of the step box, otherwise the person would lose the balance. Thus, the deepest muscles of the stabilization system are activated more intensively. In the aqua step aerobics class, we can use individual exercises separately with a certain number of repetitions or put them into simple choreographies for more advanced users" (Muchová, Janošková, 2004).

Movement is a fundamental expression tool of man, the tongue of his feelings and moods, and the primary form of ancient human communication (Mužík & Krejčí, 1997). Regular physical activity contributes to achieving mental balance and quality of life of a man (Blahutková, Řehulka, & Dvořáková, 2005). The term quality of life is multidimensional, being created with difficulties over long time, quite relativistic, idealized and unreachable.

Quality of life can be measured by qualitative research, various questionnaires and surveys, observations, interviews and subjective evaluations. First attempts at measuring quality of life surfaced in the health care field, in connection with oncology diseases of patients and senior citizens. The predecessor of the quality of life measuring was the so called Health state (HS) – state of health records of a specific patient, alternatively the file of their health problems. The goal was to outline the health state from a medical point of view (the physiological viewpoint).

The period of university studies is a period of mental perception and rational cognition development for young people. While studying a personality, we have to respect all rules that relate to a personality research and it is important to respect the personality as a whole, with its specific specialties and unique characteristics. We have to always start with the basic assumption that a personality cause for behaviour or experience is rarely a mechanically working part of the personality (one of the exceptions is restlessness). The cause for experience or behaviour usually lies in the realization of a specific plan, intention or goal of which the personality does not have to be fully conscious of (Smékal, 2002). A university student´s personality is defined by a number of specific characteristics, many of which would have a number of identical factors. Women differ from men in many characteristics, but their common goal is to finish their studies and achieve the needed recognition.

AIMS, RESEARCH QUESTIONS AND TASKS

The main aim of our work was to ascertain the level of impact of physical activities, specifically aqua aerobics with equipment and without it, onto the current well-being of female university students. The partial goal is to determine the involvement of this physical activity in the experience sphere of the personality, including the health aspects. The determination

of our aims was based upon the knowledge of modern psychology and kinanthropology and, at the same time, we followed upon the plans of the Ministry of Education, Youth and Sports of creating conditions that contribute to the growth of a harmonically developed university student´s personality in all aspects, i.e. also in the aspect of physical education and physical activity.

The aim of the work was to contribute to the support of sports physical activities and, at the same time, highlight the importance of movement for every university student.

We defined two research questions:

1. How will physical activities of aqua aerobics impact the decrease of the feeling of fatigue and exhaustion of female university students?

2. What influence do physical activities of aqua aerobics have on the well-being of the female university students?

In order to verify these research questions, we defined research tasks pertaining particularly to:

- determine the impact of aqua aerobics on reducing fatigue in a selected group of female university students via Eight State Questionnaire (8SQ).

- determine the influence of aqua aerobics on the current well-being via a questionnaire

METHODS

Description of the researched population

At the beginning of the research a survey was conducted involving 326 female students aged 18-28 years old, from all years of study. This survey questionnaire was conducted in order to determine the students´ interest in optional physical education classes. Out of all the students surveyed, we selected a group of students interested in aqua aerobics and continued the research and interventions with this group.

Personality survey was used to obtain basic information from students concering their field of study, year of study, their sport activities and their sport interests, including their views on the range of sports and physical activities offered by the university. The questions were compiled to suit the needs of our research. We inquired about students´ interest in optional physical education, as well as students´feelings with regards to water and aquatic environment and the impact of the inclusion of new tools and musical accompaniment during physical activities on the mood of students and their current emotional sphere. The personality survey was conducted at the beginning of the research using an internal university system. We contacted the students by a letter and then evaluated the aquired data.

Based on the results of the personality survey, we decided to use the standardized psychological questionnaire Eight State Questionnaire (8SQ) (Curran, Cattel, 1986) which was standardized for the Czech population by Smékal (1994). This method was included as the main research tool, complemented by the Berne questionnaire of subjective well-being (Grob et al., 1995) as the supplementary method.

The aqua aerobics classes were attended by 70 students in the year when we executed the research and intervention program.

The students that agreed to cooperate were aged between 18 and 26, and were in the first to fifth year of their university studies. They have chosen physical education voluntarily and from the fifteen physical activities offered, they chose the aqua aerobics class. Although, the attendance at physical education classes is optional, it can be noted that the attendance at aqua aerobics classes was almost hundred percent. The classes took place on Monday between 11am and 12 pm and on Thursday between 2 pm and 3 pm in the spring semester of the 2009/2010 school year.

The aqua aerobics classes took place once a week. The duration of the class was around 40-45 minutes. The exercise was always accompanied by music. The aqua aerobics classes took place in transitional water.

For the research, we selected the Eight State Questionnaire (8 SQ), which was intentionally put together to diagnose eight basic emotional states and moods (Cattell & Curran, 1986). The theoretical significance of the emotional states diagnostics is based on the fact that every prediction of human behaviour and action is dependent equally upon the current state and the long-term characteristics.

The aim of the 8SQ is to present the multi-state array of the widest spectrum in accordance with the current scientific research. In many types of situations, it is desirable to first research reactions by their dependency on the structures of various types of emotional states. The questionnaire can be used in various environments, in various conditions (e.g. before the strain, after the strain), with individuals or groups. In the next survey, we focused on the subjective well-being of the students which can have a very positive effect on their study results and their quality of life.

We executed the research using intervening variable-the regular physical activity in the form of aqua aerobics.

The composition of the class, as stated by Janošková and Muchová (2002), is comprised of the following parts. During the research, the *Stretching* part was left out due to the lower water temperature (it should be done in a warm enough water (28-30°C), in order to prevent hypothermia).

1. Warm up I. – (preparing the organism for strain).
   Duration: 5 minutes.
2. Warm up II. – increasing intensity by extending the bar, moving around (in order to reach the aerobic zone).
   Duration: 5 minutes.
3. Main part - straining the organism; the exercise intensity reaches maximum; switching between accessories- frisbee disc, weights, step box, swimming noodle, etc.
   Duration: 25 minutes
4. Cool down – gradual decreasing of the exercise intensity.
   Duration: 5 minutes
5. Warm down – re-warming of the organism, so the students feel warm, e.g. walking).
   Duration: 5 minutes

The students can leave the pool at the end of the class (in our case, the aqua aerobics class took 45 minutes, some students stayed in to swim for 10 more minutes).

The Eight State Questionnaire (8 SQ)

It is a standardized questionnaire which is used to determine emotional states. The questionnaire uses multi-state array which provides users with characteristics of a whole variety of emotional reactions that are caused by various situations or their changes. In certain cases, a thorough knowledge of the complexity of emotional reactions of an individual to a situation can provide crucial findings. For example, a new method can prove beneficial in decreasing anxiety, but it can have unintended side effects on its levels. Thus, if only the factor of anxiety was to be determined, relevant information could be lost.

The questionnaire examines a total of eight states at scales: Anxiety, Stress, Depression, Regression, Fatigue, Guilt, Extroversion, Arousal.

The test consists of eight scales and scores are counted on twelve items in each form. The questionnaire is standardized. Each question has four options to choose the answer from. The score of each item relates always only to one factor. The test can be taken individually or in groups. In our research, we used the group form (always the entire group of the class that agreed to be part of the research, others swam).

When the results show a decrease or an increase of the score in particular component in the zones, we have to look at the component specifically. For some, a positive movement means an increase, for others a decrease. E.g. an increase in the result in the Positive attitude to life means an improvement in the life of the student and thus a better result while for the Anxiety component it is the other way around. The scales range from 0 to infinity.

The responses were recorded on a separate answer sheet. The average completion time was 25 minutes. For the processing of the results we used scoring (template). Reponses were displayed as graphical marks in the answer sheet checkboxes. Numbers that appeared for the individual items were always added up and thus we aquired score for the particular compoments of the test. The aquired scores were compared with the population average (before we can evaluate and interpret the gross score, it has to be transfered to a system which puts the score of the specific individual into context with results aquired from other people included in a specifically defined population). These results allowed us to compare each individual to the group norm and, at the same time, compare results from the entry and exit surveys (standard deviation). The results were compared with the population average (8SQ manual).

Berne questionnaire of subjective well-being for Adolescents (BFW)

This questionnaire was first standardized in 1991 (Grob, Luethi, Kaiser BSW - A) and later in 1995 (Grob, Džuka, BSW -Y). The questionnaire structure consists of two main components of well-being, i.e. cognitive and emotional dimensions. The questionnaire is comprised of five sclaes which measure individual areas relating to subjective well-being. These are:

a) general life satisfaction (Cronbach´s $\alpha = 0{,}968$) which measures the habitual aspect of subjective well-being, i.e. relatively stable personal characteristic. This scale thus represents cognitive evaluation of one own´s life contentment. At the same time, it is considered the main

component of the subjective well-being of the cognitive nature. Higher score means higher general life satisfaction.

b) current psyhcological problems (Cronbach´s $\alpha = 0{,}584$) which measure s the negative aspect of the current subjective feeling of the individual. Higher score means higher occurence of problems.

c) current physical problems (Cronbach´s $\alpha = 0{,}809$) which also measures the negative aspect of subjective feeling. Together with the previous scale, these are not considered an integral part of the subjective well-being, nonetheless they can be an important area for experiencing physical problems.

d) self-esteem (Cronbach´s $\alpha = 0{,}949$) which maps self evaluation through expressing attitude to one´s self. A person who aquiress a high score on this scale has a positive attitude to himself/herself, i.e. has a positive self evaluation.

f) depressive moods (Cronbach´s $\alpha = 0{,}806$) which registers levels of negative content of the researched individual´s mind and habitual ways of experiencing of that individual. Higher score shows that habitual psychological problems are typical for this person.

This questionnaire belongs to Becker´s concept of subjective well-being. His structural model of subjective well-being is one of the most complex existing definitions of this phenomenon. The questionnaire can also be considered a complex tool to measure subjective well-being from the viewpoints of the current and habitual components while also including the physical and psychological aspects (Džuka, 1999). The questionnaire consists of six fields which are to be filled in by the tested person according to their own ideas and opinions.

Stress test (Selye, 1993, Křivohlavý, 2001)

Duagnostic tools can also be used to diagnose stress and its levels. Psychology uses a range of tests and survey methods which examine levels of stress. A person experiencing stress behaves differently, has decreased attention, difficulties with solving problems and thus his problems can be described. Therefore, it is possible to determine the level of stress tension.

Levels of stress can be determined e.g. by a method used by the WHO, the Stress test (Selye, 1993). This test examines the emotional, cognitive and behavioral symptoms of stress. Psychologists use many different testing methods, this table can thus be considered a basic method informing us about the current state of the examined client. It has been adapted for the Czech environment by Křivohlavý (1994).

During the research, we employed both qualitative and quantitative methods. Quantitative research is based on standardized quantifiable data, the qualitative part regards itself with texts and words. The quantitative part of the research includes statistical data analysis and the qualitative part uses interpretative methods of searching for themes and patterns in narrative data.

Analysis breaks down the whole into individual components and examines them, searches for their mutual dependencies and their behavior, tracks their functionality as individual elements and their mutual relations (Hendl, 2005). We assumed that both research models would complement each other.

Statistical evaluation

To evaluate our results, we used the Diaroswin testing manual which is a part of a testing array from the Psychodiagnostika s.r.o. company, as well as consultations with a psychologist. In our case, we used standard deviation, correlations, gross score calculations for group evaluations and factor analysis. Results were recaulculated into sten scores and these were compared to the norms for the general population of the same age category and the same sex.

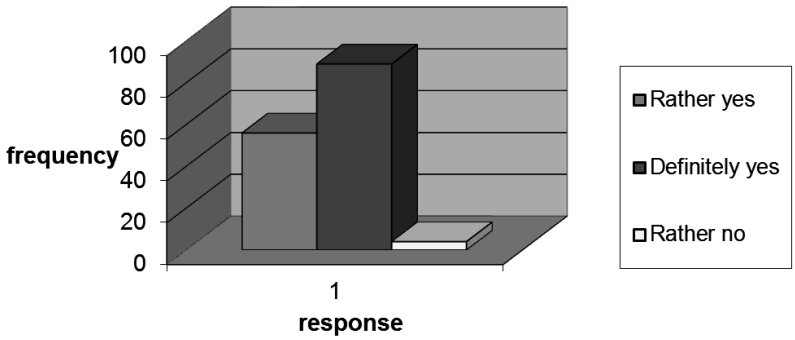
RESULTS AND DISCUSSION

To answer Research question 1, we used the evaluation of the results acquired from the Subjective well-being of youth questionnaire. Overall higher sense of well-being has been detected by the students after the class. The entry figures of self-evaluation were actually higher at psychological problems than other components. In this area, a statistical significance with the subjective well-being item has been detected. The change in current psychological problems has occurred in the positive direction; at the end of the research, the students marked this item lower than at the initial testing. This component represents the current aspect of subjective well-being, i.e. well-being at a specific time. It can change due to many variables which can be influenced by the students during the class.

We acquired the basic information for the entry research from a personal survey of a group of 326 students. As fatigue and exhaustion are connected to health, the first question was about the subjective sense of health. Thus, we asked about health problems in the personal survey.

We asked whether the students that attended the optional physical education experienced positive feelings during the aqua aerobics. This question was not answered by 177 students (they probably did not attend aqua aerobics). A total of 145 students responded positively, only 4 thought that aqua aerobics does not induce pleasant feelings (pic. 1). From practice we know that the exercise brings not only health benefits but also pleasant feelings to all involved. These feelings are accompanied also by a physiological reaction of the organism as the body releases endorphins during exercise, which is why people usually feel very well after physical strain. Of course, exercise also causes other positive effects on health (the muscle apparatus, the respiratory system, etc.) and thus it is a necessary part of our lives. For harmonic personality development, it is essential to exercise regularly because students spend most of their studies sitting in classrooms.

We surveyed the same thing after the exercise class, i.e. whether the exercise induces positive feelings after it ends. Although the same number of students responded, the answers differed from the previous question. This time, 180 students did not respond and 142 students felt they had positive feelings after the exercise class. Four students responded with no (tab. 1).



Pic.1: Response to a question whether aqua aerobics exercise induces positive feelings

Tab. 1. Student´s responses to a question how they feel after the exercise class

Category	Frequency table: **Aqua aerobics exercise induces positive feelings in you after the class** (data adjusted)			
	Frequency	Cumulative	Rel. frequency	Cumulative
Rather yes	50	50	15,33742	15,3374
-	180	230	55,21472	70,5521
Definitely yes	92	322	28,22086	98,7730
Rather no	4	326	1,22699	100,0000
Boys and girls	0	326	0,00000	100,0000

In the Eight State Questionnaire, the feeling of fatigue is present in several segments; in depression, stress, partly in anxiety and mainly in fatigue (tab. 2). These items are closely connected and their level displays the real exhaustion of a person during the everyday activity. At the selected group, we observed all segments and evaluated them with regards to senses of health and subjective feelings of well-being. Many students were surprised by the results because they subjectively did not feel any problems, even though the values were verified by several methods (stress test, Eight State Questionnaire, Subjective Well-being of Youth test).

Table 2: Statistical values for selected items in individual examinations

Segment	1st examination	Standard deviation	2nd examination	Standard deviation
Depression	4,50	2,19	3,88	1,59
Stress	8,33	4,39	10,53	3,72
Anxiety	4,81	2,17	3,88	1,45
Fatigue	2,13	1,06	3,67	1,84

Dependencies have emerged in the Eight State Questionnaire that we assessed statistically through correlation and paired t-test results (tab. 3). We selected the students that marked positively the feelings that were included in the fatigue and exhaustion segments in their response.

At the beginning of the class, the students were in zone 5 in the fatigue area with a gross score between 9 and 14 points. At the end of the class, they moved to zone 4 with a gross score

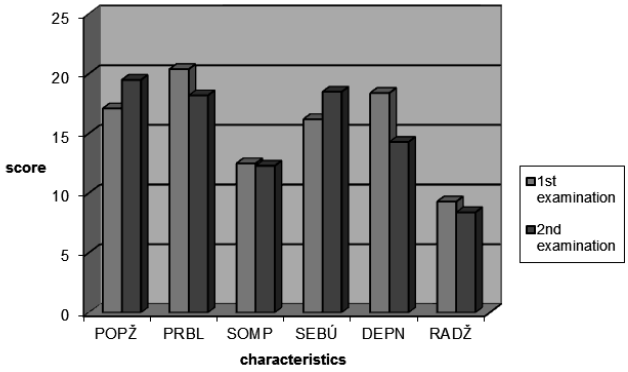
between 7 and 8 points. When compared to the general population, it is slightly below average (the population has a sten score of 13,96 with a standard deviation of 7,43), the researched group has thus been 0,5 sigma below the population average at the beginning of the classes and 0,5 sigma above the population average at the end of the classes in the level of fatigue.

From the previously stated can be noted that the classes of aqua aerobics really affected positively the decrease of feeling of fatigue and subjective feelings of stress and negative moods. The students were always smiling after classes, they were full of optimism and enthusiasm for further work.

Table 3: Statistical assessment of selected items

Segment	Correlation	P (correlation)	P (t-test)	N
Depression	0,225	0,314	0,664	22
Stress	0,354	0,106	0,968	22
Anxiety	0,206	0,358	0,033	18
Fatigue	0,289	0,244	0,042	22

In the tests of subjective well-being, we discovered that the group of students displayed different values after the aqua aerobics than at the beginning of the exercise. In the individual components, the biggest differences were displayed in the positive attitude to life and depressive mood components. In selected components, we inquired into the changes that emerged after the classes finished. We noted the lowest and highest scores reported by the individuals and the groups. It can be said that the results were not statistically significant, only a material significance has been proven (pic. 2).



Pic. 2 : Changes in the score of individual items of the Subjective well-being questionnaire

POPŽ - Positive attitude to life (always sees the positives in life)

PRBL - Problems experienced (e.g. lack of self confidence , feeling insecure, school)

SOMP - Physical problems (pain and fatigue)

SEBÚ - Self-esteem (pride and confidence in oneself)

DEPN - Depressive moods (low moods , feeling of sadness, worthlessness, helplessness and sometimes guilt)

RADŽ - Happiness in life (success at job, home and family or school in general)

The personal survey of 322 of male and female students shows that appropriately selected equipment used in the class contributes positively to the greater appeal of the classes. See the students´ responses (table no. 4).

Table 4: Students´ addiction to aqua aerobics after previous exposure

Category	Frequency table: **Are you becoming, in a positive sense, addicted to aqua aerobics?** (data adjusted)			
	Frequency	Cumulative	Rel. frequency	Cumulative
Rather yes	61	61	18,71166	18,7117
-	169	230	51,84049	70,5521
Definitely no	22	252	6,74847	77,3006
Rather no	60	312	18,40491	95,7055
Definitely yes	14	326	4,29448	100,0000
ChD(boys & girls)	0	326	0,00000	100,0000

Along with this response, the students also evaluated other criteria which influenced their choice to attend aqua aerobics. Out of everyone that attended these classes, 24 would attend the classes outside of the school semester as well, 28 noted the appropriate selection of equipment for aqua aerobics and a lot of them mentioned the trainer as a motivation for other sports physical activities.

All these factors positively affect our organism and can bring sense of well-being through movement. The students that regularly attend the aqua aerobics classes are more satisfied and lead a fulfilled life.

CONCLUSION

The research aimed to examine the influence of physical activity, specifically aqua aerobics accompanied by new modern technologies (accessories), on the quality of life of female university students. To conduct the research, aqua aerobics classes were selected and 60 students that have attended these classes for the whole semester agreed to take part in the research. The influence of aqua aerobics was examined through standardized methods, both quantitative and qualitative. The research results have been subjected to a statistical data analysis, so we can answer the research questions thusly:

The dependency between regular aqua aerobics exercise and well-being (including current well-being) of university students does exist and is very significant. The equipment used in the aqua aerobics has increased the overall appeal of the physical education classes according to the students.

Regular physical activity of aqua aerobics does positively influence not only the feelings of anxiety and eliminates stress, but also increases confidence. It also has positive influence on positive attitude to life and decreases physical problems. The students felt relaxed, showed lower levels of stress and depressive moods and looked forward to next classes. The positive influence of regular physical activity on personality development positive thinking and

improvement of quality of life has been proven. The equipment used in the aqua aerobics has increased the overall appeal of the physical education classes according to the students. Thanks to the new equipment used in the classes, the exercise has become not only more effective but also more entertaining and varied. From this point of view, it has a big influence on improving the quality of the classes.

REFERENCES

1. BAUMANN, Z. (1995). *Úvahy o postmoderní době.* Praha: Sklon.
2. BLAHUTKOVÁ, M., ŘEHULKA, E., & DVOŘÁKOVÁ, Š. (2005). *Pohyb a duševní zdraví.* Brno: Paido.
3. CATTEL, R. B., CURRAN, J. P. (1973). *Personality and mood by questionnaire.* San Francisco: Jossey-Bass.
4. GIDDENS, A. (1999). *Sociologie.* Praha: Argo.
5. HOFSTEDE, G. (1984). The Cultural Relativity of the Quality of Life Concept. *Academy of Management Review.* vol. 9. p. 389-398.
6. JANOŠKOVÁ, H.; MUCHOVÁ, M. *Aqua aerobik.* Brno: PAIDO, 2002. 71 s. ISBN: 80-7315-030-1.
7. MUCHOVÁ, M., JANOŠKOVÁ, H. *Aqua fitness.* Aqua fitness. Brno: Paido - edice pedagogické literatury, Brno, 2004. s. 1-71. ISBN: 80-7315-076-X.
8. KŘÍŽOVÁ, E. (2005). Sociologické podmínky kvality života. In J. Payne et al. *Kvalita života a zdraví* (pp. 351-364). Praha: Triton.
9. MUŽÍK, V. & KREJČÍ, M. (1997). *Tělesná výchova a zdraví.* Olomouc: Hanex.
10. ROZENTHAL, R., J. (1966). Trachet expectancies. Determinant of pupils IQ gains.In: *Psychological Reports.* No. 19. p. 34-46
11. SMÉKAL, V. (2002). *Pozvání do psychologie osobnosti.* Brno: Barrister & Principal

FLIPPED INSTRUCTIONAL MODEL IN PHYSICAL EDUCATION

CHAD M. KILLIAN, KIM C. GRABER, AMELIA MAYS WOODS
Department of Kinesiology and Community Health, University of Illinois at Urbana-Champaign, Illinois, Urbana, USA

The amount of physical education time in which students in the United States (US) are engaged during the school day varies extensively and is largely dependent on state regulations and school or district guidelines. In many schools throughout the world, physical education is a marginalized subject and its allotted time is decreasing or has remained stagnate, failing to increase to acceptable levels (Marshall & Hardman, 2000). Students may go several days or even a week without physical education class, especially at the elementary level. As a result, teachers are often left with the difficult task of balancing cognitive, social, and affective learning opportunities within what should be a highly active environment, where students spend the majority of class time actively engaged in physical activity. Effective teachers may do a better job than less effective teachers at maintaining elevated activity levels within their classes, however, they still may lack the necessary time to provide students with a well-rounded physical education curriculum that would meet the US national standards (SHAPE America, 2013).

The expectation that students will develop deep knowledge and achieve motor competence without adequate class time to practice and engage is unrealistic. This presents a challenge for teachers who understand the value of the national standards and expect students to demonstrate motor skill competency; acquire knowledge about concepts and strategies related to motor performance; acquire knowledge and skills related to health-related fitness and physical activity; demonstrate responsible behavior; and value health and physical activity (SHAPE America, 2013). Limited physical education time presents a number of challenges to both students and teachers. It prevents students from receiving adequate physical activity during the school day, limits their opportunity to develop physical skills, and prevents them from acquiring the knowledge and skills necessary for successfully engaging in life-long physical activity. It also impedes physical education teachers' ability to implement best instruction across the curriculum.

Flipping the physical education classroom may be one way to remedy some of these dilemmas because it provides teachers with additional time to teach content while simultaneously increasing the amount of available time in which students can be actively engaged in health-related fitness and motor activities. The model may also facilitate the ability of the physical education teacher to implement formative and summative assessments of student learning in the cognitive, affective and psychomotor domains without using class time to administer the evaluations.

FLIPPED INSTRUCTION DEFINED

Flipped instruction, also known as inverted learning or blended learning, is a pedagogical approach in which students acquire required knowledge prior to class. Course content is

disseminated outside of class through the use of video lectures or demonstrations, PowerPoints, and other web-based platforms (Mason, Shuman, & Cook, 2013). Teachers subsequently facilitate the application of that knowledge during class, through student-centered learning experiences (Stone, 2012). Instructors may also choose to implement assessments outside of class through the use of a variety of online programs and applications.

The flipped instructional model leverages the high quality video recording capabilities of new technology along with increasingly diverse distribution modalities like tablets and mobile devices to disseminate course content (Munson & Pierce, 2015). This asynchronous approach of flipped instruction allows for students to prepare for class in advance, with ample time to preview upcoming material and identify areas where they may need support or clarification. Class time is then used for guided practice opportunities where students interact with one another to apply the content to which they were introduced prior to class (Hawks, 2014).

Early on, flipped instruction was described as "events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa" (Lage, Platt, & Treglia, 2000, p. 32). Although not initially explicit, flipped instruction emerged as a means of promoting the use of technology as well as promoting active and collaborative learning in classroom settings (Hotle & Garrow, 2015). The instructional model has since evolved to include (1) well-defined, technology assisted, self-regulated learning outside of the classroom that focuses on foundational knowledge (Giannakos, Krogstie, & Aalberg, 2016), and (2) active learning within the classroom (usually cooperative activities focused on critical knowledge and skills). A natural result of flipped instruction is a shift in the role of the teacher, from one who disseminates knowledge to one who facilitates learning. The outcome of which results in more student-centered learning.

RESEARCH ON FLIPPED INSTRUCTION

Research on flipped instruction has shown that the method has a positive impact on a variety of learning-related metrics within classroom-based settings which include improved academic learning time (Mason, Shuman & Cook, 2013; Schilling, 2014), positive student perceptions of the model and its impact on their learning (Pierce & Fox, 2012), and higher academic achievement (Missildine, Fountain, Summers, & Gosslin, 2013). Research demonstrates that a flipped instructional approach can also result in improved attendance (McLaughlin, et al., 2014), increases in student empowerment (McLaughlin, et al., 2013), increases in learning engagement (Hung, 2014), and additional learning flexibility (Forsey, Low, & Glance, 2013).

The majority of research on flipped instruction has focused on higher education settings, particularly in relation to student perceptions about the approach and academic achievement. Peripheral evidence suggests, however, that the flipped instructional model may also facilitate teachers' ability to implement best teaching practices, like allowing for self-directed learning, differentiating instruction, and seamlessly implementing formative and summative assessments, which apply to any grade level. Although the flipped instructional model deviates from the teaching methods and workload students might experience in a traditional physical education course, it has the potential to positively impact many aspects of physical education for students, as well as the instructional role of the teacher.

ACADEMIC LEARNING TIME

The flipped instructional model has been especially useful for teachers and students in applied subjects like math and chemistry where students have traditionally been lectured and then expected to work through complex homework problems, away from the assistance of their instructors. In other words, students in these courses have customarily had limited or no time to engage in guided practice activities with access to instructor feedback because practice opportunities mostly occurred as homework assignments. This parallels the experience of many physical education students. Although lectures during physical education should be of limited duration, task presentations and concepts necessary for more engaging in more complex skills require instructors to provide additional instruction while students are listening and not moving. This leaves less time for students to engage in physical activity. This is not to suggest that physical education teachers should avoid providing comprehensive instruction in order to preserve movement time, however, there is simply not adequate time for physical education teachers to provide cognitive instruction and also achieve all of the other expected learning outcomes described in the national standards. Further, as movement concepts and skills become increasingly complex, the amount of time necessary for instructing and demonstrating invariably increases, which results in less time for students to be actively engaged in physical activity. Thus, teachers must think creatively about how to maintain depth in the curriculum, while also maximizing engagement in physical activity.

A logical advantage of flipping physical education instruction is the potential availability of additional class time that can be allocated for concept and skill application outside of the physical education environment. Fulton (2012) discussed several advantages of flipped instruction that reinforce this potential and relate to how class time can be positively impacted. For example, class time can be used more efficiently because flipped instruction allows teachers to *facilitate* learning activities, rather than to deliver content. If some physical education content is delivered outside of the classroom through web-based technology, then more class time is available for students to engage in movement-based application of content.

Research has demonstrated that flipped instruction can increase active learning opportunities when applied effectively. Mason and colleagues (2013) reported that additional content was delivered by instructors when they implemented the flipped instructional model. Students in the flipped class were one week ahead of those in the traditionally-taught class at the end of the semester. The authors speculated that the active nature of the learning activities in the flipped classroom allowed key ideas to be reinforced without sacrificing content. Another study reported that flipped instruction resulted in a 40% reduction in the amount of time the instructor spent teaching content during class (Schilling, 2014). These results are encouraging for physical education teachers seeking practical ways to increase physical activity time without sacrificing content. Although these studies examined an entire course flip, ultimately it is the instructor's decision about how much content to flip. Lessons or sequences of lessons that may involve more complex explanations or have considerable introductory concepts may lend themselves to a flipped approach. This would allow students more time to practice and receive feedback. Other simpler sequences may be better off delivered in the gymnasium.

ACADEMIC ACHIEVEMENT

A number of studies have demonstrated there is an increase in academic achievement for students participating in flipped classrooms. Day and Foley (2006) examined the impact of flipped instruction on student performance. A control group received traditional instruction whereas an experimental group received online, flipped instruction. Each group engaged in the same activities and assignments over the course of the semester and all assignments were graded blindly. At the end of the course, the experimental group had significantly higher grades than the control group. Similar results have been found in other studies (Missildine, Fountain, Summers, & Gosslin, 2013; Rivera, 2015; Schultz, Duffield, Rasmussen, & Wageman, 2014). Engineering students enrolled in a flipped course achieved at the same or higher levels than their counterparts enrolled in the same traditionally taught course (Mason, Shuman, & Cook, 2013). Other studies have shown student improvement on quiz scores (Forsey, et al., 2013), exam scores (Albert & Beatty, 2014) and increases in pre- and post-assessments of class content (Kurup & Hersey, 2013).

These studies illustrate the positive impact that flipped instruction can have on student achievement. The interactive nature of the flipped classroom, coupled with an increase in guided practice opportunities, allowed students in these classes to master the content in a way that was missing in traditionally taught classes. O'Flaherty and Phillips (2015) noted, however, that many studies exhibiting increases in academic achievement for students in flipped classes did not employ rigorous measures of student learning. Results have been generated by comparing exam scores, pre- and post-test results, or grades based on historical control groups. No current studies have reported validation or reliability measures for the assessment tools that were used. This, however, should not negate the positive impact flipped instruction may have on student learning in the settings that were investigated or in physical education. Since flipped content is online and available for review at the convenience of the learner, students in a flipped physical education class would have on-demand access to physical education material that can be studied and reviewed multiple times, whereas in a traditional setting students are generally exposed to only a single instructional presentation. Since students in a flipped approach would have been exposed to a lecture outside of class time, in-class time can be used solely for practicing content conveyed in the online format.

STUDENT PERCEPTIONS

Flipped instruction is still an emerging instructional method. As such, researchers have been interested in examining students' perceptions of and experiences with the model. Pierce and Fox (2012) reported that 80% of their 71 participants were satisfied with their learning experience. The convenience of online instruction and additional class time to apply knowledge were cited as reasons for students' positive perceptions. Young, Bailey Guptil, Thorp and Thomas (2014) reported that participants' positive perceptions related to additional contact with instructors during class and the interactive nature of the flipped instruction. Other researchers have also indicated positive student views about flipped instruction that related to continuous access to content (Enfield, 2013), greater instructional enjoyment (Love, Hodge, Grandgenett,

& Swift, 2014), the motivating factor of online accountability quizzes (Tune, Sturek, & Basile, 2013), and the richness of learning and increased productivity required by flipped instruction (Forsey, et al. 2013).

In a review of literature, Bishop and Verleger's (2013) reported that students view the model with generally positive perspectives, although some students are invariably resistant to moving away from a traditional lecture-based form of instruction. Negative perceptions of a flipped approach have been associated with the age of the learner (Findlay-Thompson & Mombourquette, 2014) and preferences for a traditional lecture format (despite increased academic performance) (Missildine, et al., 2013). Some students also expressed their negative perceptions stemmed from the perceived lack of fairness of increased independent learning expectations (Wilson, 2014) and their general struggles with independent learning (Butts, 2014). Other students have noted their displeasure at the increased amount of work involved in learning outside of class (Yeung & O'Malley, 2014). Strayer (2012) did find, however, that students who reported lower levels of satisfaction with flipped instruction became less oppositional after growing more accustomed to the model throughout the semester.

Schultz and colleagues (2014) noted that flipped instruction had less of an impact on female students' academic achievement, perhaps because female students were more likely to have a preference for traditional instruction and perceive flipped instruction negatively. Results from their study highlights the need for instructors to understand the uniqueness of their learners. Flipped instruction may not enhance the learning and achievement for all students, and it may not be a preferred learning method for everyone. Therefore, instructors should consider a variety of instructional methods when developing instructional content.

DESIGN CONSIDERATIONS

Flipped instruction often has a positive impact on student learning, but those outcomes require considerable preparation and effort on the part of the instructor. A certain level of understanding about web-based instructional applications and considerable preparation is necessary to effectively flip the classroom while maintaining fidelity to course objectives. In order for the model to have the greatest chance of success, it is important that students understand the flipped framework and reasons for its implementation. Limited understanding of the framework has resulted in students' resistance to the model. For example, Yueng and O'Malley (2014) reported that student frustration related to limited introduction to the format as well as a lack of clarity about asynchronous learning expectations. Thus, it is important for instructors to explain the model thoroughly, along with providing a reasonable rationale for its implementation. Physical education teachers seeking to implement the model might emphasize that it provides additional opportunity during class for engagement in physical activity while simultaneously providing students with access to continuously available online information about class content.

In order to maximize the impact of flipped instruction, video content must be directly related to the learning objectives of the class for which it is designed. In turn, the in-class learning activities must be related to the flipped content. The need for up-front planning and development of resources is necessary for a successful flipped experience (Davies, Dean, &

Ball, 2013), although this can sometimes be challenging. For example, Schlairet, Green, and Benton (2014) admitted that flipping instruction for their class was extremely time intensive, however, they acknowledged that future iterations of the class required less time and only moderate modifications. Other researchers have recommended that videos continually be updated until the best ones emerge, which can then be used until the content needs revised (Prober & Khan, 2013).

Another consideration is familiarity with technology and the need for technology support during the design and implementation phase (Schlairet, et al., 2014). Although the initial process can be time-consuming and sometimes frustrating, the approach becomes increasingly less complex as one gains familiarity and a level of comfort with the technology. As the availability and quality of video editing software and applications continues to improve, the ease by which instructors are able to develop and deliver high quality content modules will increase.

Some students may be resistant to a new instructional approach for a variety of reasons. For example, simple preferences for traditional instruction may produce negative perceptions (Missildine, et al., 2013). As a result, students may neglect to engage with the content before class. Thus, Schlairet and colleagues (2014) recommend providing short, online quizzes throughout the class to hold students accountable for the material. The quizzes are an excellent mechanism for obtaining formative information about student learning and whether the flipped approach is achieving intended learning outcomes. In the case of physical education, these quizzes can be used to assess cognitive leaning objectives without sacrificing in-class time for students to take a written assessment.

Finally, instructors should consider whether or not all students have access to the internet. Students of lower SES, or those who live in areas with poor or limited internet reception, would be unable to engage with online content outside of school (Missildine, et al., 2013). In cases such as these, accommodations should be made for students to use school-based technology during study halls or before or after school. Fortunately, as access to technology and the internet becomes more ubiquitous, the practicality and efficiency by which flipped content can be disseminated online will increase.

MODEL AND CASE EXAMPLE OF FLIPPED INSTRUCTION

Figure 1 provides an illustrative example of how time spent engaged in physical activity can be maximized through flipped instruction by engaging students in cognitive and affective learning outside of class.

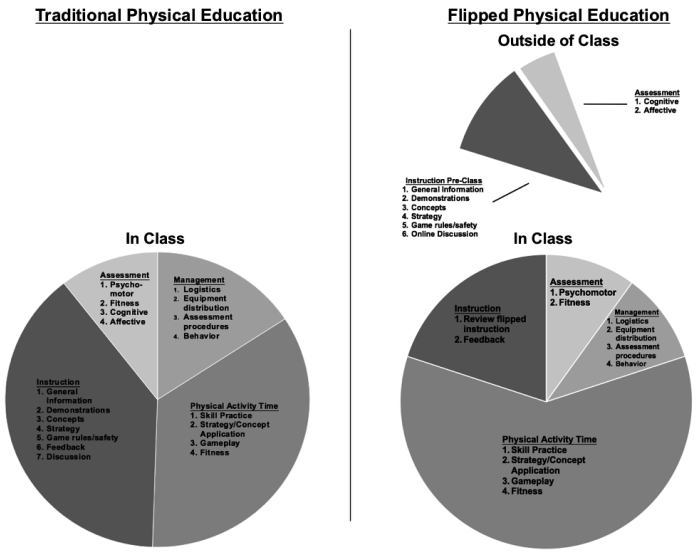


Figure 1. Comparison of traditional physical education and flipped physical education. Note that the portion of the pie chart containing each component is meant to illustrate the relative amount of time students and teachers might spend in related tasks.

The following fictional example describes specifically how this might occur:

Mr. Damon is a high school physical education teacher. He spent the early part of his career building a quality physical education program that focused on helping students achieve state and national physical education standards. As such, assessment played a key role in his classes. He monitored students' psychomotor, cognitive, and affective progress, and designed appropriate instruction based on the data he collected. He understood that in order for students to be fairly assessed, they needed adequate in-class time to increase their knowledge and skill level. Recently, Mr. Damon's school reduced physical education class from five days to two days per week. Mr. Damon realized it would be impossible for him to consolidate his instruction, implement the same assessments, *and* provide students with adequate levels of physical activity.

After attending a physical education conference, Mr. Damon discovered flipped instruction. He learned that he could videotape skills demonstrations and simultaneously explain strategies, game rules, and safety procedures, by using easily accessible equipment and software. He could post the videos online and assign students to watch and engage in online homework. Students without access to technology at home could use the schools' equipment. During class, he could review what they had watched and transition them quickly into application activities. In addition, many of the cognitive and affective assessments he previously employed could be posted online.

Initially, there was a bit of a transition period during the implementation stage because students exhibited some resistance, but Mr. Damon was patient and offered support. Soon

afterward, however, class time for physical activity increased because considerable instructional content was now posted online. He was also able to implement many of the assessments he had previously used, and they were far more efficient because there was no longer a need to distribute pencils and paper, answer questions, collect the assessments, and transition to instruction.

An unintended result of flipping his instruction became apparent when Mr. Damon began receiving compliments from parents about the quality of his program. Parents noted they never knew what their students learned in physical education prior to having them engage in online homework. They appreciated the insight they gained into their students' physical education experience and even learned a few things themselves by watching some of the instructional videos. This, of course, got the attention of Mr. Damon's administrators, who were equally impressed with how resourceful he had been to return the program to its previous standard of quality.

Flipped instruction helped to increase students' activity time without losing high quality instructional and assessment opportunities necessary for achieving state and national standards. Although he had to learn new technology and encountered initial student resistance, Mr. Damon was persistent and worked closely with his school's information technology personnel. In the end, both he and his students came to appreciate the model.

CONCLUSION

Although there have been several investigations examining the perspectives of physical education teacher educators about K-12 online physical education (Daum & Buschner, 2012; Daum & Woods, 2015), no investigations have focused exclusively on examining flipped instruction. And though teaching and learning in the gymnasium are different than teaching and learning in a classroom setting, there also exist many similarities. Evidence suggests that flipped instruction may be a viable instructional tool for physical education teachers, however, research is needed to determine the effectiveness of the model in a physical education environment, as well the design and implementation implications.

It appears that the flipped approach has great potential for increasing cognitive outcomes while simultaneously engaging students in higher levels of physical activity during physical education class. The challenge for physical educators is to balance cognitive and social learning with physical skill development, while maintaining adequate engagement in physical activity within a limited amount of class time. A benefit of flipped instruction is that foundational knowledge is shared with students outside of allocated class time. This is an intriguing aspect of flipped instruction that makes it well suited for physical education. Not only could a flipped approach enhance the learning experience for students, it also might provide additional class time for students to be engaged in movement-based activities. This relatively new technological approach to instruction makes for a potentially exciting match between flipped instruction and physical education.

REFERENCES

1. Albert, M., & Beatty, B. (2014). Flipping the classroom applications to curriculum redesign for an introduction to management course: Impact on grades. *Journal of Education for Business, 89,* 419-424.
2. Bishop, J. L., & Verleger, M. A. (2013, June). The flipped classroom: A survey of the research. In *ASEE National Conference Proceedings, Atlanta, GA*.
3. Butts, A. (2014). Student views on the use of a flipped classroom approach: Evidence from Australia. *Business Education & Accreditation*, *6*(1), 33-44.
4. Daum, D. N., & Buschner, C. (2012). The status of secondary online physical education in the United States. *Journal of Teaching in Physical Education, 31,* 86-100.
5. Daum, D. N., & Woods, A. M. (2015). Physical education teacher educator's perceptions toward and understanding of K-12 online physical education. *Journal of Teaching in Physical Education, 34,* 716-724.
6. Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development*, *61*, 563-580.
7. Day, J. A., & Foley, J. D. (2006). Evaluating a web lecture intervention in a human–computer interaction course. *IEEE Transactions on Education*, *49*, 420-431.
8. Enfield, J. (2013). Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN. *TechTrends*, *57*(6), 14-27.
9. Findlay-Thompson, S., & Mombourquette, P. (2014). Evaluation of a flipped classroom in an undergraduate business course. *Business Education & Accreditation*, *6*(1), 63-71.
10. Forsey, M., Low, M., & Glance, D. (2013). Flipping the sociology class: Towards a practice of online pedagogy. *Journal of Sociology, 49*, 471-485.
11. Fulton, K. P. (2012). 10 reasons to flip: A southern Minnesota school district flipped its math classrooms and raised achievement and student engagement. *Phi Delta Kappan*, *94*(2), 20-24.
12. Giannakos, M. N., Krogstie, J., & Aalberg, T. (2016). Toward a learning ecosystem to support flipped classroom: A conceptual framework and early results. In Y. Li, M. Chang, M. Kravcik, E. Popescu, R. Huang, Kinshuk, & N. Chen (Eds.). *State-of-the-art and future directions of smart learning* (pp. 105-114). Singapore: Springer.
13. Hawks, S. J. (2014). The flipped classroom: now or never? *AANA journal*, *82*, 264-269.
14. Hotle, S. L., & Garrow, L. A. (2015). Effects of the traditional and flipped classrooms on undergraduate student opinions and success. *Journal of Professional Issues in Engineering Eduction and Practice*, *142*(1), 1-11.
15. Hung, H. (2014). Flipping the classroom for English language learners to foster active learning. *Computer Assisted Language Learning*, *28*(1), 81-96.
16. Kurup, V., & Hersey, D. (2013). The changing landscape of anaesthesia eduction: Is flipped classroom the answer? *Current Opinion in Anesthesiology, 26*, 726-731.
17. Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, *31*(1), 30-43.
18. Love, B., Hodge, A., Grandgenett, N., & Swift, A. W. (2014). Student learning and perceptions in a flipped linear algebra course. *International Journal of Mathematical Education in Science and Technology*, *45*, 317-324.
19. Marshall, J., & Hardman, K. (2000). The state and status of physical education in schools in international context. *European Physical Education Review*, *6*, 203-229.
20. Mason, G. S., Shuman, T. R., & Cook, K. E. (2013). Comparing the effectiveness of an inverted classroom to a traditional classroom in an upper-division engineering course. *IEEE Transactions on Education*, *56*, 430-435.

21. McLaughlin, J. E., LaToya, G. M., Esserman, D. A., Davidson, C. A., Glatt, D. M., Roth, M. T., . . . Mumper, R. J. (2013). Instructional design and assessment: Pharmacy student engagement, performance, and perception in a flipped satellite classroom. *American Journal of Pharmaceutical Education, 77*(9), 1-8. Retrieved from http://www.ajpe.org/doi/pdf/10.5688/ajpe779196
22. McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., . . . Mumper, R. J. (2014). The flipped classroom: A course redesign to foster learning and engagement in a health professions school. *Academic Medicine*, *89*, 236-243.
23. Missildine, K., Fountain, R., Summers, L., & Gosslin, K. (2013). Flipping the classroom to improve student performance and satisfaction. *Journal of Nursing Education*, *52*, 597-599.
24. Munson, A., & Pierce, R. (2015). Flipping content to improve student examination performance in a pharmacogenomics course. *American Journal of Pharmaceutical Education*, *79*(7), 1-7.
25. O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, *25*, 85-95.
26. Pierce, R., & Fox, J. (2012). Instructional design and assessment: Vodcasts and active-learning exercises in a "flipped classroom" model of a renal pharmacotherapy module. *American journal of Pharmaceutical Education*, *76*(10), 1-5.
27. Prober, C. G., & Khan, S. (2013). Medical education reimagined: A call to action. *Academic Medicine*, *88*, 1407-1410.
28. Rivera, E. (2015). Using the flipped classroom model in your library instruction course. *The Reference Librarian*, *56*(1), 34-41.
29. Schilling, W. (2014). *Proceedings from the 2014 ASEE North Midwest Section Conference, Increasing material coverage in software engineering through the introduction of the flipped classroom*, Iowa City, IA.
30. Schlairet, M. C., Green, R., & Benton, M. J. (2014). The flipped classroom: Strategies for an undergraduate nursing course. *Nurse educator*, *39*, 321-325.
31. Schultz, D., Duffield, S., Rasmussen, S. C., & Wageman, J. (2014). Effects of the flipped classroom model on student performance for advanced placement high school chemistry students. *Journal of Chemical Education*, *91*, 1334-1339.
32. SHAPE America. (2013). *Grade-level outcomes for K-12 physical education.* Reston, VA: Author.
33. Stone, B. B. (2012). *Flip your classroom to increase active learning and student engagement*. Paper presented at the 28th Conference on Distance Teaching and Learning, Madison, WI. Retrieved from http://www.uwex.edu/disted/conference/Resource_library/proceedings/56511_2012.pdf
34. Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, *15*, 171-193.
35. Tune, J. D., Sturek, M., & Basile, D. P. (2013). Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology. *Advances in Physiology Education*, *37*, 316-320.
36. Wilson, S. (2014). The flipped class: A method to address the challenges of an undergraduate statistics course. *Teaching of Psychology, 40*, 193-199.
37. Yeung, K., & O'Malley, P. J. (2014). Making "The Flip" work: Barriers to and implementation strategies for introducing flipped teaching methods into traditional higher education courses. *New Directions for Institutional Research*, *10*(1), 59-63.
38. Young, T. P., Bailey, C. J., Guptill, M., Thorp, A. W., & Thomas, T. L. (2014). The flipped classroom: A modality for mixed asynchronous and synchronous learning in a residency program. *Western Journal of Emergency Medicine*,*15*, 938-944.

APPLICATION OF MODERN TECHNOLOGY IN TEACHING AND TRAINING WITH SPECIAL EMPHASIS ON BASKETBALL CONTENTS

DAMIR KNJAZ, TOMISLAV RUPČIĆ, LJUBOMIR ANTEKOLOVIĆ
Faculty of Kinesiology, University of Zagreb; Zagreb, Croatia

INTRODUCTION

Nowadays the use of modern technology has a widespread applicable value in the field of health, diagnostics and in improving existing conditions of the anthropologic status, as well as in observing and monitoring the implementation of specific kinesiological operators designed to further improve them, regardless of whether this modern technology is used in teaching physical education, in the field of physical recreation or for training with top athletes.

Among all the mentioned aspects, when it comes to using modern technology in the field of sports, the primary accent is these days directed towards the health status where the possibilities of application are unlimited, whether it is used in diagnostics and improving the loco-motor system or in basic implementations of various physical activity programmes aimed at improving the overall health status.

The application of modern technology in the field of physical education should likewise primarily be directed towards advancing the health status of children, as well as on diagnosing the existing conditions of the anthropological profile and its further improvement. However, a high level of applicability is also present in processes of adopting and enhancing particular motor skills.

As modern technology constitutes an indispensable element of modern sports, thus also of basketball, its application is practically without limits, regardless of whether it is used in the teaching process with an emphasis on basketball contents, or in the training process with the youngest basketball players or with top level professionals. In addition, in the process of including new technologies, it is important to educate all the participants included in the process so that they can all independently use these technologies, at least to a certain degree. Then the role of a sports coach is completely fulfilled.

All basketball players, in some part of their technical, technical and tactical (individual, group or team tactics) or physical conditioning and motor preparation (diagnostics), have had contact with a certain form of modern technology for which at that particular moment their teachers or coaches considered it could improve their motor performance of a certain element of basketball technique, their adoption and understanding of specific tactical knowledge or that it could simply develop a certain motor range which was essential for their physical or basketball development. In addition to including new technology, a mandatory part of its application is a certain level of education and expertise of the professionals who are using it. Identically as for the implementation of all segments of the training process, it is important that educated personnel take part in the process of applying new technologies as they include all their knowledge and experience, while respecting the responsibility of their work.

It is also important to keep in mind that modern technology does not and never will be able to completely replace a sports coach and an educator. However, it can provide assistance in many segments in terms of verifying certain observations and irrefutably pointing to necessary information, both to the sports teacher, as well as to the athlete himself/herself. The ideal combination of expert knowledge and modern technology ensures the subject in question's (athlete's) complete confidence that he/she is treated in an individually defined and ideal manner.

This chapter will demonstrate an overview of selected modern technology which is applied in diagnostics and improving the health status of children and young adults; in the fields of adopting and enhancing specific motor skills in basketball; in the process of conducting high quality scientific research; or in aspects of top level basketball in terms of technical and tactical training or physical conditioning and motor preparation of basketball players.

Key words: technology, basketball player diagnostics, motor performance, Kinovea, 94Fifty

HEART RATE SENSORS

Monitoring the actual physiological workload of children during the implementation of various physical education programmes, as well as players in the training process or during a basketball game, is one of the most objective indicators for evaluating the real intensity that the mentioned motor movements represent for children.

There is currently a wide range of this type of measuring instruments in the market that primarily enable monitoring heart rate values, whereas secondarily, depending on various scientific, training or teaching requirements, they also measure some other parameters such as maximum heart rate, energy consumption, covered distance, time spent in a specific workload zone, difference in altitude, etc.

Picture 1
Heart rate monitor manufactured by POLAR (V800) with the corresponding chest strap (H7)
web source: www.polar.com

The measuring instrument consists of a strap (transmitter) and the corresponding watch that records all the monitored parameters. In addition to the mentioned option, there is also the possibility of only using the chest strap which is fastened around the chest of the examinee, whereas the device is connected via a Bluetooth connection with a corresponding application which enables real-time heart rate monitoring for all the students or players who are participating

in a certain exercise or motor assignment. This enables the teacher or coach to very easily "manipulate" the teaching or training process based on objective parameters of the workload intensity.

Picture 2
Digital interface representation of the application programme Polar Team®

In top level basketball researchers and coaches very often use systems that in addition to real-time heart rate monitoring for all the players involved in the training process or a game, also enable entering relevant parameters, i.e. workload zones which are determined pursuant to some other protocols (e.g. spiroergometry in laboratory conditions), and based on which more precise intensity levels are individually determined.

It should be pointed out that performance during the training process is often attempted to be drawn closer to situational conditions, and hence also in the segment of intensity. If we acknowledge the most common distribution into 5 levels of physiological workload (based on heart rate), during a basketball game, players most often perform their actions in the fourth workload zone. Each player must have defined parameters for each one of these zones and then be "tested" in any required zone, as well as have his/her efficiency improved in realistic physiological situational conditions.

Application options in the process of teaching physical education with special emphasis on basketball contents, as well as in the basketball training process or situational conditions:

- *observing and monitoring the workload intensity based on heart rate readings,*
- *more precise programming of the teaching/training process, depending on its goals and tasks, by altering the desired workload intensity,*
- *more precise programming of individual resting phases between specific exercises,*
- *determining the actual physiological workload of players during a basketball game,*
- *producing a plan and programme based on the physiological workload determined in situational conditions,*

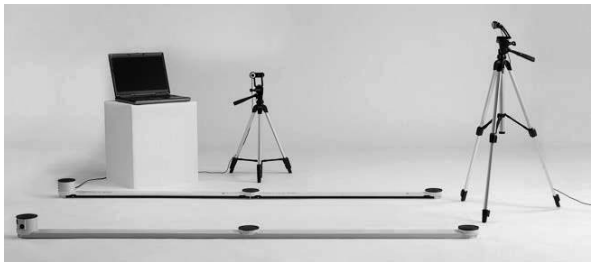
- *a higher level of quality in implementing and monitoring plans and programmes on the basis of individual programme workload zones,*
- *performing various technical or technical and tactical skills in realistic situational conditions in terms of physiological workload (shooting practice, realisation of tactical principles, etc.).*

DIAGNOSTIC EQUIPMENT MANUFACTURED BY MICROGATE, IT

The OptoJump testing system is a measuring instrument composed of two identical one-meter-long panels based on optical technology. Each panel contains 96 LEDs which are all interconnected by the impulses that they transmit. The described system is connected by a USB cable to a portable laptop and it is managed via the OptoJump Next application programme.

The device itself can primarily be used in diagnostics of various parameters in performing different jumps, such as reflection height, duration of contact with the surface, duration of the jump, etc. It can also be applied for determining specific kinematic parameters in walk analysis (OptoGait) and run analysis. The above mentioned ultimately enables objective diagnostics, as well as implementation of corrective kinesiological operators for the purpose of correcting certain established imbalances, which finally aims at enhancing the loco-motor system of children.

Considering that explosive leg strength has a significant impact in the specification equation of basketball from the aspect of motor abilities, this instrument can also be used for assessing all the parameters based on which the analysis of the desired results can be performed in assessing explosive leg strength.



Picture 3
OptoJump system
web source: www.optojump.com

Likewise, in certain basketball research, this device had been used for assessing certain parameters of performing a jump shot in different variable and situational conditions as a means of observing parameters such as duration of contact with the surface, reflection height, duration of the jump, etc. (Rupčić, Knjaz, Baković, Borović and Zekić, 2016; Svoboda, Knjaz, Baković, Matković and Prlenda, 2016; Borović, Rupčić, Antekolović, 2016).

The practical value of this instrument is in its mobility and applicability in realistic conditions, as well as in the fact that it can also measure parameters that are manifested during specific movements that players perform in basketball.

Moreover, the OptoJump is composed of two video cameras which record a player's motor motion during the performance of a specific test, enabling a standardized analysis of the results obtained from the video recording during subsequent processing.

In addition to the above mentioned, in combination with the Gyko device, it allows an assessment of the duration of the concentric and eccentric phase during a basic or specific motor movement.

Due to the short duration of the said movements, it is absolutely impossible to obtain the desired results in this sense via subjective assessment. By using video technology, it is also possible, in addition to the obtained data, to analyse the slow movement and detect certain errors, as well as potential improvements. The data can also be presented to the student/athlete in order for him/her to determine the accuracy of the analysis for himself/herself. Such an approach is very important because of trust and further motivation, as well as for the formation of the relationship between the teacher/coach and the student/player and vice-versa.

Picture 4
Gyko sensor
web source: http://gyko.microgate.it/en

Application options in the process of teaching physical education with special emphasis on basketball contents, or in the basketball training process:

- *walk analysis (OptoGait) and run analysis aiming at improving the mobility of movement,*
- *measuring certain parameters for assessing basic and specific explosive strength of the lower extremities,*
- *measuring the dynamic balance and rhythm using specific standardized protocols,*
- *measuring certain kinematic parameters during the performance of a jump shot in various conditions and situations.*

WITTY SEM SYSTEM

This measuring instrument also represents the Microgate technology and it is comprised of several (1-16) sensor indicators (size 7x5 cm). Each of the indicators is composed of a series of LEDs that have the possibility of forming specific marks in the shape of various direction indicators, numbers and letters which are then displayed in different colours. The device is managed by a programme console that, in addition to some pre-programmed tests, has the option of designing custom tests that are specific for each particular sport (e.g. basketball).

Based on the obtained results, it is possible to assess the examinee's score in basic and situational tests for assessing agility, reaction time or coordination, as well as in evaluation processes of acquiring certain motor skills in combination with the mentioned motor abilities (e.g. ball dribbling).

Application options in the process of teaching physical education with special emphasis on basketball contents, or in the basketball training process:

- *measuring and assessing basic and specific agility, reaction time, movement coordination, etc.,*
- *creating various exercises for developing basic and specific agility, reaction time and movement coordination,*
- *assessing the acquisition level of specific motor skills in basketball,*
- *creating various exercises for improving specific motor skills in basketball.*

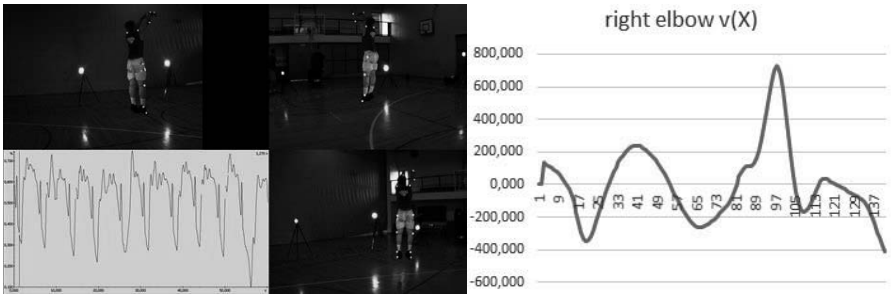
The practical value of the above mentioned technology manufactured by Microgate, IT in the field of basketball is manifested in the fact that it can be used both with the purpose of creating highly ranked scientific research, as well as during the implementation of the teaching and training process as part of the adoption and developing processes of certain motor skills and abilities.

VIDEO ANALYSIS

Nowadays it is practically unthinkable not to apply elements of video analysis as one part of sports diagnostics or during the process of adopting or developing a particular motor movement or technical and tactical knowledge.

There are numerous areas of application of video analysis and the specific choice depends on the final goal. For the purpose of scientific research of human motion, various systems for very precise measuring of certain kinematic parameters are applied, whereas in the field of top level basketball, when it comes to the segment of tactical preparation, various applications

are very often used which enable coaches to obtain extremely precise information on all the advantages or shortcomings of an individual player or the entire team in a very short period of time.



Picture 5
Kinematic analysis of the jump shot by using the Simi Motion Analysis system

Naturally, these technologies enable the implementation of various applicative researches or technical and tactical preparation at a very high level, however unfortunately, this type of equipment still demands extremely high financial cost, and for that reason it is less applied in widespread programmes and more often in professional sport.

Picture 6
„Synergy" application programme which enables detailed technical and tactical preparation for basketball teams
web source: www.synergysportstech.com

Numerous researches have demonstrated that using video analysis has an advantage during the process of adopting or improving a certain motor movement (of technical and tactical knowledge). This form of technology provides basketball players their own visualisation of the performance of a certain motor movement, and is thus most often used when coaches want to point out to their players, or teachers to their students, a specific mistake in their motor performance, after which it is very often that the specific segment of the incorrectly adopted motor movement is more easily corrected.

One of these, at the moment free of charge, application programmes is Kinovea®, version 0.8.15., which provides a very precise video analysis during or after the training process, i.e. learning process. One of the advantages of this application programme is that it enables the player to get visual feedback immediately after his/her motor performance of a certain technical

and tactical skill, in addition to an instantaneous oral or practical correction from the coach/ teacher if one is necessary. Moreover, this application provides a subsequent analysis of specific kinematic parameters in its programme display if certain required conditions are met, such as for example, the position from which the recording is taking place or the quality of the video footage. Besides the said application programme which is free of charge, it is necessary to provide a laptop and a web camera.

The possibilities of video analysis by applying the Kinovea®, version 0.8.15., application programme:

- *creating a visual conception of one's own performance of a specific motor movement during the process of adopting or improving technical or technical and tactical skills in the teaching or training process,*
- *enabling the making of one's own visual conception on the existence of certain motor mistakes during the process of adopting or improving specific motor skills in the teaching or training process,*
- *adopting or improving tactical skills in the teaching or training process,*
- *from a scientific aspect, analysing specific kinematic parameters in the performance of certain specific motor movements.*

94FIFTY SMART SENSOR BASKETBALL

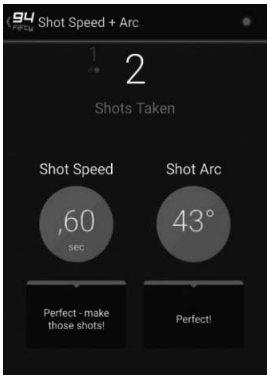
The 94Fifty Smart Sensor Basketball is a basketball which represents a measuring instrument manufactured by InfoMotion Sports® and that provides instantaneous diagnostics of extremely important kinematic parameters in two elements of basketball technique - shooting and dribbling.

This is a basketball of standard weight (567-650 g) and volume (749-780 mm) which is managed by using an application programme that is directly connected with the ball via a Bluetooth connection.

When it comes to shooting technique, this instrument enables the measuring of kinematic parameters on which a player's situational efficiency directly depends during a game, such as the speed of performing the shot, the angle at which the ball enters into the basket and the number, i.e. the speed of the ball's rotation around the horizontal axis. The speed of performing the shot represents an important parameter that sets the time interval between the moment of

receiving the ball and the moment in which the contact between the fingers of the shooting hand and the ball in the final phase of the jump shot ends. The angle at which the ball enters into the basket is defined by the decline line of the ball in relation to the horizontal level of the basket. It was precisely numerous scientific research that provided evidence that the angle at which the player releases the ball towards the basket directly influences the shooting success, and also, it is a well-known fact that there is a correlation between the angle of the throw-out of the ball and the angle of the ball's entry into the basket during a jump shot (Miller and Bartlett, 1996).

In addition to shooting, during dribbling it is possible to measure the number of iterations, i.e. the number of dribbles in a certain time interval during which the device has the additional option of assessing the percentages of ball control and the power of each dribble based on certain algorithms.



Picture 7
Digital interface representation of the 94Fifty Smart Sensor application programme (the speed of performing the shot and the angle at which the ball enters into the basket)

Former scientific research has determined a high level of reliability of the results obtained in the said kinematic parameters that are measured by this measuring instrument (Rupčić, Antekolović, Knjaz, Matković, Cigrovski, 2015). Therefore, this device has a high applicative value in the teaching or the training process, not only due to its reliability, but also as a result of the fact that during the process of adopting and improving the mentioned motor skills it provides the coach/teacher an objective confirmation of his/her often very subjective evaluation on the quality of performance of the mentioned elements of basketball technique.

Picture 8
94Fifty Smart Sensor Basketball
web source: www.94fifty.com

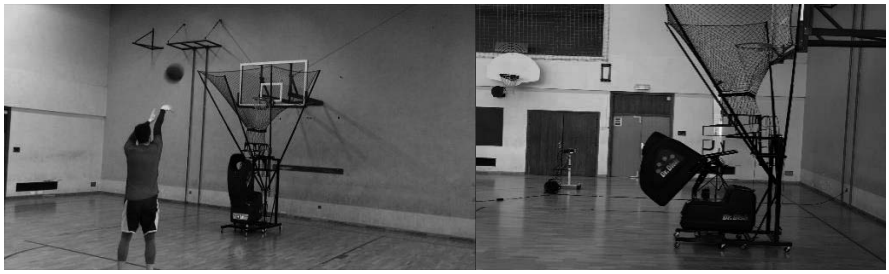
Application options in the process of teaching physical education with special emphasis on basketball contents, or in the basketball training process:

- during the process of adopting and improving specific motor skills, such as shooting with one hand from the chest without jumping, jump shooting or dribbling,
- during the performance of the said elements of basketball technique with special emphasis on situational efficiency in correlation with quality motor performance during the basketball training process.

SHOOTING MACHINE

The shooting machine represents a part of modern basketball technology which is primarily used in the process of enhancing the shooting technique in different situations and positions. It is primarily composed of a grid that has the function of collecting the balls and the instrument with its corresponding control console. The device provides the option of using pre-programmed shooting exercises, as well as creating custom exercises in which the coach/teacher can independently define certain parameters, such as the speed of the pass, the angle of the pass, the time span between each pass, the number of determined positions from which the player chooses to shoot, the number of passes to a certain position, etc.

The advantages of this type of technology are the standardization of each pass directed towards the player, creating a regular time-space relationship between passing and receiving the ball, as well as the mere position of the grid which in a certain way demands the player to perform the correct shooting technique that will in the end enable the ball to form the correct trajectory towards the basket.



Picture 9
A player shooting using the Dr Dish Shooting Machine

Application options in the process of teaching physical education with special emphasis on basketball contents, or in the basketball training process:

- *adopting and enhancing the shooting technique with emphasis on the biomechanical aspect during which the player/student performs a large number of repetitions in a low intensity - correction of motor performance,*
- *enhancing the shooting technique with emphasis on situational aspects (physiological and psychological load),*

- *adopting and enhancing the shooting technique with complying to basic organizational and methodological principles - a large number of repetitions of a certain motor movement with minimum passive time periods.*

CONCLUSION

This chapter contains an overview of selected equipment that is nowadays used with emphasis on basketball. Modern technology is an irreplaceable segment of the modern approach to physical activity, whether it applies to the field of health-related physical activity or to sport aiming at achieving competitive results. The application of technology in physical activity in a quality and effective way is possible only in a systematic programme that is organized and implemented by an educated and motivated person. The process of data analysis is particularly demanding, as based on that process the plan and programme are thus adapted, i.e. corrected, with the purpose of achieving work optimization. That is the only way to achieve maximum use of the potentials possessed by the participants in the programme. Technologies, i.e. technological aids, also have a significant impact on the level of quality and motivation in the implementation of the programme as they provide infinite application options. In this manner, the everyday and long-term training process can at the same time also be diverse and playful.

REFERENCES

1. Miller, S. and Bartlett, R.M. (1996). The relationship between basketball shooting kinematics, distance and playing position. J Sports Sci. 1996 Jun; 14(3):243-53.
2. Borović, I., Rupčić, T., Antekolović, Lj. (2016). Does an active position of the defensive player influence the changes in certain kinematic parameters of a jump shot? Summer School for Croatian Kinesiologists – accepted research paper.
3. Rupčić, T., Knjaz, D., Baković, M., Borović, I., Zekić, R. (2016). Differences in certain kinematic parameters between jump shots from different distances in basketball. Summer School for Croatian Kinesiologists – accepted research paper.
4. Svoboda, I., Knjaz, D., Baković, M., Matković, B., Prlenda, N. (2016). Differences in certain kinematic parameters between jump shots from the 6,25 m three-point line and the 6,75 m three-point line in U16 basketball players. Summer School for Croatian Kinesiologists – accepted research paper.
5. www.synergysportstech.com
6. www.94fifty.com
7. www.polar.com
8. www.optojump.com
9. http://gyko.microgate.it/en

SEAS OF SEPARATION: TRANSFORMING THE DIGITAL DIVIDE

ULANA LYSNIAK, ED.D.
Bronx Community College, City University of New York, New York, USA

EVE R. BERNSTEIN, ED.D
Queens College - C.U.N.Y, New York, USA

INTRODUCTION

The student population in the United States is becoming increasingly diverse. Often students experience a school culture that is very unlike from their family and community cultures (Stoicovy, 2002). It has been suggested that in order to create a productive learning environment that is culturally responsive (Flory & McCaughtry, 2011; Gay, 2010), instruction in the gymnasium should be used to link culture with activities. While this might be the case, teachers often feel unprepared to link activity based curriculum with students' diverse cultural backgrounds (Bernstein & Lysniak, 2015; Ferry & McCaughtry, 2013). Teachers do not come from the same cultural background as all of their students. This can cause teachers to not fully understand their students' experiences or backgrounds and the impact of these differences on the learning process (Santoro & Forghani-Arani, 2015; Stoicovy, 2002). Thus, students might feel disengaged from the activities (Cothran & Ennis, 2010).

Culturally relevant teaching is tied to multicultural education, and this gives each student the opportunity for the best possible educational experience (Banks, 2008). Students' backgrounds and experiences are at the core of their learning and focus their multiple ways of thinking and of experiencing physical education class (Azzarito & Solomon, 2005). Teachers need to be culturally responsive to the educational needs of learners from diverse cultural backgrounds (Gay, 2010). To ensure that there are no gaps in the academic achievement of all students, some researchers and teachers believe that education should be adapted to match the students' cultural interests (Castagno & Brayboy, 2008). Activities that create a sense of belonging and relevance to students' lives tend to be of more interest, and students then might increase participation in these activities (Subramaniam & Silverman, 2002).

Diverse populations and instruction in physical education is increasing (Azzarito, Solmon, & Harrison, 2006; Durden, Escalante, & Blitch, 2015; Williams & Bedward, 2001). Instructional strategies have been developed to transform and prepare for today's diverse students (Brown, 2007). In some cases, culturally relevant pedagogy is now planned for and implemented into the physical education classes for the students' learning and growth (Peralta, O'Connor, Cotton, & Bennie, 2015). Teachers are more aware of this ethnic diversity in society (Castro, 2010) and in the gymnasium.

Physical education curriculums that support inclusion should attend to the diversity within cultural groups, which can be overlooked (Williams & Bedward, 2001). Activities, the majority of them competitive, have been predominantly hegemonic (Fernández-Balboa & Muros, 2006). This historical foundation has now been challenged, as physical education has

started to reexamine activities for underserved populations, such as minorities and girls. This population is especially important as physical activity tends to decline, especially after middle school (Johnson, Hayes, Brown, Hoo, & Ethier, 2014). Reflecting this trend, physical activity and physical education opportunities have been declining worldwide (Hardman, & Marshall, 2000). Also, girls, have felt limited in their physical education choices as compared to male students (Azzarito et al., 2006). Therefore, increasing the inclusion of these students, with the intention of improving the class environment by increasing the perception of enjoyment, has been discussed (Ennis, 1999).

The importance of culturally relevant pedagogy is a practice that unites students of different races and backgrounds and works on breaking stereotypes (Flory & McCaughtry, 2011). Exposing students to diversity and introducing culture has enhanced cultural awareness. Culturally relevant pedagogy was conceptualized and implemented with multicultural students, and it further advanced their sociocultural development and awareness (Banks, 1993; Durden et al., 2015). New curricular models, Curriculum of Possibilities and the Body as Curriculum, are now being developed to include voices and cultural perspectives that have at times been excluded or felt unheard during physical education class (Oliver & Hamzeh, 2010; Oliver & Lalik, 2001; Oliver, Hamzeh, & McCaughtry, 2009).

Incorporating technology can influence the way teachers plan and design instruction. By understanding the use of technology, teachers can connect culture to content. Although classroom teachers have been using technology for a number of years (Wozney, Venkatesh, & Abrami, 2006), physical education teachers have now also integrated the use of various electronic platforms into their instruction (Gibbone, Rukavina, & Silverman, 2010; Riley, Slater, & Stern, 2004). Technology enables teachers to have a far broader range and reach of communication (Hastie, Farias, & Gutiérrez, 2013; Stephenson, 2009). It can play a central role in supporting learning, particularly in physical education (Fiorentino & Castelli, 2005). The experiences with technology that students undergo may augment their understanding and enjoyment in physical activities (Kooiman, & Sheehan, 2014).

FRAMEWORKS

To this end, there have been several theoretical frameworks used to guide the study of technology and student interest. As an outcropping of the Theory of Reasoned Action (TRA) model (Ajzen & Fishbein, 1980), the Technology Acceptance Model (TAM) (Davis, 1986) focuses on technology. The individual can perceive the technology by its relevance and usefulness. TRA and TAM are used to examine both behavioral intentions and attitude. These frameworks can be utilized to measure the effectiveness of exchanging ideas internationally by using electronic based platforms (Galy, Downey, & Johnson, 2011). In recent reviews, it was found that in over 25 studies of exergaming situations, both TRA and TAM frameworks were used. These studies found that enjoyment and flow (learning in the moment) were reported in over 15of the studies, with perceived usefulness closely following (Hamari, Keronen, & Alha, 2015; Wittland, Brauner, & Ziefle, 2015).

Another framework has also been used to understand electronic platforms. This framework is situational interest (Hidi, 1990; Hidi & Renninger, 2006). It suggests that interest

changes according to the environmental and contextual factors that are presented to the student (Schraw & Lehman, 2001). The framework of situational interest has been linked with physical education and exergaming platforms, and several recent papers have been published on this topic (Roure, Pasco, Kermarrec, & Gao, 2015; Sun, 2015; Sun & Gao, 2015).

Finally, the ecological paradigm was extended by McCaughtry, Tischler, and Flory (2008) and had been used to examine a negotiated plan of action between teachers, students, and the task. This negotiated plan of action was used to examine competitive exergaming situations and skill level (Bernstein, Gibbone, & Rukavina, 2015). It was found that the integration of the three elements of instruction: social environment, students participating in the task, and management of tasks, as teachers shaped competitive and non-competitive task structures, played an important role the in the enjoyment of this modality.

One framework used to guide cultural competence is a conceptual framework developed by the National Centre for Cultural Competence (NCCC). This framework has identified five key components that may be used to understand cultural relevance. This includes valuing cultural diversity, conducting cultural self-assessments, managing the dynamics of difference, acquiring and institutionalizing cultural knowledge, and adapting to diversity and cultural contexts (NCCC, 2006). It will guide teachers to be responsive to students from diverse cultural backgrounds.

IMPORTANCE OF ELECTRONIC CONNECTIONS

Education is moving toward a more technology based forum of instruction and learning. Technology brings with it new ways that teachers and students can communicate with each other, and over great distances within the United States, and abroad with other countries and cultures. The methods of teaching and learning can be transformed with technology. Using technology efficiently for the planning of instruction (Riley & Stern, 2004), implementation of instruction, and collaboration with teachers in different geographical locations can enable culturally relevant teaching. Teachers would be able to relate course content to the students' interests and cultures.

The technology used does depend on the teachers' intent and the available equipment (Drucker, 2006). Teachers can then use the current technology to create curriculum that can utilize it (Summers, Waigandt, & Whittaker, 2005). The sparsity of extensive research in the effectiveness of technology is due to the ever changing and rapid evolution of electronic platforms. Technology has, however, provided various learning outcomes in motor skills (Fery & Pontserre, 2001) and curricula (Goodard, 2002).

ELECTRONIC PLATFORMS

The variety of electronic platforms that are available for physical education teachers are constantly growing and changing (Williamson, 2015). New and emerging technologies promise efficiency and different teaching and learning modes (Palao, Hastie, Cruz, & Ortega, 2015). By infusing technology throughout the physical education curriculum, the attainment of cultural relevance can be heightened. Increasing the ability of teachers to retrieve and disseminate information about instructional methods and content used all over the world can also make lessons more connected to the diverse classroom. Implementing culturally relevant

instructional lessons amplifies the teachers' abilities to show respect, exhibit care, communicate curricular content, and eliminate language barriers (Flory & McCaughtry, 2011).

Platforms such as exergaming are currently very popular and being used by teachers as a relevant activity for students in the gymnasium. Dance, Dance Revolution, a type of exergaming, was used by physical education students in competitive and non-competitive situations. The students reported success and liking the task elements (Bernsteinet al., 2015; Gibbone, Bernstein, Rukavina, 2013). As exergaming has a global reach (Lin, 2015) and dance has many cultural elements, this type of task can be utilized in future physical education classes and extended to supply platforms that allow opportunities for instruction of cultural dances from various countries. These exergaming activities could be a shared, culturally relevant experience, where students could log performance and use an electronic platform to compare their results with students from around the world.

To add to the cultural dimensions and to enrich the instructional experience, physical education teachers could link instruction by using the following electronic platforms: Skype, Google Translate, Moodle, Weblogs, Podcasts, Webinars, or Blackboard. These platforms could be used in conjunction with physical education classes globally to share the various physical activities taught. Google Classroom could be used to link academic classrooms worldwide; this could be transformed, as proposed by the authors, into the "Google Gymnasium".

ASSESSMENT POSSIBILITIES

Developing digital assessments can prove beneficial not only for student learning but also to enhance authentic experiences (Penney, Jones, Newhouse, & Cambell, 2012). Students and teachers could brainstorm and share culturally relevant activities that could include the interests of all the students involved. Blackboard Discussion Boards could be used by the students to share their experiences and thoughts about the activities that were performed along with students from other nations. Physical education teachers could share assessments, and these assessments could be translated on Google. Technology could also be useful for student performative assessment throughout the unit. Blogs and Wikis could be used as a type of summative assessment as well.

CAUTIONS

As with any electronic based communication, one important consideration would be working out the glitches in electronic transmissions. In addition, as the instruction would be shared with various countries, language translation would be a major obstacle that would have to be overcome. Google Translate would then have to be used. It should be mentioned that Google Translate also has limitations. Google Translate can support 51 languages, English being for the most part most reliable; however, accuracies can vary (Patil & Davies, 2014). For multilingual meetings Google Translate may be useful if inaccuracies are limited (Aiken, Balan, Vanjani, & Garner, 2010). If there was a live transmission, subtitles would have to be supplied, or a live translator, if subtitles were not available. Teachers' resistance to technology and training might hinder the use of electronic platforms in the gymnasium (Gibbone et al., 2010; Silverman, 1997). Physical educators would also need to be willing to allow the technology to be used in their classes.

CONCLUSION

In any new modality, future research needs to be conducted to ensure that learning outcomes are met. Technologies are developing at a rapid rate, so obstacles would need to be considered. It will become necessary to explore both teachers' and students' experiences during the activities and further the knowledge base on how to create a connection between culturally relevant and technologically based practices in the gymnasium. Physical education teachers need to embrace the challenges of both diversity and technology in order to advance the field forward and bridge the digital divide.

REFERENCES

1. Aiken, M., Balan, S., Vanjani, M., & Garner, B. (2010). The effect of comment errors in multilingual electronic meetings. *Communications of the IIMA*, *10*(4).
2. Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
3. Azzarito, L., & Solomon, M. A. (2005). A reconceptualization of physical education: The intersection of gender/race/social class. *Sport, Education and Society*, *10*(1), 25-47.
4. Azzarito, L., Solmon, M. A., & Harrison, Jr, L. (2006). "... If I Had a Choice, I Would...." A feminist poststructuralist perspective on girls in physical education. *Research Quarterly for Exercise and Sport*, *77*(2), 222-239.
5. Banks, J. A. (1993). Multicultural education: Historical development, dimensions, and practice. *Review of Research in Education, 19*, 3–49.
6. Banks, J. A. (2008). Diversity, group identity, and citizenship education in a global age. *Educational Researcher*, *37*(3), 129-139.
7. Bernstein, E., & Lysniak, U. (2015). Teachers' beliefs and implementation of competitive activities for multiculturalstudents. *Urban Education. doi:10.1177/0042085915602538.*
8. Bernstein, E., Gibbone, A., & Rukavina, P. (2015). Task design and skill level perceptions of middle school students toward competition in dance-related active gaming. *Physical Educator, 72,* 123-141.
9. Brown, M. R. (2007). Educating all students: Creating culturally responsive teachers, classrooms, and schools. *Intervention in School and Clinic*, *43*(1), 57.
10. Castagno, A. E., & Brayboy, B. M. J. (2008). Culturally responsive schooling for indigenous youth: A review of the literature. *Review of Educational Research*, *78*(4), 941-993.
11. Castro, A. J. (2010). Themes in research on preservice teacher's views of cultural diversity: Implications for researching millennial preservice teachers. *Educational Researcher, 39*(3), 198–210.
12. Cothran, D.J., & Ennis, C.D. (2010). Alone in a crowd: Meeting students' needs for relevance and connection in urban high school physical education. Journal of Teaching in Physical Education, *18*, 234-247
13. Davis, F. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology.
14. Durden, T. R., Escalante, E., & Blitch, K. (2015). Start with us! Culturally relevant pedagogy in the preschool classroom. *Early Childhood Education Journal*, *43*(3), 223-232.
15. Drucker, M. J. (2006). Commentary: Crossing the digital divide: How race, class, and culture matter. *Contemporary Issues in Technology and Teacher Education, 6*(1), 43-45.
16. Ennis, C. D. (1999). Creating a culturally relevant curriculum for disengaged girls. *Sport, Education and Society*, *4*(1), 31-49.

17. Fernández-Balboa, J. M., & Muros, B. (2006). The hegemonic triumvirate—ideologies, discourses, and habitus in sport and physical education: implications and suggestions. *Quest*, *58*(2), 197-221.
18. Fery, Y. A., & Pontserre, S. (2001). Enhancing the control of force in putting by video game training. *Ergonomics, 44*, 1025-1037.
19. Ferry, M. D., & McCaughtry, N. (2013). Factors contributing to sport prominence in physical education teacher content selection. *Research Quarterly for Exercise and Sport*, *84*, A40-A41.
20. Fiorentino, L. H., & Castelli, D. (2005). Creating a virtual gymnasium. *Journal of Physical Education, Recreation & Dance, 76*(4), 16-18.
21. Flory, S. B., & McCaughtry, N. (2011). Culturally relevant physical education in urban schools: Reflecting cultural knowledge. *Research Quarterly for Exercise and Sport*, *82*(1), 49-60.
22. Galy, E., Downey, C., & Johnson, J. (2011). The effect of using e-learning tools in online and campus-based classrooms on student performance. *Journal of Information Technology Education*, *10*(1), 210-230.
23. Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.
24. Gibbone, A., Bernstein, E., & Rukavina, P. (2013). Gender and grade level analysis of student perceptions regarding competition during dance-related active gaming. *Global Journal of Health and Physical Education, 2*(2), 128-149.
25. Gibbone, A., Rukavina, P., & Silverman, S. (2010). Technology integration in secondary physical education: Teachers' attitudes and practice. *Journal of Educational Technology Development and Exchange, 3*(1), 27- 42.
26. Goddard, M. (2002). What do we do with these computers? Reflections on technology in the classroom. *Journal of Research on Technology in Education, 35,* 19-26.
27. Hamari, J., Keronen, L., & Alha, K. (2015, January). Why Do People Play Games? A Review of Studies on Adoption and Use. In *2015 48th Hawaii International Conference on System Sciences (HICSS)* (pp. 3559-3568). IEEE.
28. Hastie, P. A., Farias, C., & Gutiérrez, D. (2013). Students' and teachers' responses to a transatlantic sport education league. *Journal of the International Society for Comparative Physical Education and Sport, 35*(2), 22-33.
29. Hidi, S. (1990). Interest and its contribution as a mental resource for learning. *Review of Educational Research, 60*, 549-571.
30. Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41,* 111-127.
31. Johnson, N. B., Hayes, L. D., Brown, K., Hoo, E. C., & Ethier, K. A. (2014). CDC national health report: Leading causes of morbidity and mortality and associated behavioral risk and protective factors—United States, 2005–2013. *MMWR Surveillance Summaries*, *63*(Supplement 4), 3-27.
32. Kooiman, B. J., & Sheehan, D. P. (2014). The efficacy of exergames played proximally and over the internet on cognitive functioning for online physical education. *American Journal of Distance Education*, *28*, 280-291.
33. Lin, J. H. (2015). "Just Dance": The effects of exergame feedback and controller use on physical activity and psychological outcomes. *Games for Health Journal*, *4*(3), 183-189.
34. National Centre for Cultural Competence. (2008). *Conceptual frameworks/models guiding values and principles.*Washington, DC: Georgetown University.
35. Marshall, J., & Hardman, K. (2000). The state and status of physical education in schools in international context. *European Physical Education Review*, *6*(3), 203-229.
36. McCaughtry, N., Tischler, A., & Flory, S. B. (2008). The ecology of the gym: Reconceptualized and extended. *Quest*, *60*(2), 268-289.
37. Oliver, K. L., & Lalik, R. (2001). The Body as Curriculum: Learning with adolescent girls. *Journal of Curriculum Studies*, *33*(3), 303-333.
38. Oliver, K. L., & Hamzeh, M. (2010). "The Boys Won't Let Us Play" Fifth-grade Mestizas challenge physical activity discourse at school. *Research Quarterly for Exercise and Sport*, *81*(1), 38-51.

39. Oliver, K. L., Hamzeh, M., & McCaughtry, N. (2009). Girly girls can play games/las niñas pueden jugar tambien: Co-creating a curriculum of possibilities with fifth-grade girls. *Journal of teaching in physical education*, *28*(1), 90-110.
40. Palao, J. M., Hastie, P. A., Cruz, P. G., & Ortega, E. (2015). The impact of video technology on student performancein physical education. *Technology, Pedagogy and Education*, *24*(1), 51-63.
41. Patil, S., & Davies, P. (2014). Use of Google Translate in medical communication: Evaluation of accuracy. *BMJ*, *349*, g7392.
42. Penney, D., Jones, A., Newhouse, P., & Cambell, A. (2012). Developing a digital assessment in senior secondary physical education. *Physical Education and Sport Pedagogy*, *17*(4), 383-410.
43. Peralta, L. R., O'Connor, D., Cotton, W. G., & Bennie, A. (2015). Pre-service physical education teachers' indigenous knowledge, cultural competency and pedagogy: A service learning intervention. *Teaching Education*, 1-19.
44. Riley, K. L., & Stern, B. S. (2004). Problems and possibilities of web-based instruction: Transforming social studies methods and practice. *Journal of Computing in Teacher Education*, *21*(2), 65-71.
45. Roure, C., Pasco, D., Kermarrec, G., & Gao, Z. (2015). High school students' situational interest predicting physical activity levels in exergaming. *Health & Medicine*, *18*(2), 233-241.
46. Santoro, N., & Forghani-Arani, N. (2015). Interrogating practice in culturally diverse classrooms: What can an analysis of student resistance and teacher response reveal? *European Journal of Teacher Education*, *38*(1), 58-70.
47. Schraw, G., & Lehman, S. (2001). Situational interest: A review of the literature and directions for future research. *Educational Psychology Review, 13*, 23-52.
48. Silverman, S. (1997). Technology and physical education: present, possibilities, and potential problems. *Quest*, *49*(3), 306-314.
49. Stephenson, N. (2009). *The many roles of Skype in the classroom.* http://www.isteconnects.org/2009/02.15/the-many-roles-of-skype-in-the-classroom/
50. Stoicovy, C. (2002). A case for culturally responsive pedagogy. *International Research in Geographical and Environmental Education*, *11*(1), 80-84.
51. Subramaniam, P. R., & Silverman, S. (2002). Using complimentary data: An investigation of student attitudes in physical education. *Journal of Sport Pedagogy*, *8*, 74-91.
52. Summers, J. J., Waigandt, A., & Whittaker, T. A. (2005). A comparison of student achievement and satisfaction in an online versus a traditional face-to-face statistics class. *Innovative Higher Education, 29* (3), 233-246.
53. Sun, H. (2015). Operationalizing physical literacy: The potential of active video games. *Journal of Sport and Health Science*, *4*,145-149.
54. Sun, H., & Gao, Y. (2015). Impact of an active educational video game on children's motivation, science knowledge, and physical activity. *Journal of Sport and Health Science*. doi:10.1016/j.jshs.2014.12.004
55. Williams, A., & Bedward, J. (2001). Gender, culture and the generation gap: Student and teacher perceptions of aspects of national curriculum physical education. *Sport, Education and Society*, *6*(1), 53-66.
56. Williamson, B. (2015). Algorithmic skin: Health-tracking technologies, personal analytics and the biopedagogies of digitized health and physical education. *Sport, Education and Society*, *20*(1), 133-151.
57. Wittland, J., Brauner, P., & Ziefle, M. (2015). Serious games for cognitive training in ambient assisted living environments–A technology acceptance perspective**.** In J. **Abascal,** S. **Barbosa**, M. **Fetter**, T. **Gross, P. Palanque**, & M. **Winckler** (Eds.), *Human-Computer Interaction–INTERACT 2015* (pp. 453-471). New York: Springer International Publishing.
58. Wozney, L., Venkatesh, V., & Abrami, P. C. (2006). Implementing computer technologies: Teachers' perceptions and practices. J*ournal of Technology and Teacher Education, 14*, 173-207.

START WITH ONE MODULE, ONE GROUP, ONE IPAD AND ONE APP

SUSAN MARRON, MAURA COULTER
St. Patrick's College, College of Dublin City University, Dublin, Ireland

INTRODUCTION

This article outlines the authors' journey of how initial teacher educators could be role models (Semiz and Ince, 2012), integrating digital technology into their taught modules. It describes new developments in an initial teacher education programme which encouraged the integration of digital technology through the following pathways: (i) the effective preparation of teachers; (ii) the challenges to teach technology-infused lessons and (iii) the technological pedagogical content knowledge model. This article describes the participants on the journey, the module within which the study took place and what we did to integrate digital technology. The opportunities and challenges of our journey are signalled. We conclude with recommendations based on our professional learning journey.

INITIAL TEACHER EDUCATION PROGRAMMES

Initial Teacher Education (ITE) programmes in Ireland have gone through recent change due to the outcomes of the European Convergence in Higher Education. In 1999 forty six countries signed the Bologna Declaration (Confederation of European University Rectors' Conferences, & the Association of European Universities, 1999). The purpose of the Bologna Accords was to create the European Higher Education Area (EHEA) by 2010-11 through making academic degree standards and quality assurance standards more comparable and compatible throughout Europe. As a consequence of this process our College re-imagined its Bachelor of Education Programme and Post Graduate Programme in line with the criteria and guidelines for providers of programmes of ITE in Ireland (Teaching Council, 2011) while acknowledging the increasingly complex and diverse role of teachers (p.6). The three year Bachelor of Education programme has increased to a four year programme and the 18- month Post Graduate Diploma programme is now a two year Post Graduate Masters in Education. Alongside Numeracy and Literacy, Information Communication Technology (ICT) has been identified as a key national priority area. The re-imagining of our programmes (Waldron, Smith, Fitzgerald and Dooley, 2012, p.1) and its increase in duration allowed for many innovations in modules. Taking a living theory perspective which placed us at the heart of our own education enquiry we undertook to improve our practice by integrating digital technology into physical education. This approach enabled us to focus on improving our practice and generating knowledge on 'How can we integrate digital technology with physical education?'

(i) The effective preparation of teachers

The effective preparation of teachers in the use of educational digital technology has been extensively discussed by researchers in the past few years (Butler, Marshall & Leany,

2015; Casey & Jones, 2011; Koehler & Mishra, 2008; Liang, Walls, Hicks, Clayton & Yang, 2006; Settlage, Odom & Pedersen, 2004; Smerdon, Cronen, Lanahan, Anderson & Innottie, 2000). Innovative computing paradigms have emerged that make it possible to design novel environments for engagement and learning (Hall, 2012). Plowman and Stephen describe the educational potential which "may lead to technologies that can encompass participation by practitioners, parents, and children in different learning spaces and promote discovery, delight, curiosity, creativity, self-expression, and pleasure in learning" (2005, p. 160). The availability of a range of digital tools such as social media, digital games, ultra-mobile, and portable devices can potentially facilitate digital literacy across the curriculum, including in physical education (Hague & Payton, 2010).

(ii) The challenges in teaching technology-infused seminars

Questions such as how to teach a subject with technology in a pedagogically appropriate way and how to develop the knowledge base to design and implement technology-infused seminars in physical education are often addressed in pre-service teacher education programmes (Kirschner & Sellinger, 2003). Physical education is usually taught in a gymnasium or outdoors, therefore it is important for teacher education programmes to prepare teachers to infuse technology in a way that will support the pedagogical strategies used in those settings. While the acceptance and use of digital technologies has been slow to evolve, in some regions of the world technology is seen as more than an add on (Jones, 1980). In their investigations Banville and Polifko (2009) stated that both the rapid increase in technological capabilities and falling costs have made the use of technology in physical education increasingly important. Mobile devices, such as iPads, provide an excellent vehicle with which to implement technology in physical education. The application of these devices can deliver content and assist with teaching. Teachers can video student performances and then replay the video to show students the skills elements they are performing correctly and those elements that require improvement. Highlighting students, who are successful at a particular task, can positively reinforce student behaviour (Eberline & Richards, 2013).

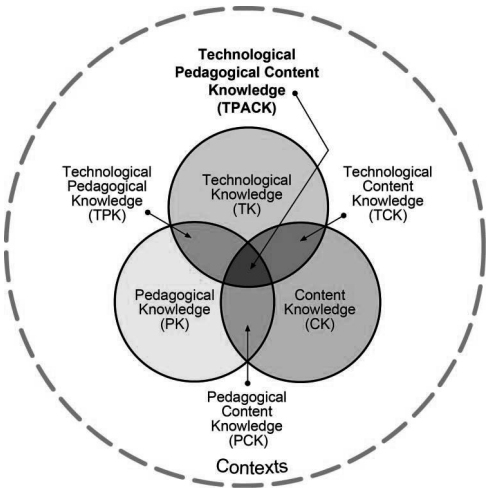
Macdonald and Hay (2010) identified the use of the above-mentioned technologies in physical education in the context of four main purposes: (1) to facilitate the integration of movement principles with movement performances; (2) to generate information for the application and evaluation of movement principles; (3) to develop formative assessment processes and (4) to acquire summative assessment evidence for movement performances. In the teaching process, it is important not only how you teach (pedagogy) and what you teach (content) but also which materials (technology) you use while teaching (Jones & Moreland, 2004).

(iii) Technological pedagogical content knowledge model

The literature suggests that effective technology integration with specific subject matter requires teachers to apply their knowledge of curriculum content, general pedagogies, and technologies. This approach, known as the "technological pedagogical content knowledge" TPCK model (Koehler & Mishra 2008), is grounded on Shulman's (1987) idea that teachers should be

able to apply their content knowledge in a pedagogically sound way that is adaptable to the characteristics of children and of the educational context (e.g., the gymnasium). Consequently, the relationship between technological knowledge and pedagogical content knowledge forms the basis of Technological Pedagogical Content Knowledge (TPCK) See Figure 1.

Figure 1: TPCK Mishra & Koehler (2009, p.63)



Technological knowledge (TK) is knowledge about analogue technologies, such as books, pens, blackboards, etc., and digital technologies, such as computers, the Internet and digital video. This includes the skills that require the use of particular technologies in teaching activities (Mishra & Koehler, 2006). In the field of physical education, for example, computer-based teacher observation systems can be used to assess fundamental movement skills (FMS), or provide video analysis, while giving immediate visual feedback to children in lessons.

Content knowledge (CK) refers to the mastering of major facts, concepts and relationships within a particular field. Importantly, this knowledge is independent of any pedagogical activities or how one might use methods or strategies to teach (Cox, 2008). For example, a physical education teacher should possess a basic understanding of motor learning in all physical activities. In relation to this study, specific outcomes related to content had to be achieved by the pre-service teachers (PSTs) in their module.

Pedagogical knowledge (PK) refers to techniques or methods of teaching and strategies for evaluating student understanding (Mishra & Koehler, 2006). For example, when teaching a skill or a movement in physical education, a teacher should consider child development and their needs as well as behaviours and motivation. All of these aspects require a sufficient PK. Pedagogical content knowledge (PCK), proposed by Shulman (1987) is the combination of the knowledge of teaching strategies and concepts to be taught. It then follows that technological pedagogical knowledge (TPK) refers to one's knowledge of the various technologies, which can be integrated and used in educational settings. This can be seen when a physical education teacher, who has high TPK, can easily select the appropriate tool or device to use in

teaching by taking into consideration a child's age or readiness level. Technological content knowledge (TCK) refers to one's awareness of the available technology, knowing how to use it, and understanding its purpose within the content of the specific subject matter. In physical education, choosing and using a suitable technology for teaching a specific skill can be crucial. Using pedometers to measure children's step count as a quick in-class indicator of physical activity measurement, or using the Video Delay app as a speedy and easy to manage system for visual, peer and teacher feedback where video clips vanish after a pre-set number of seconds are examples of TCK.

Teachers' confidence (self-efficacy) and motivation (outcome expectations) with regards to integrating technology in education are considered important variables in teaching effectiveness (Niederhauser & Perkmen, 2010). Graham et al., (2004) believes that like students, faculty members also have a diverse range of technology skills and many do not feel comfortable teaching technology applications to students.

PARTICIPANTS ON THE JOURNEY

While we, the authors, the principal participants in this journey had pedagogical content knowledge (PCK) of fundamental movement skills our own technological content knowledge (TCK) and technological pedagogical knowledge (TPK) required development. Our backgrounds in the use of technology included PowerPoint, Photo Story, Online Adobe classroom and Loop, our College's online teaching environment which provides staff and PSTs with access to electronic teaching and learning materials and activities (such as lecture notes and links to useful websites) and activities (such as discussion forums, reflective journals). We both own iPads and smartphones for our personal use. Our interest in integrating digital technologies into our seminars emerged from our personal use of these technologies and our personal and professional belief that to observe movement, simpler observation tools such as a video and applications like Video Delay were more accessible and easy to use for school purposes than complicated and expensive movement analysis software. Setting out on our journey we engaged in conversations with our colleagues in the Digital Learning department. We understood that our PSTs had completed one module in first year in the use of digital technologies in the use of cameras, video and Photo Story. The PSTs personal use of digital technologies included computers, social media and smartphones.

Our journey was underpinned by an ethos of collegial collaboration and cooperation between Marron and Coulter. The spotlight was not on our individual competence and performance. We were aware of our strengths and limitations but felt there was only one way to build our confidence. This was to begin to initiate the integration of technology into a module, which would focus on the PSTs' experiences and how they make sense of the physical education concepts being taught with the help of digital technology. The gymnasium and lecture classroom became the context for us to study our own subject area and associated pedagogy, while simultaneously understanding our PSTs and their engagement with the module. Fielding and colleagues (2005) contend that teachers need to be able to maintain an open mind when it comes to reflecting on their practice, to show a willingness to experiment and take risks in one's teaching in order for professional learning to occur.

THE JOURNEY

Marron was responsible for the design and the facilitation of the FMS module and Coulter acted as a critical friend. Over three years, we collected research data including personal written notes, video/audiotapes of classroom discussion, planning and lesson debriefing session notes to allow reflection and evaluation of our study and work with reference to the module outcomes.

Rather than infusing digital technologies throughout the physical education modules we chose to begin our journey by focusing our learning in one module. We engaged with a new second year undergraduate Physical Education Major Specialism PSTs cohort each year during the three year journey. Each cohort of twenty five PSTs was developing pedagogical content knowledge (PCK) in physical education as part of their undergraduate studies. The aim was to develop our confidence and competence in TPCK with the view that over time digital technologies would be integrated into other modules.

THE MODULE

'Children's Fundamental Movement Skills' was the module we chose to initiate our learning. It was chosen for the following reasons:

a. 25 PSTs was a manageable group;

b. It was the first module on a new Physical Education Major Specialism course;

c. The focus was on FMS which lends itself more easily to the integration of digital technologies;

d. Our lecturing timetables enabled us to collaborate and support each other through this learning.

The module consisted of 16 contact hours, four two-hour seminars and two four-hour seminars. One four-hour seminar was for the video assessment however after Year 2 of the study this was reduced to three hours.

For the purpose of our story it is important to define what a fundamental movement skill is

> 'A fundamental movement skill is an organised series of basic movements that involve the combination of movement patterns of two or more body segments. Fundamental movement skills (FMS) may be categorised as stability, locomotor or manipulative movements. Twisting and turning, running and jumping and striking and throwing are examples from each of the categories' (Gallahue & Donnelly, 2003, p. 52).

Children should learn FMS at a young age (Murphy & Ní Chróinín, 2011) recognising the positive impact that proficiency in a wide range of skills can have on the lifelong participation of the child in physical activity and sport (Gallahue & Donnelly, 2003). According to Graham, Holt/Hale & Parker, (2010) "children and adolescents who possess inadequate motor skills are often relegated to a life of exclusion from the organised and free play experiences of their peers, and subsequently, to a lifetime of inactivity because of their frustrations in early movement behaviour". Evidence-based research into children's understanding and learning (Jess, Dewar & Fraser, 2004; Graham et al., 2010) informed the teaching of FMS in the module. The purpose of the module was to

(1) describe how movement competencies are developed and learned;
(2) know the cognitive and emotional implications of movement competences;
(3) explore and develop formative assessment processes to enhance the performance of FMS and
(4) acquire summative assessment and formative evidence for movement performances using digital technologies.

Pre-service teachers, in pairs, were required to observe and analyse their performance of a fundamental movement skill using an iPad. They had to represent the teaching of this fundamental movement skill in a two minute video clip.

THE IPADS AND THE TROLLEY

We had the opportunity within our Physical Education Unit in the College, to purchase 25 iPads, protective covers and a trolley in which to store and charge the iPads to use in our teaching. A mac-mini, keyboard and monitor were also purchased which when plugged into the trolley acted as a management tool for the iPads. An iPad is an iOS-based tablet computer designed and marketed by Apple Inc. The user interface is built around the device's multi-touch screen, including a virtual keyboard. An iPad includes built-in Wi-Fi and it can capture video, take photos, play music, and perform internet functions such as web-browsing and emailing. Other functions such as games, GPS navigation and social networking can be enabled by downloading and installing apps. The iPad trolley (See Figure 2 and 3) has a password protected lock for security and swivel wheels for easy manoeuvring.

Figure 2. The iPad Trolley (a)

Figure 3. The iPad Trolley (b)

THE OPPORTUNITIES AND CHALLENGES ON THE JOURNEY

Key opportunities and challenges during our three year journey are summarised under the following headings: (1) Technological Content Knowledge (2) Technology Knowledge (3) Technological Pedagogical Knowledge.

Technological content knowledge

During the teaching of the FMS module in the first year of the study, the iPads were only made available to the PSTs in one 2-hour seminar and in the 4-hour final assessment seminar. The isolated seminars focussed mainly on the workings of the iPad to take video, images and apply a voice over. The Year 1 seminars were disjointed in relation to TK, CK, and PK. However, in Year 2 the iPads were integrated into 4 seminars, each of 2 hours duration and the final 3-hour assessment seminar. In Year 2 Coulter integrated the iPads into orienteering seminars with the same group of PSTs in her module 'Teaching Personal and Social Responsibility through Outdoor and Adventure Activities'. She also used additional applications related to fitness and exercise in her module 'Physical Education, Physical Activity and Sport for Young Children'. Marron presented a workshop to primary school generalist physical education teachers at the Irish Primary Physical Education Teachers annual conference where the focus of the workshop was on the use of the Video Delay app to analysis FMS. By Year 3 we had integrated the iPads in almost all the 'Children's FMS' module seminars and in other modules with other PSTs. We began to grow in confidence and competence in using and integrating digital technologies. We relied less on each other for support, however we were delighted to continue on our professional learning journey together, chatting about and sharing how we were using the iPads within our own modules and coming up with innovative ways to integrate the iPads.

Technology knowledge

Becoming familiar with the technology, the iPads and their capabilities was a steep learning curve in Year 1. We needed to work together to find answers to our questions in order to find our way (Lave & Wenger 1991). We required the services of the company who supplied the iPads to provide a training workshop and to be available for technical enquiries and visits. We kept a folder with our personal 'how to' technology notes and the operating manual close at hand, as we navigated our way, blindfolded at times!

The PSTs had opportunities to take images and video clips of their peers performing FMS with the inbuilt video. We all received practice at importing images and video clips to the iMovie application; edit the clips and recording audio sound. In Year 1 this practice happened in isolated seminars however as the years of the study progressed we had further opportunities to practice these skills in a number of seminars. All PSTs included text on their video clips indicating the teaching points for the FMS. Some PSTs imported music for background effect.

In Year 1 we discovered during videoing that there is no zoom available on the iPads which was a disadvantage in terms of focusing in on aspects of the FMS performances e.g. bending the knees in preparation for a jump. One organisational challenge, which arose in the gymnasium where the assessment seminar took place, was the positioning of the 'camera person' to video

their partners performing their FMS. To optimise the images captured when videoing the FMS, some skills were best videoed from the side, others from in front of the performer or from the back e.g. striking a ball with a racket.

The achievement of learning how to Airdrop was exciting for the PSTs. They were unaware of this application but realised its potential in teaching when in the gymnasium classroom when Marron airdropped their work to the interactive whiteboard. They could all view the video clip together on the one large screen. Airdrop is a method of transferring files wirelessly from one device to another device. This iPad feature allows users to easily share photos, videos and other supported documents to anyone nearby who is using a supported iOS device or Mac.

Some of the challenges when working using the iPads to video included remembering to open the flaps on the protective covers to expose the camera and the microphone. It may appear obvious but in the beginning little was obvious! We found when taking images or video clips that the iPad would be on landscape mode but the screen would be in portrait. We learned there was an orientation lock which keeps the display from switching between portrait and landscape.

Initially we tried to share too many apps with the PSTs. We assumed incorrectly that the PSTs had good technological knowledge. The number of apps and possibilities for their use became overwhelming and complicated for us and the PSTs especially in the time we had available in the module. It was difficult to keep our focus on achieving the module outcomes and not get distracted with the technology. In order to make things more manageable, within the timeframe of the module, we focused on one app, 'iMovie' in Year 2 and 3.

Some may consider managing the trolley as a minor inconvenience however; it proved a challenge to us. In Year 3 the trolley security lock, which operates by battery, would not open due to the batteries having expired. We contacted the company who installed the hardware and the technician guided us to a backup device (power source) that is used in such an emergency. This solved our problem in the short term. The battery compartment location was not obvious even to the technician who was supporting us. The drawer had to be dismantled to gain access to the compartment.

Further challenges included developing a system to save the PSTs digital work assignment. Generally users save their work to the iPad or to 'the cloud', i.e. OneDrive or Google Drive. If the iPads were being used long term by a number of groups, individual PSTs work saved to an iPad would not be secure. To save to the cloud, each iPad would require a separate user email and account, which was not possible with multiple users. Therefore we were faced with a major problem – how did we get PSTs work from the individual iPads to a central secure location? Our initial solution was to airdrop each assignment to a master iPad. During Year 2 and Year 3 we investigated alternative ways to transfer the PSTs work from the individual iPads to the mac mini. Applications were explored such as Webdav Nav and Meraki before we finally decided to synch all the iPads with the mac mini through the trolley and upload all the data from each iPad in turn.

Deciding which apps to purchase was a challenge as many of the recommended apps we had not encountered in our work prior to this. Then the method to purchase apps for the iPads from iTunes – did we set up a credit card link or purchase iTunes vouchers– had to be overcome. Other practicalities, such as 'cleaning down' each device at the end of a semester and at the end of the year, were time-consuming tasks and we did not have technical support within our College.

In Years 2 and 3 we began to integrate the iPads into other physical education modules using one app, Video Delay. We had Wi-Fi availability in our gymnasium and classroom which made the use of the interactive whiteboard and the iPads possible. Prior to the installation of Wi-Fi we used an Apple AirPort. This provided us with a local wireless internet connection. We were relieved when the AirPort was made redundant as it resulted in fewer wires and plugs, and connections (See Figure 2 and 3). Over time our achievements included becoming more confident and competent risk taking, exploring, experimenting and using other apps.

The value of a critical friend cannot be underestimated to discuss possibilities, technical difficulties as well as to celebrate our achievements. Most importantly Coulter, as critical friend ensured that Marron remained focussed on the module outcomes when she would get to an impasse, frustrated with the technology or began to feel that the technology was an 'add-on' (Jones, 2010).

Technological pedagogical knowledge

At the commencement of Year 3 of our journey, we had the opportunity to undertake professional development with a focus on physical education apps. This resulted in a bank of suitable pedagogical physical education apps available to us in our teaching. We believe that physical education delivery in our College is now being enhanced by the use of digital technologies. Some examples include using Video Delay and iMovie to assess PSTs' FMS; using the camera to provide evidence of finding controls in orienteering activities; using iMovie to capture PSTs' dance performances; using apps to perform warm up activities and examples of balances in gymnastics. We are linking instructional approaches and learning outcomes to the goals of physical education seminars (Koszalka & Ganesan, 2004) and we believe that TPCK (Mishra & Koehler, 2006) is happening. We are only limited by what we can think up, it is important that physical education steps out of its comfort zone and finds the technology that will support not hinder our movement cultures (Fernández-Balboa, 2003).

CONCLUSION

At the end of our journey, we the initial teacher physical education educators have become more technologically adept with iPads and physical education apps to enhance teaching and learning in physical education. We have established a clear and focussed usage of the iPad and its possibilities in physical education teaching and learning. We have become more comfortable teaching technological applications (Graham, Culcatta, Pratt & West, 2004). We, 'the people' are beginning to make things happen (Butler et al., 2015). We are now not only using digital technologies but now know how to use technology to support PSTs' learning in physical education to enhance children's FMS and beyond. Linking the use of digital technologies with the purposes of physical education pedagogy as outlined by Macdonald and Hay (2010), we believe video analysis of PSTs' FMS focuses their ability to teach skills. It makes them more conscious of their own movement ability to demonstrate skills when teaching and to use the iPad and appropriate apps as possible assessment tools.

If you are to plan your technology infused journey with iPads as initial teacher educators, we recommend commencing with a colleague from your field as he/she will understand the

workings of your department. Your friend can be a novice too and become either a critical friend or a partner in learning the technology. Start with one module, one group of students, one iPad and one app. Be prepared for the technology to let you down but don't let it get you down. We believe that having taken a living theory approach with us at the heart of the study to improve our practice (Whitehead, 2008) we have become role models for the integration of digital technologies (Semiz & Ince, 2012) to enhance the teaching of quality physical education.

Acknowledgement: The research reported here was conducted under the CREATE (Collaborative Research Across Teacher Education) programme based in St Patrick's College, Drumcondra, Dublin, Ireland, a College of Dublin City University.

REFERENCES

1. Banville, D., & Polifko, M. (2009). Using digital video recorders in physical education. *JOPERD the Journal of Physical Education, Recreation & Dance, 80*(1), 17-21.
2. Butler, D., Marshall, K., & Leahy, M. (Eds.). (2015). *Shaping the future: How technology can lead to educational transformation* (1st ed.) the liffey press.
3. Casey, A., & Jones, B. (2011). Using digital technology to enhance student engagement in physical education. *Asia-Pacific Journal of Teacher Education, 2*(2), 51-67.
4. Confederation of European University Rectors' Conferences & the Association of European Universities. (1999). The Bologna declaration on the European space for higher education: An explanation. Retrieved fromhttp://www.eurodesk.it/sites/default/files/file/doc_pogiovanili/bologna_process.pdf
5. Cox, S. (2008). *A conceptual analysis of technological content knowledge.* (Unpublished Doctoral Dissertation). Brigham Young University, Provo, Utah, USA.
6. Eberline, A., & Richards, A. (2013). Teaching with technology in physical education. *Strategies: A Journal for Physical and Sport Educators, 26*(November/December), 38-39. doi:http://www.tandfonline.com.dcu.idm.oclc.org/action/showCitFormats?doi=10.1080/08924562.2013.839522
7. Fielding, M., Brag, S., Craig, J., Cunningham, I., Eraut, M., Gillinson, S., Thorp, J. (2005). *Factors influencing the transfer of good practice.* (No. 615). Sussex: University of Sussex and Demos DFES Publications.
8. Gallahue, D., & Donnelly, F. (2003). Chapter 2. Childhood growth and motor development. *Developmental physical education for all children* (4th ed., pp. 24-59). Champaign: IL: Human Kinetics.
9. Graham, C., Culatta, R., Pratt, M., & West, R. (2004). Redesigning the teacher education technology course to emphasize integration. *Computers in the Schools: Interdisciplinary Journal of Practice, Theory, and Applied Research, 21*, 127.
10. Graham, G., Holt/Hale, S. A., & Parker, M. (2010). *Children moving a reflective approach to teaching physical education* (8th ed.). Boston: McGraw-Hill.
11. Hague, C., & Payton, S. (2010). Digital literacy across the curriculum. Retrieved from http://www.nfer.ac.uk.dcu.idm.oclc.org/publications/FUTL06/FUTL06.pdf
12. Hall, T. (2012). Emplotment, embodiment, engagement: Narrative technology in support of physical education, sport and physical education. *Quest, 64*(2), 105-115.
13. Jess, M., Dewar, K., & Fraser, G. (2004). Basic moves: Developing a foundation for lifelong physical activity. *The British Journal of Physical Education,* 24-27.
14. Jones, A., & Moreland, J. (2004). Enhancing practicing primary school teachers' pedagogical content knowledge in technology. *International Journal of Technology and Design Education, 14*(2), 121-140.
15. Jones, R. (1980). Microcomputers: Their uses in primary schools. *Cambridge Journal of Education, 10*(3), 144-153.

16. Kirschner, P., & Selinger, M. (2003). The state of affairs of teacher education with respect to information and communications technology. *Technology, Pedagogy and Education, 12*(1), 5-17.
17. Koehler, M., & Mishra, P. (2008). Introducing TPACK. In Committee on Innovation and Technology (Ed.), *AACTE Handbook of technological pedagogical content knowledge* (pp. 3-30). New York: Routledge.
18. Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge. *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.
19. Koszalka, T.A., & Ganesan, R. (2004). Designing online courses: a taxonomy to guide strategic use of features available in course management systems (CMS) in distance education, *Distance Education*, 25.2, 243-256.
20. Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
21. Liang, G., Walls, R., Hicks, V., Clayton, L., & Yang, L. (2006). Will tomorrow's physical educators be prepared to teach in the digital age? .*Contemporary Issues in Technology and Teacher Education,*
22. MacDonald, D., & Hay, P. Health & physical education as/and technology: An Australian perspective. presented at global forum for physical education pedagogy . Retrieved from file:///C:/Users/marronsu/Google%20Drive/Research/FIEP/Macdonald-Hay%20Presentation%202010.pdf
23. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A new framework for teacher knowledge. *Teacher College Record, 108*(6), 1017.
24. Murphy, F., & Ní Chróinín, D. (2011). Playtime: The needs of very young learners in physical education and sport. *Sport pedagogy: An introduction for teaching and coaching* (pp. 140-152). Harlow, England: Pearson.
25. Niederhauser, D., & Perkmen, S. (2010). Beyond self-efficacy: Measuring preservice teachers' instructional technology outcome expectations. *Computer in Human Behavior, 26*(3), 436-442.
26. Plowman, L., & Stephen, C. (2005). Children, play and computers in pre-school education. *British Journal of Educational Studies, 36*(2), 145-157.
27. Semiz, K., & Ince, M., Mustafa. (2012). Pre-service physical education teachers' technological pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations. *Australasian Journal of Educational Technology, 28*(7), 1248-1265.
28. Settlage, J., Odom, A., & Pedersen, J. (2004). Uses of technology by science education professors: Comparisons with teachers: Uses and the current versus desired technology knowledge gap. *Contemporary Issues in Technology and Teacher Education, 4*(3), 299-312.
29. Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1)
30. Smerdon, B., Cronen, S., Lanahan, L., Anderson, J., Iannottie, N., & Angeles, J. (2000). *Teachers' tools for the 21st century: A report on teachers' use of technology* . Washington DC: National Center for Education Statistics.
31. The Teaching Council. (2011). Initial teacher education: Criteria and guidelines for programme providers. Retrieved from http://www.teachingcouncil.ie/_fileupload/Teacher%20Education/Final%20Criteria%20and%20Guidelines%20for%20Existing%20Progs%20Aug2011.pdf
32. UNESCO. (2008). *Understanding information literacy: A primer, by forest woody horton, jr.* (No. 2016).
33. Waldron, F., Smith, J., Fitzpatrick, M., & Dooley, T. (Eds.). (2012). *Re-imagining initial teacher education: Perspectives on transformation* (1st ed.) the liffey press.
34. Whitehead, J. (2008). Using living theory methodology in improving practice and generating educational knowledge in living theories. *Educational Journal of Living Theories, 1*(1), 103-126.

FITNESS INTEGRATED WITH TECHNOLOGY (F.I.T.) CURRICULUM: CONNECTING TECHNOLOGY AND PHYSICAL EDUCATION

RISTO MARTTINEN
California State University, Fullerton, U.S.A
RAY FREDRICK III
Teachers College, Columbia University, New York, U.S.A

INTRODUCTION

It would be an understatement to say that the world we live in today is much different than it was 20 years ago due to technology. However, when we state this, would we say the same about the pedagogy of physical education? Many physical education programs still function relatively similarly as they did 10, 15, or 20 years ago. This is not to say that all programs in physical education lag behind. There are several successful programs around the world that utilize technology in innovative ways to engage students and support students' learning. We could point you to a myriad of examples such as Sutherland et al. (2016), Graves, Ridgers, & Stratton (2008) or Lannigham-Foster et al. (2006), even The National Association for Sport and Physical Education in the USA (NASPE) have agreed that technology can be an effective tool for instruction if used appropriately (NASPE, 2009). However, much of physical education is not keeping up with the technology available to educators to help connect with the students of today. The students in most industrialized countries grow up with access to television, internet, tablets, digital music players, and smart phones. How are we, as educators, connecting with students who grow up with this technology?

The purpose of this chapter is to outline a new fitness curriculum that integrates technology into a middle school physical education unit. The Fitness Integrated with Technology (F.I.T.) curriculum uses accelerometers to not just measure students' physical activity levels but uses them as a tool for instruction to support math and English language arts lessons. In the following chapter, we explain the need for technology in physical education classes, explain how the F.I.T. curriculum fills this void, and describe the ways in which the F.I.T. curriculum, when implemented correctly, has the potential to impact student PA levels and provide an opportunity to integrate academic subjects into physical education.

YOUTH PHYSICAL ACTIVITY LEVELS

Youth are not participating in adequate amounts of physical activity to gain health benefits (Cook & Kohl, 2013). Furthermore, physical activity levels decline with age (Cook & Kohl, 2013). Interestingly, this pattern of declining physical activity levels follows the same pattern and age range when student attitudes toward physical education have been shown to begin their decline (Subramaniam & Silverman, 2007). Many researchers have tried to change this trend of declining PA levels by implementing new curricula that aim to increase youth physical activity levels both in school and outside of school (Cale & Harris, 2006; Eisenmann et al.,

2008). Successful curricula have certain specific things in common. First, they provide support for the teacher who is implementing the curricula; second, they focus on more than just PA levels and aim to educate the whole child, and finally, they often collaborate with universities to deliver the curriculum to the students. Empirically tested curricula are available to change youth PA levels with the right implementation. Furthermore, PA levels can be measured in a wide variety of ways that have shown to produce valid and reliable results (Cook & Kohl, 2013; Hastie & Trost, 2002).

TECHNOLOGY INTEGRATION IN SCHOOLS AND PHYSICAL EDUCATION

Technology integration in education, both general (Chen et al., 2014) and physical (Gibbone et al., 2010), has been studied and the results, while divergent in nature, reveal that technology has great potential to positively transform teaching and learning in schools. Technology as an instructional tool has been shown to enhance teachers' abilities to differentiate instruction, personalize learning, and effectively assess student outcomes (Benjamin, 2005). For current technology and emerging technologies to reach their full potential, however, many current issues with technology that have been identified must be addressed. The challenges of insufficient pre-service training and continuing professional development (Kay, 2006; Pellegrino et al., 2007) for teachers and insufficient broadband and wireless access in schools (Consortium for School Networking, 2015; USDOE, 2016; United States, 2010) must be addressed to realize the transformative power that new technologies can bring to teaching and learning.

NEW TECHNOLOGIES

Smartphone and Mobile Device Applications. Due to the explosion of technology into the fitness sector, there are several mobile applications available that can be used as educational tools. Although even a few years ago it would be uncommon to see smartphones being used by youth now it seems to be commonplace. In our work with under-served youth in Harlem, NY, we found that students still had some type of smartphone with them all the time. With the advancement of mobile applications such as messaging and voice over IP that do not require phone contracts, students are able to connect to a wireless network at school or one of several free networks in town and communicate with their friends. This access to smartphones by youth is unprecedented and can be an avenue to connect them to mobile fitness apps that work with accelerometers or a myriad of other functions.

Additionally, tablet technology, such as Android, iPad, Kindle, and Galaxy, are becoming readily available in many schools because of technology investment initiatives, such as the New York State Smart Schools Bond Act, which authorized $2 billion to finance improved educational technology and infrastructure to improve learning and opportunities for students in New York State. These tablet devices allow both teachers and students to optimize the construction, use, and evaluation of knowledge. Furthermore, the increasing capability to synchronize information across smartphone and tablet devices through emerging software applications makes the idea of integrating technology into physical education more attractive. Curriculum resources, unit objectives, lesson activities, and knowledge assessments are now

readily available in digital format and accessible at all times by anyone with a device thus allowing for more self-directed learning to take place.

USES OF TECHNOLOGY IN PHYSICAL EDUCATION

When used in appropriate ways, technology has the capacity to transform teaching and learning in physical education. Technology can and should be used in physical education to help students self-reflect, self-analyze, and self-discover (Juniu, 2011). For example, many physical activity monitors (e.g., accelerometers, pedometers, heart rate monitors) allow users to synchronize their activity history to web-based platforms where they are able to analyze and reflect on their activity. Given the current emphasis on Science, Technology, Engineering and Math (STEM) integration in schools, the use of these technologies and the data they produce make the integration of physical education with other content areas such as math, science and language arts specially ideal (Marttinen et al., in press). In addition to helping students self-assess, technology-enabled assessment helps communicate meaningful information to parents, teachers, and administrators (USDOE, 2016).

Online Collaboration Platforms. Online collaboration platforms such as Google Education, and its suite of products and applications (i.e. Docs, Sheets, Forms, etc.), allow teams and groups the opportunity to share ideas, exchange information, and experience learning in multiple venues (i.e. school, home, library, etc.). Such innovative, collaborative technological applications provide students the opportunity to publish and receive not only feedback but also collaborative opportunities to work with others in learning, creating, producing, and improving.

Research Supporting the Integration of Technology into Pedagogy. While research on the integration of technology into physical education is still emerging, the literature suggests that the inclusion of technology can have a positive influence on both teachers and students (Hew & Brush, 2007; Gibbone et al., 2010). New technologies (i.e. software applications, mobile applications, wireless connectivity, etc.) have substantially improved the possibilities to personalized learning in educational settings, including physical education (MacArthur, 2009). In a recent study by Direito et al., (2015), the researchers found that both immersive and non-immersive mobile applications slightly improved the fitness levels of adolescent youth. While the results from this study were insignificant, they do provide evidence to support the integration of technology into physical education and activity.

SUCCESSFUL CURRICULUM INTERVENTIONS IN PHYSICAL EDUCATION

Successful curriculum interventions range in their method of delivery, length of units, support given to teachers, their goals and aspirations as well as the target population. Several large-scale studies have been conducted that have successfully increased physical activity levels in youth during the school day. The most successful curricula that were able to increase PA levels of students in PE provided support to the teachers through professional development. These successful curricula also conducted classes on a weekly basis and often used part of the time to educate the students on fitness concepts and healthy lifestyle choices (Cale & Harris, 2006). Overall, most successful curricula chose a holistic approach where they did not simply

rely on just increasing PA levels but also to educate the student and to have a lasting impact on their wellness.

F.I.T. CURRICULUM

The F.I.T. curriculum consists of a 12-lesson, multi-week, fitness-based unit broken into three themes: (a) Theme 1-Fitness Foreword; (b) Theme 2-Fitness Feature and; (c) Theme 3-Fitness Folio. The basis behind the unit is to deliver fitness-based knowledge while integrating academic subjects into a unit of instruction and empowering students to make his or her own plan for fitness. In addition, information and data from the accelerometers are used in the lessons. Data from accelerometers are then used to set goals for physical activity, monitor activity levels by teaching students how to analyze and interpret graphs as well as how to understand averages and other mathematical terms. The three themes are below:

(a) Theme 1: *Fitness Foreword,* defines fitness and gives examples of how to become fit through various activities.

(b) Theme 2: *Fitness Feature,* begins integrating academic subjects into the fitness unit. Examples include analyzing and interpreting graphs from the MOVband server as well as integration of English language arts into lessons.

(c) Theme 3: *Fitness Folio,* has the students develop a personal fitness plan on how they decide to be active and reach their daily/weekly movement goals.

Throughout this set of lessons, the teacher implements his or her own general topic of teaching and supplements that unit with the F.I.T. curriculum. The F.I.T. curriculum acts as an umbrella over the teachers regularly selected unit plan, not in place of one. This means that the teacher is not forced to augment his or her unit plans to teach the F.I.T. curriculum. Teachers are provided support to supplement their original lessons with fitness knowledge and the integration of technology. The main aspects of the F.I.T. curriculum are delivered in the introduction and closure of the lessons where fitness terms were introduced and class discussion was held. The middle part of each lesson follows the plans set forth by the teacher according to his or her unit planning.

The unit was developed through recurring feedback from a group of doctoral students in a doctoral seminar group at Columbia University in the U.S.A. where the F.I.T. curriculum was discussed and feedback was sought, at least twice a year during the development phase. In addition, feedback was acquired from four curriculum and physical education pedagogy experts at different universities simultaneously during the pilot and development phase. Suggestions from these curriculum experts were taken into account and modifications were made to the unit. Once the lesson plans were complete, the F.I.T unit was pilot tested in 2014 with a cooperating teacher and two eighth-grade classes. This pilot study implemented all F.I.T. curriculum lessons over a period of approximately six weeks. Forty-two students participated in the pilot study. A full debrief was conducted with the cooperating teacher as well as selected students on the fidelity of the intervention. Changes to the lesson plans were made based on pilot test results and feedback from university professors. Throughout the development phase there were multiple iterations of the unit. The results of the pilot study suggested that the curriculum can withstand further testing and a large-scale study was conducted, which is described later in this chapter.

WHY ACCELEROMETERS?

By getting practical and relevant data from the accelerometers, it may provide teachers a tool to assess when students are most active, which days they are most active and give the teacher the ability to use those data to help students plan their activity and exercise plans. Teachers also may gain a new way to assess students by measuring their activity levels from the accelerometer data provided. In an age where society is used to instant feedback, the accelerometers will provide students with instant data on their activity levels. Through the use of the online database, with which the accelerometer is linked, students can interact with their movement patterns, amounts and frequencies like never before. For example, a student can log on to their profile and see when they were active, their average number of steps and their daily goal of activity that they have set.

Accelerometers. The use of accelerometers to monitor activity levels has grown increasingly popular. Accelerometry is based on a relationship between muscular force and body acceleration that occurs during physical movement (Goran, 1998). Typical accelerometers measure movement in 3D, meaning they measure movement up and down, side to side, and back and forth. The accelerometer then uses an algorithm using the person's movement, stride length, and intensity to calculate distance traveled. This can be displayed in steps, which is most common, miles, or other units. Beyond this, accelerometers have the ability to collect data around the clock, so the frequency, intensity, and duration of activity can be measured even when a researcher is not present (Welk, Corbin, & Dale, 2000). The general consensus of the research is that accelerometers provide valid measures of physical activity (Cook & Kohl, 2013). Accelerometers have also been successfully integrated into curriculum interventions (Donnelly et al., 2013; Stewart et al., 2004).

Benefits of accelerometers. The benefit of using accelerometers is that they are programmed to make sure the unit does not pick up random movements. Accelerometers typically have a built in sensor to wait to make sure the person wearing it is actually being active and not simply just say, moving their arm. This is different from most pedometers, which record all movement as long as the pedometer is moving. Accelerometers measure movement in 3D, as noted before, and therefore are able to measure movement that pedometers might miss, like the intensity and duration of activity, which does not typically register on a pedometer. One setback to the use of accelerometers has been the high cost. These new units can range from $100-$500 for an individual unit. Often this price range disqualifies the accelerometer as a way to collect data, especially in large-scale studies. A decade ago, although studies showed the accelerometer to be the most accurate tool to estimate items such as VO_2Max researchers still could not justify the cost of the unit as a realistic tool for research (Eston et al., 1998).

A new wave of accelerometers. A new wave of low-cost accelerometers may change the way they are being used in research on curriculum interventions. Accelerometers such as the MOVband® are retailing for approximately 20USD and have been shown to provide valid estimates of physical activity (Menickelli, Sidman, Claxton, Grube, Leonard, & Lowell, 2013). In a validity study, the MOVband® was compared to a pedometer (NL-2000), as this model had been recommended for use in research. The availability of low-cost accelerometers can aid the measurement of physical activity in large sample sizes. The United States Institute of Medicine (IOM) has suggested that accelerometers are the best method for collecting information about energy expenditure for low and middle ranges (Cook & Kohl, 2013).

Past Uses of Accelerometers in Physical Education Research. Much of the past research has used accelerometers as tools to measure students' physical activity (Cain, Sallis, Conway, van Dyck & Calhoon, 2013). Very few have used them as tools to attempt to increase physical activity levels. Recent research has shown however that there may be a motivational effect for students wearing accelerometers (Ho et al., 2013). This study specifically noted a strong yet short-lived effect on females who wore an accelerometer when compared to those who did not. Other research has shown that using an on-line intervention system (Zamzee) that is linked to accelerometer scores of students can increase Moderate to Vigorous Physical Activity (MVPA) (Guthrie et al., 2015). These scores were shown to not diminish over the 6-week intervention.

PAST USES OF THE F.I.T. CURRICULUM

The F.I.T. curriculum has been implemented in a large-scale study that looked at physical activity levels and student attitude measures of 211 middle school students in 12 classes in Northeast U.S.A. Preliminary analysis of data from this study suggest a short motivational effect of the accelerometers as physical activity spiked immediately after participants gained access to the units. Results from this research are published elsewhere.

The F.I.T. curriculum approaches physical education through the lens of constructivism. Constructivism advances the idea that an individual constructs his or her own knowledge and understanding through experiences and her interpretation of those experiences. Social constructivism posits that knowledge originates in and is a product of social interactions and therefore is not simply constructed but rather co-constructed, socially and individually (Vygotsky, 1978).

The curriculum promotes both individual and collaborative learning experiences primarily through the use of the interactive Movable dashboard. Students are able to engage with data created by not only themselves, but also their peers. Teachers are then able to facilitate a learning process that is not simply teacher directed but responsive and meaningful to the students. The Movable dashboard allows students to set personal and group movement goals, monitor and evaluate their progress, and share their results and ideas with others through the dashboard platform as well as other integrated media that is compatible with the Movable platform. Students can collaborate on tasks such as writing goals, designing a game, creating a routine, or another physical education project that integrates the accelerometer and allows them to gain valuable knowledge into how their body moves as well as how their body metrics relate to other content areas such as math and science.

INTEGRATION OF ACADEMIC SUBJECTS INTO THE PHYSICAL EDUCATION CURRICULUM THROUGH F.I.T. CURRICULUM

The F.I.T. curriculum integrates both ELA and math into lessons. Math is integrated through analysis of each students' individual physical activity scores. Math lessons consist of students learning how to interpret graphs, charts, understand averages, ranges and sums. ELA is integrated using reflective writing as well as the preparation of a visual display, poster, or PowerPoint presentation on what fitness means to them.

CONCLUSION

The goal of the Fitness Integrated with Technology curriculum is to integrate academic subjects into a physical education class while using technology to enhance students' learning. The F.I.T. curriculum uses data that students produce by being physically active to help them learn how to analyze charts, graphs, and to understand averages and ranges of data. The lessons are developed to deliver fitness-based knowledge through the use of technology and to empower students to make their own plans to stay fit. The goal of the curriculum is to teach how students can be active and what a physically active day consists of. It is not the intention to have students rely on technology (in this case accelerometers) to keep reminding them to move. Rather it is the goal of the F.I.T. curriculum to use technology as a tool to supplement learning, not replace it. Through curricula such as the F.I.T. curriculum we hope to use technology to enhance learning, and provide students access to real-life data that they produce and use that data to produce knowledge.

Table 1. Block plan for the F.I.T curriculum

	F. I. T. Unit		
	Theme 1 Fitness Foreword	Theme 2 Fitness Feature	Theme 3 Fitness Folio
1	Fitness Defined	How to increase PA Levels	Fitness Folio
2	Technology and Fitness	Measuring Activity MATH	Personal Plan
3	FITT Principles	English Language Arts	Fitness Presentation
4	Fitness Activities and Resources	Fitness Favorites	How will I continue to stay active?

WHAT DOES A NORMAL DAY LOOK LIKE?

Below is a description of the 12-lesson F.I.T curriculum. Full curriculum materials can be obtained by contacting the lead author. Due to space constraints, we are only able to publish a summary of each lesson. All lesson lengths are dependent on how much time is available for physical education classes. Ideally, classes should be 60min in length. However, the F.I.T Curriculum can be adjusted to classes that vary in length. The curriculum is flexible and can be adjusted to fit individual needs of teachers and students as classes around the globe are inherently different. For instance, in shorter classes, written assignments can be assigned as homework so class time is not spent writing.

Table 1
F.I.T. Curriculum

Lesson Number	Description of Lesson	Assignments Due in class	Integrated subject
	Theme 1: Fitness Foreword		
Lesson 1: Fitness and Physical Activity Defined	This lesson provides a definition of fitness and introduces the goals of the unit. Fitness terms will be defined in this lesson and an introduction to different activities will be provided. Students receive their accelerometers and an introduction to the functions of the device.	None	Technology
Lesson 2: Technology and Fitness	This lesson will introduce how using technology can improve fitness knowledge. The teacher will re-explain to students how the accelerometer tracks their movement (from lesson one) and students will measure how many moves they perform in a normal PE class by taking note of the number they have when they walk into class and then again looking at the number after. During the closure, the teacher will remind the students of the importance of daily physical activity.	None	Technology and Math
Lesson 3: FITT Principles	The FITT principle will be introduced. Teachers will use this lesson to teach students that ANY activity will increase steps, and moves. After this lesson, teachers will also teach students to try to increase their goal of steps (online MOVband server) by 10% in a week. Individual goals are recommended but no more than 10% should be attempted in the first week.	Goal sheet	Technology and Math
Lesson 4: Fitness Activities and Resources.	The focus of the class will be to start a short discussion. Teachers pose a question to the students to see which activities can increase their steps. What are some ways that they are planning to achieve their goal of X number of steps/moves per week or per day? What will you do over the weekend to be more active? What are some move/step numbers you are getting to on a daily basis?	In class discussion	English and Technology
	Theme 2: Fitness Feature		
Lesson 5: How to increase PA Levels	The theme today is going to be "moving in a city setting." The teacher will introduce "urban" or "limited space" workouts that can include body weight workouts or resistance bands. We suggest station with various equipment.	None	Technology
Lesson 6: Measuring Activity Using MATH	This lesson will focus on integrating math to teach students how to measure their activity level so far. Today we will find the percentage increase since Day One, compare week to week, compare percentage of goal to what your actual is etc. Most of this will be covered at the end of class and assigned as homework. The homework assignment covers averages, ranges, and sums; all based on the students' personal accelerometer data.	Math Assignment	Math and Technology

Lesson 7: English Language Arts	This lesson will give students a chance to do a written reflection on the use of an accelerometer so far by journal writing for 7 minutes at the end of class. The format of the free write will be very basic and one sheet of paper (double sided) will be given to each student and they are given three simple prompts to guide their replies.	Free Write Activity	Technology and English
Lesson 8: Fitness Favorites	Students choose the fitness activity they want to do and get to do that activity in class (games, jump rope, run, walk). The goal of choice day is for students to get active while still having a choice in which activity to participate in. This can be anything they have done in class up until this point. Remind students that they are going to still work on the components of fitness and monitor their steps. The class can then compare what activities produced the most steps	None	Technology
	Theme 3: Fitness Folio		
Lesson 9: Fitness Folio	Students will begin the construction of their own plan to stay fit. The goal of the unit is to allow students to choose how they want to become active. The lesson will begin with the teacher introducing the final project for the end of the unit, and prompting a check of the accelerometer scores.	Fitness Plan	Technology
Lesson 10: Personal plan for Fitness	This lesson will focus on working on individual plans of activity. The lesson focuses on empowering the student to make a plan on when they will get activity and what that exercise is. The teacher will teach principles of specificity, progressive overload, and overtraining during this lesson.	Fitness Plan	Technology
Lesson 11: Fitness Presentation	This project is to show how they moved and what they did during the project. Students will share their completed collages with a group of 4. They can give a short oral presentation of why they chose to add the images that they did.	Activity Collage	Technology and Arts
Lesson 12: How will I continue to stay active?	This is the last session of the unit. Students will have time to write down what their goal for physical activity is and how they plan on achieving that goal. The aim is to have the students understand the amount of work they will need to put in to reach this goal and to have them understand the time commitment that they need to invest to achieve this goal.	Goal Sheet	Technology and English

REFERENCES

1. Benjamin, Amy (2005). Differentiated Instruction Using Technology: A Guide for Middle and High School Teachers. Larchmont, NY: Eye on Education.
2. Cain, K., Sallis, J., Conway, T., Van Dyck, D., & Calhoon, L. (2013). Using accelerometers in youth physical activity studies: A review of methods. *Journal of Physical Activity & Health*, *10*(3), 437-450.

3. Cale, L., & Harris, J. (2006). School-based physical activity interventions: Effectiveness, trends, issues, implications and recommendations for practice. *Sport, Education and Society*, *11*(4), 401–420. http://doi.org/10.1080/13573320600924890
4. Chen, S. P., Wu, H. K., & Hsu, Y. S. (2014). An investigation of teachers' beliefs and their use of technology-based assessments. Computers in Human Behavior, 31, 198–210.
5. Consortium for School Networking. *CoSN's 2015 annual E-rate and infrastructure survey.* (2015).
6. Cook, H. D., & Kohl III, H. W. (2013). Educating the Student Body: Taking Physical Activity and Physical Education to School. *National Academies Press*.
7. Direito A, Jiang Y, Whittaker R, et al. (2015). Apps for Improving Fitness and Increasing Physical Activity Among Young People: The AIMFIT Pragmatic Randomized Controlled Trial. *Journal of Medical Internet Research*, 17(8):e210.
8. Donnelly JE, Greene JL, Gibson CA, et al. (2013). Physical activity and academic achievement across the curriculum (A + PAAC): Rationale and design of a 3-year, cluster-randomized trial. *BMC Public Health*, 13, 307–21.
9. Eisenmann, J. C., Gentile, D. A., Welk, G. J., Callahan, R., Strickland, S., Walsh, M., & Walsh, D. A. (2008). SWITCH: rationale, design, and implementation of a community, school, and family-based intervention to modify behaviors related to childhood obesity. BMC Public Health, 8, 223.
10. Eston, R. G., Rowlands, A. V., & Ingledew, D. K. (1998). Validity of heart rate, pedometry, and accelerometry for predicting the energy cost of children's activities. *Journal of Applied Physiology*, *7*, 362–371.
11. Gibbone, A., Rukavina, P., & Silverman, S. (2010). Technology integration in secondary physical
12. education: Teachers' attitudes and practice. *Journal of Educational Technology Development and Exchange, 3*, 27-42.
13. Goran, M. (1998). Measurement issues related to studies of childhood obesity: Assessment of body composition, body fat distribution, physical activity, and food intake. *Pediatrics*, *101*, 505–518.
14. Graves, L. E. Ridgers, N. D., & Stratton, G. (2008). The contribution of upper-limb and total-body movement to adolescents' energy expenditure whilst playing Nintendo Wii. *European Journal of Applied Physiology, 104*, 617-623.
15. Guthrie, N., Bradlyn, A., Thompson, S., Yen, S., Haritatos, J., et al. (2015). Development of an accelerometer-linked online intervention system to promote physical activity in adolescents: E0128639. *PLoS One*, *10*(5)
16. Hastie, P.A., and S.G. Trost (2002). Student physical activity levels during a season of sport education. *Pediatric Exercise Science*, 14, 64-74.
17. Hew, K.F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*, 223-252.
18. Ho, V., Simmons, R. K., Ridgway, C. L., van Sluijs, E. M. F., Bamber, D. J., Goodyer, I. M., … Corder, K. (2013). Is wearing a pedometer associated with higher physical activity among adolescents? *Preventive Medicine*, *56*, 273–277.
19. Juniu, S. (2011). Pedagogical uses of technology in physical education: Choose your technology to aid your teaching, rather than designing your lesson to fit the available technology. *Journal of Physical Education, Recreation & Dance, 82*, 41-49.
20. Kay, R. J. (2006). Evaluating strategies used to incorporate technology into pre-service education: A review of the literature. *Journal of Research on Technology in Education, 38*, 383-408.
21. Lannigham-Foster, L., Jensen, T. B., Foster, R. C., Redmond, A. B., Walker, B. A., Heinz, D., et al. (2006). Energy expenditure of sedentary screen time compared with activity screen time for children. *Pediatrics, 118*, 1831-1835.
22. MacArthur, C. A. (2009). Reflections on research on writing and technology for struggling writers. *Learning Disabilities Research & Practice, 24*, 93-103.

23. Marttinen, R., McLoughlin, G., Fredrick III, R. F., & Novak, D. (in press). Integration and physical education: A review of research. *Quest.*
24. Menickelli, J., Sidman, C., Claxton, D., Grube, D., Leonard, E., & Lowell, S. (2013). Convergent Validity of an Activity Monitor With a Research-Grade Accelerometer. In *Poster Presentation*. Research Consortium for the 2013 AAHPERD National Convention and Exposition, Charlotte, NC.
25. NASPE. (2009). Appropriate Use of Instructional Technology in Physical Education Appropriate Use of Instructional Technology in PE. Reston, VA: The National Association for Sport and Physical Education.
26. Pate, R. R., Ross, R., Dowda, M., Trost, S. G., & Sirard, J. R. (2003). Validation of a 3-Day physical activity recall instrument in female youth. *Pediatric Exercise Science*, *15*, 257–265.
27. Pellegrino, J. W., Goldman, S. R., Bertenthal, M., & Lawless, K. A. (2007). Teacher education and technology: Initial results from the "What Works and Why" Project. *Yearbook of the National Society for the Study of Education, 106*, 52-86.
28. Stewart, J. A, Dennison, D. A, Kohl, H. W., & Doyle, J. A. (2004). Exercise level and energy expenditure in the TAKE 10! in-class physical activity program. *The Journal of School Health*, *74*, 397–400.
29. Subramaniam, R., & Silverman, S. (2007). Middle school students' attitudes toward physical education. *Teaching and Teacher Education*, *23*, 602–611.
30. Sutherland, R., Campbell, E., Lubans, D.R. et al. (2016). Physical Activity 4 Everyone school-based intervention to prevent decline in adolescent physical activity levels: 12-month (mid-intervention) report on a cluster randomized trial. *British Journal of Sports Medicine*, 50, 488-495.
31. United States (2010). *Transforming American education: Learning powered by technology: draft*. Washington D.C.: U.S. Dept. of Education, Office of Educational Technology.
32. U.S. Department of Education, Office of Educational Technology, Future Ready Learning: Reimagining the Role of Technology in Education, Washington, D.C., 2016.
33. Vygotsky, Lev (1978). *Mind in Society*. London, UK: Harvard University Press.
34. Welk, G. J., Corbin, C. B., & Dale, D. (2000). Measurement issues in the assessment of physical activity in children. *Research Quarterly for Exercise and Sport*, *71*, 59–73.

IMPACT OF THE PERCEPTUAL LEARNING BY SIMULATION ON DECISION-MAKING IN VOLLEY BALL

MERZOUGUE DJAMEL, ABDEDAIM ADDA, FOUAD ABED,
SEBBANE MOHAMMED
Institute of Physical & Sport Education, Mostaganem University, Mostaganem, Algeria

INTRODUCTION

Factors of success in sports require adopting the correct scientific method that achieves what is needed by specialists' includingtrainers or teachers. This is in order to reach the best results. Volleyball is considered one of the games that need research, study,analysis and evaluation as this game is characterized by high level of technical performance of skills. Lately, there was a notabledevelopment in this game which asserts the concern of trainers and researchers in the use and development of means ofmeasurement and evaluation for the purpose of identifying status and condition of players or learners. in order to preparetraining or educational programs based on the results of measurement and evaluation to raise performance level frompsychological and physical skills.

Volleyball is considered one of the forms of ball games which are characterized by dynamism and thrill whichgive it a special nature that differs from other team games. This is evident in the way of using the ball through a set of various anddifferent skills. In addition, volleyball has its basic various principles that depend on mastering and raising their levels on optimalachievement level. This is done by adopting the right methods of teaching, learning and training with the choice of thelatest among them. A lot of specialists in volleyball workers (trainers. teachers or academics this game) in their studies andresearches agreed that the success of any team in volleyball is determined to a great extent by the degree of mastering the game'sbasic principles of skills.(Khater & El Bek, 1984, p. 122)

However, this success cannot be reached except for mastering total complex mental skills that are considered as essentialin tacticalstrategies in volleyball. Among these mental skills, there is decision making skill which is considered the core of achieving resultsin performance. So this mental skill should have important and great concern of teachers, trainers and players themselves. This isdone only through intensifying exercises which include various mental skills and develop them in order to reach a highdegree of distinction, accuracy and consistency. In addition, volleyball is one of the team sports that are characterized by continuous observation of situations, continuous concentration and preparation for decision making suitable in acting at anytime.

The nature of this game also makes it as a scenario which is full of continuous events and changes. This encourages us to use totalmental and physical abilities to cope with these changes through good and right employment of these abilities in order to reach agood level of playing and competition(Hassan & Ali, 2004, p. 12)

PROBLEM OF THE STUDY

There is no doubt that the importance and effectiveness of basic skills in volleyball represent the main base for effectiveperformance and achieving good results. Evaluation of these skills is a helping aspect, so decision making is very important inindividual's educational process if connected with volleyball as it is one of the games which requires great mental and movementconcentration. Significance of the study comes in determining the performance of some important and effective skills in skilledand technical performance of this game. The tactic which builds aesthetics of this game is built if the game is connected withdecision making and showing the level of this skill for learners. It is the decision making which makes teachers able to determine optimal way and pattern of raising the game's level and considering points of strength and weaknesses in preparing teaching programs. Individuals are characterized by individual differences and attributes. Therefore, physical education teachersare suffering from some problems when they evaluate their demand or players. Among them, there are those who believe that theyknow their students well and able to evaluate them this is based on many impressions formed by improvised scenes, but this knowledgeand experience is not different from other scientific methods of evaluation. from researcher works in the sport field and good watchers of volleyball, we notice that most teachers focus on skilledperformance, ignore mental aspect or they lack experience in this field especially when it comes to mental skills includingdecision making skill which is considered one of the updated and modern terms which tackles optimal mental ability of learners inan accurate way for good preparation, exert efforts and excel in competition. Therefore, the researcher studies the level of decisionmaking in serving, reception and preparation skills by posing the following essential question: What is the level of decisionmaking in some volleyball skills for secondary stage for secondary school students?

METHODOLOGY

Field Procedures of the Study

The researcher used the descriptive approach with a survey as it is suitable to the nature of the study.

Sample of the Study The sample of the study consisted of 148 students (7% of original population which is 2279 students).

Fields of the Study

- **Human Field:** This study included students of the 2nd secondary grade for some secondary schools of Mostaganem city (Algéria).

- **Temporal Field:** The study started from 20/01- 20/02/2014.

- **Spatial Field:** This study was applied in the volleyball playground at all secondary schools.

The Tools of the Study

* Arabic & foreign references and sources.

* A computer device including the electronic program.
* Scientific observation.
* Skill tests.

The Used Devices

Volleyball hall, volleyballs, volleyball net, measuring bands, measuring watches and assistant crew

The Used Tests

The researcher designed a form concerned with basic skills and determined the most important tests that measure the accuracy ofthese skills. After presenting the form to a group of experts, the most important of these tests were determined as shown in table (1). All tests were taken from the book of scientific basics of volleyball, measuring and testing methods. (Hassanein & Abdelmoneim, 1997).

Serial	Skill	Proposed test	Purpose of the study
1	**Serving**	**Test. 1: long serve accuracy**	**Measuring long serve accuracy**
		Test 2: hard points serve accuracy	**Measuring specific hard points serve accuracy**
2	**Serving**	**Test. 1: serve reception test (1)**	**Measuring player's skill in serve reception**
		Test 2: serve reception test (2)	**Measuring player's skill in serve reception**
3	**Serving**	**Test. 1: test of preparation close to net**	**Measuring preparation close to net accuracy**
		Test 2: test of preparation from above with fingers	**Measuring readiness of the tested in close preparation skill**

Table (1): Basic Skills of Volleyball and the most important tests chosen by expert

The Electronic Program

The used program was a test of decision making skill using simulation of playing postures in volleyball using computer programcalled "Super Lab (Version 4.04)". It presents images as visual attention for choice. This programming presents pictures andrecords which answer the searching and timing experiments used on the computer. A set of images usedrepresenting different playing positions in volleyball chosen by a group of referees and then they were presented to the samples ofthe study (96 3D pictures) ordered according to the name and number usedin lottery. The informants answered correctly andquickly balls during the presentation of pictures on the computer screen to answer them through choosing the correct decision.

Test Design

The sample of the study was put before the computer screen, pictures of different positions were presented in the previously discussed playingcases and then they choosed decisions in each case in good and quick answers by using the correct playing position (eachplaying position has five choices to choose "from 1 to 5"). Each attempt was made as follows: preparation signal (!): 1500ml / second showing the picture of a certain playing position and followed by the correct chosen picture after pressing any of thefive buttons (1, 2, 3, 4, 5) by your index finger.

Pictures presentation before the tested respondents:

1500ms on the screen

Still on the screen till the answer

1500ms on the screen

Still on the screen till the answer

Exploratory Trial

After the researcher determined the most important basic attacking skills which are related to the proposed tests, he performed theexploratory trial on 01/01/2014 on a sample of second secondary stage students among those who are not included by the mainexploratory trial (10 students). The aim of this trial was to identify the difficulties which may face the researcher during theperformance of tests and the efficiency of the assistant working team and the lasted time to execute these tests.

Scientific Bases of the Tests

Test-Retest (Reliability): Test reliability is known as giving the same results if repeated on the same persons and under thesame conditions. The researcher conducted tests and re-performed them on an exploratory sample of 8 players out of thesample of the study.

Test Validity: It means correct testing of what was measured(Mokadem, 1993, p. 146) .

In order to ensure test validity, theresearcher used self-validity which is measured by counting the square root of test reliability coefficient: self validity= reliability coefficient

Serial	Test items	Reliability	Significance	Validity
1	**Serving**	0.87	0.05	0.93
2	**Reception**	0.91		0.95
3	**Preparation**	0.95		0.97
4	**Decision-making**	0.85		0.92

Table (2): Reliability and Validity Coefficients of the Test

Table (2) shows that all items of the test gave results with high reliability and validity as we recorded statistically significantcorrelations in all tests at significant level of 0.05 which asserts success in measuring the study variables.

Objectivity: Tests of the study are the most objective proper for the sample of the study and volleyball and they arederived from prior studies, Arabic and foreign references asserting their importance and objectivity. They were chosen ontheir effectiveness base, easy application and result validity.

Statistical Study

The researcher used arithmetic means. Standard deviation, contrast analysis, good compatibility testing and percentage as shown in table (3).

DISCUSSION OF RESULTS

First Hypothesis

- There are statistically significant differences between decision making and some volleyball skills (serving, receiving andpreparing).

Second Hypothesis

- There is a low decision making level for secondary stage students in serving, receiving and preparing skills.

Tests		Category no.	Mean	S.D	F Counted	F Tabulate	Significancelevel	significance
Serving	Test 1	148	27.1	11.82		3.06	3.05	Significant
	Test 2		18.8	3.6				
	Decision making		12.35	3.84				
Reception	Test 1		27.25	7.5	5.94			Significant
	Test 2		26.15	6.45				
	Decision making		7.85	2.79				
Preparation	Test 1		27	7.40	4.46			Significant
	Test 2		26.4	6.70				
	Decision making		7.85	2.79				
Total decision making	Good	18	12.16%					
	Average	40	27.02%					
	Weak	90	60.81%					

Table (3): A. Means, Standard deviations, F test of decision making tests in somevolleyball skills (serving, reception andpreparation)

In table (3) which shows results of decision making tests in some volleyball skills, we notice that the means of serving, reception andpreparation are as follows:

Serving: (12.35 / 18.8 / 27.1), reception: (7.85 / 26.15 / 27.25) and preparation: (7.8 / 26.4 /4.27) and with standard deviations asfollows: serving: (3.84 / 3.6 / 11.82), reception: (2.79 / 6.45 / 7.5) and preparation: (2.79 / 6.7 / 7.4).

Accordingly, there are statistically significant differences between decision making level and some volleyball skills as the Fcounted values for (serving, reception and preparation) were (4.46 / 5.94 / 3.80) which are better than the tabulated one (3.06) under significance level (0.05).

Decision Making: through the table which shows results of decision making tests in some volleyball skills, we notice that therewere statistically significant differences between decision making levels (good, average and weak) with percentages at all decisionmaking levels (good, average and weak) as: (12.16 / 27.02 / 60.81), so they achieved thehypothesis which says that decisionmaking level is low at each skill (serving, receiving and preparing). Results reflected a

clear weakness in responding decisionmaking as well as their poor performance in volleyball skills performance which asserts that they need a follow-up and developmental skills. Students who use their mental skills well will reflect positively in using their basic volleyball skills which meansthat skilled performance is connected to abilities(Ryan, 1991, p. 58). found that the physical and skill conditions do not only expressgeneral level of players, but what we need to know is the degree of mental recognition accuracy in their abilities and potentials.(Sakhy, 2006) found that continuous use of mental skills training is as important as training on using physical and skill abilities,which means that performing skills with high level leads to increase muscular and nervous compatibility, movement control andgood skill performance.

The researcher found that lower levels of decision making skill for the sample of the study is due to the educational content; whichis almost empty; of training related to develop mental abilities of students. It can be said that the best results that can be reachedthrough good execution of basic skills should be related to the student's ability to use his/her mental potentials, especiallydecision-making which is based on good expectation and timing and ability to follow the ball.

Through results of the study, the researcher reached some results as follows:

- There are statistically significant differences between decision making and some volleyball skills.
- There are statistically significant differences between total decision making levels.
- Sample of the study has a low decision making level.
- Most individuals of the sample are at weak level.

DISCUSSION

Through statistical treatment of the study; results and results at above tables, said that:

Discussing Results of the First Hypothesis

The researcher proposed that there are statistically significant differences between decision making and some volleyball skills.

This was found in table (3) as it showed statistically significant differences between decision making and some volleyball skills(serving, receiving and preparing). The researcher found that these differences are due to lack of experience and practice instudents performing skills as well as lack of mental and cognitive maturity. Each skill needs repeat physical training inaddition to mental skills. Skills in general need from learners high and successful consistency and perception and they need also highdegree of accuracy, attention, intelligence and recognition.

Discussing Results of the Second Hypothesis

Results in table (3) showed low decision making level for students in (serving, receiving and preparing) skills. The researcherfound that most respondents of the sample were at weak and average levels due to the difficulty of this mental skill which needshigh consistency between concentration, speed and accuracy in performance. Decision making is one of the most importantabilities of players in higher sport levels. Its success depended on basic factors such asinformation speed, accuracy, and level ofactivity, knowledge, skills and prior experiences

which are not found in the sample of the study. (Fathy, 2008) Referred that skill creative ability through the ability to take suitable decisions with experience represented in repetition.

RECOMMENDATIONS

- Asserting the use of various teaching methods based on a modern technic that makes the teacher's role effective ineducational process.

- Performing periodical and continuous tests of mental abilities of students with the aim of identifying their reality and theirwork on developing these abilities.

- Performing similar researches on students for the other volleyball skills and other sport games' skills to know theimportance of decision making on different sport events.

- The necessity of making teachers aware how to develop variables of decision making skill for sport movements throughpractical experiences using different senses.

REFERENCES

1. Al Garaan, A. A. (2003). *The Effect of an Educational Center based on Sternberg Theory to Enhance Decision Making Level for the First Secondary Grade Students.* Amman. Jordan: Dar Al Chorouk.
2. Al Hawary, M. (2011). *The Relation between Emotional Intelligence and Decision Making for Moata University Student.* Jordan: Dar Al Maaref.
3. Fathy, J. (2008). *Talent, Distinction and Creativity.* Amman, Jordan: Dar Al Fikr.
4. Hassan, Z., & Ali, E. A. (2004). *Center of Controlling Team Sports.* Egypt: the Egyptian Library.
5. Hassanein, M. S., & Abdelmoneim, H. (1997). *Scientific Principles of Volleyball and Measuring and Evaluating Methods.* Cairo, Egypt: The Book Center Press.
6. Holt, N., & Sparkes, A. (2001). *An ethnographic study of cohesiveness in a coolege soccer team over a season. The sport psychologist.*
7. Khater, A., & El Bek, A. F. (1984). *Measurement in Sport.* Cairo, Egypt: Dar Al Fikr.
8. Mokadem, A. (1993). *Statistics, Psychological and Educational Measurement.* Algeria: University Publishing Authority.
9. Ryan, A. J. (1991). *The limites of hyman performance in New york, San francisco, london.* A wadernic press.
10. Sakhy, H. S. (2006). *The Effect of a Training Method to Develop the Time of Accuracy, Expectation and Motor Response in Accuracy of some basic Skills of Young Volleyball Players.* Baghdad, Irak: Dar el Kitab.

DIGITAL TECHNOLOGIES IN SCHOOL PHYSICAL EDUCATION: FROM THE APPLICATION TO NEW LEARNING EXPERIENCES

FÁBIO ALVES DE OLIVEIRA
Senac University Center; Visconde de Porto Seguro High School, USJT – University São Judas Tadeu, São Paulo, Brazil

LUIZ SANCHES NETO
Research Center, USJT – University São Judas Tadeu , São Paulo, Brazil

INTRODUCTION

The critical observation of the teaching practice is as important as the very act of physical educating. The number of tasks and demands that physical education teachers face in their daily routines reduces the time available to devote to the analysis of the pedagogical action. Then the teachers, lacking theorizing focused on their own practice, can become a naive consumer of educational research carried out by experts. To break this vicious circle, we understand that "the appreciation of the experience of each teacher is a major factor for the qualitative improvement of their practices", according to Borges and Sanches Neto (2014). In their turn, these practices could be possibilities to contextualize the teaching knowledge.

With the intention to develop and formalize the practical argument, we have analyzed a teaching proposal situated in a Brazilian private school in the city of São Paulo, where the physical education teacher used digital technologies for the treatment of pedagogical content. The teacher shared with high school students a possibility of interaction between the use of technology, peer learning and experiencing basketball tactical schemes. From sending the theme of the lesson to the class through a digital platform used by the school, students were able to independently anticipate learning content, through a kind of inverted class (flipped classroom).

OBJECTIVE AND METHOD

Our objective is to analyze the teacher's practical argument embedded in his pedagogical practices. We understand that the practical argument emerges when the teacher is qualitatively concerned with students' learning. In this case, the teacher approached to the students with two strategies: peer learning and flipped classroom. Besides, the teacher promoted the inclusion of digital technologies in school physical education as a means for potentiating attitudinal, conceptual and procedural changes.

In the one hand, to achieve the objective, we have opted for a qualitative methodological approach informed by – but not corresponding to – the inquiry description within the action research notion. The qualitative approach is the preferred option because, according to Godoy (1995), it uses the environment as a direct source of data. It is descriptive and has as main concern the meaning that people give to things and to everyday life.

In the other hand, Thiollent (1997) explains that action research requires at least the definition of several elements: an agent (the teacher in our case), an object on which to apply

the action (we understand that the students were not objectified, but they contributed directly in the action), event or act (the class structuring), one goal (learning tactical schemes in basketball dynamics), one or more media (emphasizing digital technologies), and a field or limited field (the digital platform as learning environment). Tripp (2005) discusses that action research allows the researcher to find ways to improve practice, and also ensure common criteria for other types of research that face the peer review in significance, originality and validity.

The observation occurred in a private high school during the entire year of 2015. The physical education teacher informed us about his procedures with the students, both throughout the learning environment and using digital technologies.

CLASS STRUCTURING WITH THE DIGITAL PLATFORM

The students optionally accessed the content available in a digital platform (moodle learning environment). The class began with a brief discussion of the tactical schemes used in basketball. Then, the students began the process of peer learning and were organized into groups. The tactical schemes prepared by the students were transported graphically into an application, called Coach Note, which functions as tactical simulator. The application was installed on the students' tablets, where they could simulate the moves previously stipulated.

After the assimilation of moves by all the components of the groups, the students experienced the tactical schemes on the court or, in other words, they put the theory studied into practice. As evaluation of this process, we used a film recorded by the students from the capture of images with GoPro cameras, which were installed on the point guards of each team.

At that moment, we noticed that students who participated in this teaching strategy showed significant attitudinal changes as: leadership, cooperation, involvement, and respect for the rules. The conceptual part of the lesson was reinforced with discussions after the screening of the film recorded by students.

We believe that the analysis of the teaching activities, from the teacher's practical argument, can be a major factor for the formalization of teaching knowledge. It might also emerge as part of the teacher's experiences. In this perspective, the teaching activities are related not only to the intentions or justifications for teachers' practices, but to the permanent elaboration of the practical argument. It can support the theory of professional experiences by teachers, underpinned by the elements of a "theory of practice".

The peer learning provides interaction between students and allows the exploring of knowledge that each one brings. It is through sharing ideas, theories and doubts that the students feel challenged to seek answers and especially formalize questions. Interactive learning events, such as sports and games, are privileged because they combine opportunities for joint activity and social interaction, for the use of language and other symbols, to explore the power of the student's own interests and to engage in creation and problem solving (Brock, Doods, Jarvis, & Olusoga, 2011).

FLIPPED CLASS USING DIGITAL TECHNOLOGY

The flipped classroom approach (Bergmann & Sams, 2012) aims to reverse the traditional process of organizing classes. The intention is fulfilling the opportunity to interact with the

students during the meetings in the classroom. In its turn, the interaction makes the coexistence of students and teachers a moment of knowledge exchange, problem solving and formulation of questions. From the video recording with the theoretical information or the actual classes, teachers might post their production in an accessible digital platform to students and encouraged them to visit and support the classes.

Students become empowered with the pace control of the class, assisted by computer monitors or mobile devices. They can pause, rewind or forward any part of the class whenever they want. The students can also write down important remarks, ask questions, interact with search engines and, finally, they can relate more closely to the class content – at the desired pace of each student.

Bergmann and Sams (2012) realized that there is an achievement in the relationship their students establish with time constraints. For the time invested by the teacher to present the main concept of a lesson, which traditionally occurred at the beginning of the class, its comprehension becomes faster when classes are previously posted. But for the success of the flipped approach, both teacher and students must comply with their part in the active learning process. The teacher must prepare the conceptual dimension of the content and upload it on a digital platform, so each student needs to access, consult and follow all posted classes.

From the inverted classroom or flipped class approach, the physical education teacher prepared the conceptual dimension and uploaded the theoretical content on the digital learning environment. Then, the students were able to make contact in advance with the class proposal through the digital platform.

The teacher noticed that class attendance came forward with discussions among peers on tactical schemes recommended by the students. Basketball tactics had graphically and virtually entered in the Coach Note application pre-installed on the students' tablets. The application works as a tactical simulator and allows the storage of several plays to the repertoire of the team.

For the evaluation of the results of this educational experience, students watched the films recorded with two GoPro cameras installed on (the front head of) the point guards. They recorded all the basketball game played by the students from their own tactical choices. However, the teaching activities leading to the video analysis are not the only intention to justify the physical education teacher practices. There was a constant work by the teacher to make meaning of his practical reasoning. The reasons featured in his argument are important as they can support the emergence of a "theory of practice".

ASSESSMENTS OF PRACTICAL REASONS

Look at the teacher's own teaching practice and reflecting on it requires constant attention to the very act of educating. It is a complex action that is impossible to understand when is timely measured, or as a mere result of an inglorious class, or without proper expected progression. According to Perrenoud (2002), the reflexive practice assumes a posture, a form of identity or *habitus* from the critical analysis with pre-established goals to reformulate the practice.

Much of the problems dealt with by a professional does not appear in the books and cannot be solved only with the help of theoretical and procedural knowledge taught (Perrenoud, 2002). For reasoning it is important to question: Whether what we do is in fact the expression of who

we are? And why we prefer to question our own knowledge as we seem to diminish the value of our own subjective schemes? For Perrenoud, there is no complete reflexive practice without dialogue with the practical unconscious and without awareness.

Our life is formed by partial repetitions. Situations do not change so much as to compel us, everyday, to invent new responses. Often, the action is repeated with some minor variations, and there is a conduct already adopted in a similar situation. Repetition – although less stimulating than the permanent invention of life – is at the heart of our practice, even when minor variations require minor adjustments of schemes (Perrenoud, 2002).

In addition, for Borges and Sanches Neto (2014), the perspective of practical reasoning is consistent to the epistemology of practice covering the ways in which teachers organize their knowledge. Teachers seem to organize their work, validate their knowledge and give coherence to what they do in correspondence or at the expense of educational theories. It means that teaching is learning again.

Learning is closely linked to the learner's level of development, as well as teaching is closely linked to the capabilities and skills of the teacher. The more experienced students teach their peers and both advance knowledge: one because he/she has learned something new, and the other because sharing what one knows develops new connections and expands understandings of certain concepts. In this sense, the teacher needs to stimulate and challenge their students within a zone of proximal development (Vygotsky, 1998).

Vygotsky (1998) defines the zone of proximal development as the distance between the level of actual development, which is usually determined by independent problem solving, and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.

Students with different skills and levels of knowledge may at first identify their own level of development. And they can advance to a higher level from peer interaction, the support received from the teacher and/or through the available tools – books, articles, digital technologies – to resolve problems and find coherent answers. Each student can achieve this condition with help at first, then later to perform the same tasks alone, making new cognitive skills actually acquired and passing to a new stage of development.

Reflexive teachers seeking for practical answers to their questions often get frustrated in academic debates. It lacks a theory elaborated from practice (or from their teaching practice). But learning from shared experiences with their students also depends on an extra pedagogical time to develop. Considering time digressions, Venâncio, Betti, Freire and Sanches Neto (2016) investigated physical education students' reminiscences, in a public school from São Paulo, and demonstrated how students explicit their own relationships to knowledge when supported by the teacher.

It is necessary, in summary, to think critically on physical education and investigate the means by which the processes of teaching and learning develop. To become emancipated, the teacher needs to question the ways that we always made education policies and practices. It would allow us to break free of traditional domination. But it is necessary to recognize the possibility of transcending physical education without losing focus of the specificities at the same time.

Below, we provide a description of the four practical reasons by the physical education teacher who informed our research:

1st – the premise of value consists in the belief that the students' whole education must imply their conducts, and it goes beyond the concept taught in any lesson, it goes through their procedures and modeling of attitudes. According to Pimenta (2002), the experience based knowledge that teachers produce in their teaching requires a permanent process of reflection on their practice. So it must be seen, criticized and mediated collectively with their peers.

2nd – the premise of condition is related to the purpose of school education in the technology era, for a media centered and globalized society. The physical education teacher assumes that he shall enable his students to work with the scientific and technological knowledge, developing skills to operate them, confront them, and contextualize them. To achieve this, the teacher should respect each student's zone of proximal development and articulate classes that allow students exploring the notion of "world citizenship".

3rd – the premise of experience requires making the content more vivid or "alive" for the students. For this, the physical education teacher kept the content in constant motion to achieve the students' aspirations. The teacher had been concerned in making practical for the students what appears to be only theoretical. It was a demand that can make the teacher work as a runner that never reaches the other runners in a race, but mobilize them to run faster.

4th – the premise of context denotes that the physical education teacher seeks new approaches, such as peer learning and flipped classroom, to enhance his teaching within a sophisticated curriculum with the use of digital technologies. The high school context could remain stagnant from the standpoint of conceptual development by the students, as well as procedural and attitudinal, if the teacher does not have an attentive and refined look on his practice.

The physical education teacher's main practical argument is innovative, but based on overcoming possible denials: What would happen if he did not have adequate tools for the analysis of his pedagogical action, or if he did not realize new generating opportunities for new learning environments? The teacher avoided such condition – that would be similar to the artisan who was victim of a technique that he has only learned to repeat without proper flexibility – and developed a resilient kind of strong tendency to teach based on reflexive strategies.

CONCLUSION

We agree with Borges and Sanches Neto (2014) on the necessity that a teacher analyzes his/her practice individually. This is an important condition, but it is not enough because teachers have an interactive work in which it is necessary to support the peers (and receive support by them). Our research aimed to identify ways and possibilities that underpin a "theory of practice". We also agree with Sanches Neto and Souza Neto (2014), because we see it as essential for teachers to share common educational purposes, so the chances of improving teaching practices shift qualitatively, as strategies to improve classes and lesson plans develop professionally.

We observed a change of habit by the students in relation to the preparation for physical education classes. When watching the video lesson, students have shown more interest in the

concept. The discussions were deepened during class time and more experienced students or those who spent more time in the virtual learning environment demonstrated theoretical depth and greater ability to interact.

The exchanges between students were significant and the teenagers' "language" seemed to achieve the goal of accomplishing the proposal faster. The use of the digital application and the students' action, while recording the sports court, showed the possibility of using the tablet as an important tool for the development and evaluation in physical education classes. We identify that the teacher's practical argument implied relevant attitudinal issues by the students, such as: leadership, cooperation and respectful involvement. As a suggestion, future studies within this topic could emphasize the impact of digital technologies in students' learning and combine the findings with the expectations by their physical education teacher, formulated as practical reasoning.

REFERENCES

1. Bergmann, J., & Sams, A. (2012). *Flip your classroom: reach every student in every class every day*. Eugene, OR: International Society for Technology in Education.
2. Borges, C. M. F., & Sanches Neto, L. (2014). Compartilhando a análise de práticas pedagógicas na educação física: perspectivas colaborativas. *Instrumento*, v.16, n.2, p.231-248.
3. Brock, A., Dodds, S., Jarvis, P., & Olusoga, Y. (2011). *Brincar: aprendizagem para a vida*. Porto Alegre: Penso.
4. Godoy, A. S. (1995). Introdução à pesquisa qualitativa e suas possibilidades. *Revista de Administração de Empresas*, v.35, n.2, p.57-63.
5. Perrenoud, P. (2002). *A prática reflexiva no ofício de professor: profissionalização e razão pedagógica*. Porto Alegre: Artmed.
6. Pimenta, S. G. (Ed.). (2002). *Saberes pedagógicos e atividade docente*. São Paulo: Cortez.
7. Sanches Neto, L., & Souza Neto, S. (2014). A epistemologia da prática e a sistematização de saberes docentes na educação física: a perspectiva de um grupo autônomo de "professores-pesquisadores". *Instrumento*, v.16, n.2, p.205-220.
8. Thiollent, M. (1997). *Pesquisa-ação nas organizações*. São Paulo: Atlas.
9. Tripp, D. (2005). Pesquisa-ação: uma introdução metodológica. *Educação e Pesquisa*, v.31, p.443-466.
10. Venâncio, L., Betti, M., Freire, E. S., & Sanches Neto, L. (2016). Modos de abordar a aprendizagem na educação física escolar: sujeitos-interlocutores na relação com o saber. *Revista Brasileira de Educação Física Escolar*, n.3 (in press).
11. Vygotsky, L. S. (1998). *A formação social da mente: o desenvolvimento dos processos psicológicos superiores*. São Paulo: Martins Fontes.

FLIPPED LEARNING IN PHYSICAL EDUCATION: WHY AND HOW?

OVE ØSTERLIE
Faculty of Teacher and Interpreter Education, Norwegian University of Science and Technology, Oslo, Norway

INTRODUCTION

This chapter introduces a way of organizing learning activities in the school subject Physical Education (PE) called flipped learning. The method consists of, in short terms, that the students prepare at home, before the PE class, watching a video explaining key topics in the next PE class. This way they come to class better prepared and more motivated for participating in the practical PE class, and they achive a better learning outcome. This is a method which originate in the USA but which has now spread to the rest of the world. The method is quite new but even so, in 2014 only 12% of all American teachers had never heard of it; and school administrators now expect new teachers to know how to flip their classrooms prior to completing their certification process (Project Tomorrow & Flipped Learning Network [FLN], 2015). This calls for the method of flipped learning to be addressed, not only in America, but also worldwide. The first part of the chapter explains what flipped learning is, and why this is a teaching method for the future and how the method can be applied to the subject PE. In the second part of the chapter, we look at a few challenges in the process of applying the method and finally there are some conclusive comments.

WHAT IS FLIPPED LEARNING?

Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter (Flipped Learning Network [FLN], 2014a).

A practical example of using the flipped model can be the following: The traditional method constitutes the teacher explaining new theory and showing some examples in front of a passive group of students. Then some time is set aside to do exercises, and then the homework is to do more exercises. There is not much room for students to have the explanations repeated if they are not understood, and this leads to a dilemma: Those who are in most need of practicing the new theory, now at home, are those who need help from the teacher the most. Those students, who understood the teachers' lesson well, do not have the same need for repetition at home. The idea in flipped learning is that the students will get the one-way-communicated lesson of new theory and examples at home where the lesson can be repeated as many times as necessary since the lesson is filmed and given to the students in the form of a video. In class, there is now more time for student-centered learning activities where the teacher takes the role of a facilitator, in contrast to traditional teaching, which is teacher-centered. In flipped learning

classrooms, the classes will more typically start with questions from the students. This way of organizing learning activities is known by various names in literature; "flipped classroom", "flipped teaching", "flipped education", "blended teaching" and "mixt learning". This teaching method is most accurately named and defined by FLN, and should not be confused with "distance learning" or "online teaching" where students also watch the teacher's instructions on video, but without the teacher and student necessarily meeting each other physically during the learning process. In flipped learning, there is still student learning activities at school, with the teacher as an active supervisor, which is the backbone of the flipped learning method.

Flipped learning in school today

The idea of recording lessons for the purpose of preparation for classes or as a way of repeating class content was first done systematically by Jonathan Bergmann and Aaron Sams in their chemistry class at high-school level (Bergmann & Sams, 2012b). The method is widely used at both university and college levels and in high schools, and to some extent in primary and secondary school (Flipped Learning Network [FLN], 2014b). Since 2007, studies on flipped learning have shown improved learning outcome in a variety of subjects and on various levels in school (e.g., Dill, 2012; Wilson, 2013). There are also reports of higher class attendance and perceived value of this method (e.g., McLaughlin et al., 2014) and increased student contentment (e.g., Talley & Scherer, 2013). However, Missildine et al. (2013) found that some students were not satisfied with the experienced extra work-load which the method entails. There has also been reports of teachers using flipped learning in PE, where the method is applied to explain rules as a part of introducing new games and activities (Bergmann & Sams, 2014), but until now there has not been any studies looking into the effects of flipping content in physical education.

WHY FLIPPED LEARNING IN PHYSICAL EDUCATION?

Every generation has to adapt to the rapidly changing society. As teachers in school, we have to be open to new ways of teaching and not be resistant to new technology and ways of thinking about learning processes. In the words of Bergmann and Sams, "Flipping speaks the language of today's students" (Bergmann & Sams, 2012b, p. 20).We can only be successful in the modern school if we are open to, and able to, adapt new technologies in our teaching. Project Tomorrow & Flipped Learning Network (2015) reports of an American survey with almost half a million students in grades 3-12, in which about 40% reported that they used online videos as additional assistance in their learning process

> "The majority of polled students in grades 3-12 agreed with these statements on why using technology was helping them to learn: I am able to learn at my own pace (59 percent); I have more control over my learning (50 percent); and I am learning in a way that better fits my learning style (49 percent). While students are not known to endorse or encourage homework, 37 percent did agree with this statement: My learning does not stop at the end of the class period or school day; I can go home and continue learning after school." (Project Tomorrow & Flipped Learning Network [FLN], 2015)

However, these are not the only reasons why teachers should start flipping PE classes.

Increased knowledge and competence

In Europe there is a consensus that the subject PE is supposed to contain components of cognitive learning in a physical activity setting, and not just physically activate students through games, activities and sports (European Commission/EACEA/Eurydice, 2013). The examined national curriculums in physical education all seem to embrace the component of preparing the students for an active and healthy lifestyle in a life-long perspective, based on a cognitive and practically learned understanding of the relationship between physical activity and good health. This consensus seems to exist on several continents like in Asia (Nakai & Metzler, 2005), Australia (Australian Curriculum Assessment and Reporting Authority [ACARA], 2015), South-America (Chaves, Luguetti, & Carbinatto, 2011) and North-America (SHAPE America, 2013). This implies that theoretical knowledge is a part of PE that schools must not overlook (Solomon, 2006), if they are to fulfill the aims of the national and regional curriculums in PE. The teachers in secondary school, at least in Norway, do not pay enough attention to the theoretical parts of the curriculum. In fact, teachers in middle school consider giving the students competence about the human body more important than the teachers in secondary school (Jacobsen et al., 2001). In today's society, we have an increased focus on appearance, body and training, and this call for a higher competence about one's own body, physiology, health, training and development of a healthy body. The amount of information on websites and internet forums is rapidly increasing, and without competence, it is not easy to know what is true and what is not. Much of the information online is a way for companies to market products related to health and training. The students deserve accurate and validated information so they can sort the information brought to them from internet forums and social media. Many teachers want to give the students more knowledge about key concepts in PE without taking time from the practical activities in PE classes. We also know that young people do not exercise enough (Centers for Disease Control and Prevention [CDC], 2014). This is a global problem (World Health Organization [WHO], 2010). So how can we give the students more knowledge, and at the same time ensure that are still active in PE classes? One way to do this is to start using flipped learning in parts of the curriculum. If the method is used according to the guidelines, but still in a personalized way, the students will increase their competence in key topics without losing precious time of physical activity in PE classes. In an unpublished pilot study done in Norway in 2015 (200 students in secondary school), the students self-reported that they learned more in PE classes where flipped learning was used than in regular PE classes (Østerlie, 2015). Some of the best effects of the flipped learning method are that the students get to build new knowledge acquired in school in addition to the knowledge acquired at home, and this cognitive bridging is very effective in the learning process (Hattie & Yates, 2013). However, is there a connection between theoretical competence and motivation?

Motivation

It is pointed out by Ryan & Deci (2000) that increased knowledge about a subject can increase the motivation to become actively involved in learning situations in this topic. This implies that students who follow a PE course using flipped learning will not just have a better foundation for reaching a higher level of knowledge of the topics in the PE classes, but they

might also become more motivated to learn more and in a more profound way. Hattie (2009) has linked feeling competent to motivation and deep learning, and argues that experienced knowledge gaps motivate us (Hattie & Yates, 2013). Roach (2014) links flipped learning to deeper learning, due to the increased understanding the videos give as preparation for class. As the video homework might help students get internal pictures of the upcoming activity in class, they might get a better visualization, and this enhanced visualization is linked to higher motivation (Manger & Wormnes, 2015). In the previously mentioned Norwegian pilot study, the students self-reported that their motivation for participating in PE classes increased when flipped learning was used in contrast to regular PE classes (Østerlie, 2015) and this is conceding with results from studies in other subjects (McLaughlin et al., 2014). A follow-up study is now looking deeper into how flipped learning in PE affects motivation both in a self-determination theory perspective (Deci & Ryan, 2002) and in a expectancy-value perspective (Eccles & Wigfield, 2002). Motivation and mastery provides a good foundation for learning (e.g., Hattie, 2009), and as PE teachers we have to provide our students with a learning environment that promotes both experienced mastery, motivation and learning in a holistic perspective. Both in content and in choice of teaching methods, PE teachers must have the students' mastery and motivation in mind. One of the main goals for PE is creating a life-long active and healthy life-style. For the students to achieve this, they need to experience mastering in PE in order to develop motivation, which will help them continue a life-long active and healthy lifestyle.

Fulfilling the curriculum and variation in content and methods

Physical activity has always been at the core of PE classes. The tight bond between sports and PE has affected the way we plan and conduct learning activities in PE, and the "sportified" PE may limit the potential of the subject as a developmental asset for all (Säfvenbom, Haugen, & Bulie, 2014). Historically, training for military life has also been a part of PE (Phillips & Roper, 2006), and in Norway this was the reason for why PE became a school subject (Synnestvedt, 1994). Today the history still colors the way we think about the subject as a way of training physical capacities and not much more. This has resulted in a practice which do not allow much time for theoretical learning or discussion. There is a lack of content knowledge in physical education (Dyson, 2014). Even if there have been several reforms of national curriculums, it seems that these reforms have a marginal effect on how the teaching is conducted both in Norway (Arnesen, Nilsen, & Leirhaug, 2013), England and Wales (Curtner-Smith, 1999; Green, 1998). PE teacher education also fails to convince students to be untraditional and open-minded for new teaching methods and a more diverse content in PE, as the students' perceptions of PE are synonymous with sport in schools (Moen & Green, 2012). Dyson (2014) argues for a more holistic approach to physical education:

> "Physical educators who teach the whole child advocate for a plethora of physical activity, skills, knowledge, and positive attitudes that foster healthy and active playful lifestyles....Physical education is much broader than just physical activity, and we harm the future potential of our field if we adopt a narrow agenda." (Dyson, 2014, p. 144).

Flipping parts of the PE classes can bring us closer to the goal of teaching our students the whole subject curriculum. We also want the students to see the links between theoretical knowledge about the body, health and training and their own level of activity and life-style. It is important to learn that theoretical and practical competence is merged and not supposed to be seen as separate elements. If we succeed in this, we have come far in teaching the core concepts of PE to our students. Flipped learning is not a method that will overtake the entire teaching done in PE, but will function more as a supplement to the existing teaching. Just the effect of using a more diverse set of teaching methods has a positive impact on students' motivation for, and physical activity level in, PE classes (Gao, Oh, & Sheng, 2011). Ward (2013) reports that in USA we now see that PE teachers are beginning to be held accountable for the students' learning outcome based on the national curriculum (SHAPE America, 2014). This clearly indicates the importance of changing towards a more holistic teaching approach in PE, where knowledge is put on the agenda as this also is a part of the curriculum and thus an expected learning outcome. Activating the students physically with sports and games is not enough; they must also acquire knowledge in PE, both practical and theoretical!

Increased level of activity

As a PE teacher, you have many opportunities to film colleagues or students performing different games, activities or practicing techniques. Try making a video where you and a colleague show and explain the basic rules of basketball for middle-graders, or more advanced tactical deliberations you want to teach on a higher level. If the students watch these videos before class, you will experience that you have a more homogeneous group when it comes to understanding the class content and learning goals, and you can start immediately with the practical activity as there is no, or just little, need for explaining it to the students. Taking into account that the method itself can raise the motivation for participation, and that you can have more time for activity in every class, we see that flipped learning is a method of great potential for a higher level of physical activity in PE.

Improved student-teacher and student-student relationships

It has been observed that using the method flipped learning will bring the teacher closer to his/her students and allows teachers to get to know their students better (Bergmann & Sams, 2012b). This is because you spend considerably more time interacting with your students, rather than conducting teaching in the traditional manner in a classroom or in a circle in the gymnastics hall. PE teachers normally have more interactions with their students than teachers do in subjects conducted in traditional classrooms, but we are always welcoming more interaction and new ways of interacting with our students. The better the relationship between the teacher and the student, the better the learning outcome is (Hattie, 2009). The flipped class also facilitates greater student-student engagement than more traditional non-flipped classes because more time is allocated to cooperative assignments (Berg, Ibrahim, Magaster, & Salbod, 2015).

Transparency and status of the subject today and into the future.

There is also the matter of transparency. Many parents feel little or no connection with the content in school and this can be a breeding ground for misunderstandings and prejudices. "Flipping changes the way we talk to parents" (Bergmann & Sams, 2012b, p. 30). When parents get the chance to watch the PE homework together with their children, they do not only get an insight into your teaching and the class content, they also get an opportunity to participate in their children's learning process, and they become educated on the topic themselves (Bergmann & Sams, 2012b). When parents can share the school's expectations and involve themselves in a supporting way in the students' homework it has a positive effect on learning (Hattie, 2009). School reforms are implemented worldwide at irregular intervals and these reforms are follows by a battle between different subjects over their importance and position in school. PE does not, in Norway at least, have a strong position and is often seen more as a recreational subject than a subject where learning processes are conducted (Jacobsen et al., 2001). Physical education teacher education (PETE) also currently maintains a relatively weak position (Collier, 2006). Putting learning, where learning is understood as a holistic process where cognitive and motoric learning is melted together, on the agenda in PE is an important part of raising the status of the PE subject in the modern school.

HOW TO FLIP LEARNING IN PHYSICAL EDUCATION?

It is important to point out that the backbone of this method is still the learning that happens in school, between the students and between the students and the teacher. The videos that the students use for preparation for the PE lessons are used to increase their motivation for participating and to give the students a deeper understanding and a better learning outcome. It is also important to evaluate the content in your practical PE lessons so that the students can fulfill the aims in the curriculum in a way that creates motivation for a lifelong healthy life style. The method of flipped learning is a way of teaching that can enrich both your lessons and the subject PE.

What will you flip?

First, you have to analyze the subject curriculum for your classes. Find suitable topics where you feel that some form of teaching in front of the class would be useful, or where you feel that this topic should be taught in more detail or with other means than physical activity. If you think, "I really should have explained this to the students" or "I wish we had more time to talk about this topic" you have a well-suited topic for flipped learning. Examples from the Norwegian subject curriculum in PE are the aims: *"explain why physical activity is important in everyday life"* (after 7th grade) and: *"practice and explain the basic principles of exercise and training"* (after 10th grade) (Kunnskapsdepartementet, 2015). These aims cannot be addressed with physical activity only as they are competence aims where the students need to be challenged cognitively to acquire the desired knowledge. This is a perfect example of a situation where flipped learning is a good supplement to your existing teaching methods. Make a video where you explain your students, in your own way, why physical activity is important

in everyday life (the 7th grade aim). This may even require several videos. Your students will then see the assigned video as homework, and you can discuss the content in the following class in between physical activity that coincides with the video content. This way, the students will get first-hand experience with the content in the video, and they will achieve a deeper understanding and will improve the learning outcome for this competence aim. Breaking the main topics into smaller topics is always a good idea because this makes it easier to ensure that the videos are not too long or have too much content.

Who will make your videos?

You have to decide if you want to make your own videos or use videos found online or made by your colleagues, or a combination. The recommended length of the videos is less than 15 minutes, and less than 10 is even better (Bergmann & Sams, 2012b). If you cannot break your topic into small enough units, it is better to make two videos of 8 minutes than one of 16 minutes. You have to keep this in mind when planning the content for each topic. In general, several videos for each topic are better than one or two long videos. This way, updating content or videos in a topic is also easier as you can change one short video and not the one, long video for the topic.

How to make the videos?

It is recommended to attend a one- or two-day flipped learning workshop followed by a one-day training on screencasting. Once a teacher has learned the basics, proficiency and efficiency come through practice. The general rule of thumb is to allow 30 minutes to create a 10-minute video (Bergmann & Sams, 2012a). There are several tools and methods for making videos. One method is to use a tool grabbing your computer screen. This way you can use a PowerPoint presentation, figures, photos, videos or sketches when explaining what you want to teach the students. This way you just explain what you see on your screen and this is what the students will see in the video. Online tools like "screencastomatic" (https://screencast-o-matic.com) and "Jing" (https://www.techsmith.com/jing.html) are simple to use and the basic pack is free of charge. If you want to be able to edit, add text or animations, you will have to use a more sophisticated tool like Camtasia Studio (https://www.techsmith.com/camtasia.html), which is not free of charge. This tool also grabs your screen, or part of your screen, but gives you more opportunities to edit your takes including adding sound, text and more. The best way is to start simple and increase the level after some time using the method (Bergmann & Sams, 2012b). It is recommended that you also grab an image of yourself whilst explaining in the video. For this purpose, you use the computer's webcam or an external webcam. All tools mentioned above will include the webcam if chosen in the program.

Where to place your videos so that your students can access them?

Some teachers create a YouTube channel and upload all videos to this channel to create easy access for the students. Some teachers use the school's learning platform like "itslearning",

"Fronter", "moodle" or "Blackboard" and some use "Google Docs" or "Drop Box". There are also more specific flipped learning platforms, like "Campus Inkrement" in Norway, which allows you to insert quick-questions or quizzes in between videos. For this purpose, Google Forms also works. If you can access the students' responses to questions during homework, it will give you the advantage of knowing ahead of class what parts of the topic the students generally had trouble understanding. It is necessary that you instruct your students where to log on, where to find the homework and how to watch the videos and respond to any questions. This way you can make sure that all, or at least the majority of the students, will conduct the homework. If students do not have internet access at home, teachers have made DVD's with the course homework videos. It is all about finding a rational way that is suitable for you as a teacher and your students.

Mastery learning

The flipped PE classes can very well be conducted in a mastery learning way. In this context, mastery learning is that each student move forward in the curriculum content whenever they are ready, not depending on the progression of the whole class. For a period, students can choose their own topic for the PE lesson based on activity sheets or goals made by the teacher. They are assigned suitable homework and can individually or in groups conduct practical activity in the PE-lessons. When they master one topic, they move on to the next. This way, the students are taking more control over their own learning process with the teacher as an active facilitator and supervisor. The mastery-learning-environment is shown to be an environment where the students learn even more (Hattie, 2009), and the students will get more motivated when the physical education class has elements of self-determination (Erdvik, Øverby, & Haugen, 2014; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009; Vallerand, 2007). "Flipping allows for real differentiation" (Bergmann & Sams, 2012b, p. 28) and the positive effect of the flipped class is most pronounced for students with lower grade point averages and for female students (Gross, Pietri, Anderson, Moyano-Camihort, & Graham, 2015). How to conduct the mastery flipped classroom is thoroughly described in *"Flip Your Classroom : Reach Every Student in Every Class Every Day* (Bergmann & Sams, 2012b).

Formative assessment is very important in the learning process in school (Hattie, 2009). Flipping some parts of your PE course gives you a good opportunity to provide more personalized feedback and evaluation through organizational guides, work-sheets or goal-forms that has a list of objectives, corresponding videos, reading from the textbook and activities. These evaluations will also be based on more of the curriculum and not just on performance in activities and sports conducted in PE classes.

Concluding comments

You will learn that there is not one way to flip a class, and that you constantly have to modify your classes. It is when you are able to personalize your classes that you will be most successful (Bergmann & Sams, 2012a).

> "Once again the message is clear—school leaders, teachers, librarians and students are increasingly interested in flipped learning to transform the learning experience.

Administrators want their teachers to utilize this method of instruction. Educators and pre-service teachers want more professional development. Librarians and other media specialists need support to assist with implementations. Students continue to use video as their go to method of formal and informal learning, so why fight it?" (Project Tomorrow & Flipped Learning Network [FLN], 2015)

With these words, I wish you good luck exploring the teaching method Flipped Learning in Physical Education.

REFERENCES

1. Arnesen, T. E., Nilsen, A. K., & Leirhaug, P. E. (2013). "Den læreplanen som ikkje kan tilpassast mi undervisning, finst ikkje.": vurdering og undervisning i kroppsøving etter kunnskapsløftet. *Tidsskriftet FoU i praksis, 7*, 9-32.
2. Australian Curriculum Assessment and Reporting Authority [ACARA]. (2015). *The Australian Curriculum: Health and Physical Education (F–10)*. Retrieved from http://www.australiancurriculum.edu.au/health-and-physical-education/curriculum/f-10?layout=1.
3. Berg, A., Ibrahim, H., Magaster, S., & Salbod, S. (2015). Flipping Over the Flipped Classroom. *Contemporary Issues in Communication Science and Disorders, 42*, 16-25.
4. Bergmann, J., & Sams, A. (2012a). Before you flip, consider this. *The Phi Delta Kappan, 94*(2), 25-25.
5. Bergmann, J., & Sams, A. (2012b). *Flip Your Classroom : Reach Every Student in Every Class Every Day*. Eugene: ISTE.
6. Bergmann, J., & Sams, A. (2014). *Flipped learning : gateway to student engagement*. Eugene, Or: International Society for Technology in Education.
7. Centers for Disease Control and Prevention [CDC]. (2014). *State indicator report on Physical Activity, 2014*. Atlanta: Division of Nutrition, Physical Activity, and Obesity Retrieved from http://www.cdc.gov/physicalactivity/downloads/pa_state_indicator_report_2014.pdf.
8. Chaves, A. D., Luguetti, C. N., & Carbinatto, M. V. (2011). Physical Education in the Brazilian Educational Law and National Curriculum Guidelines. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 5*(5), 729 - 733.
9. Collier, C. (2006). Models and curricula of physical education teacher education. In D. Kirk, D. Macdonald, & M. O'Sullivan (Eds.), *The Handbook of Physical Education* (pp. 386-406). London: SAGE Publications Ltd.
10. Curtner-Smith, M. (1999). The More Things Change the More They Stay the Same: Factors Influencing Teachers' Interpretations and Delivery of National Curriculum Physical Education. *Sport, Education and Society, 4*(1), 75-97. doi:10.1080/1357332990040106
11. Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, N.Y: University of Rochester Press.
12. Dill, E. M. (2012). The Impact of Flip Teaching on Student Homework Completion, Behavior, Engagement and Proficiency. *University of New England*.
13. Dyson, B. (2014). Quality Physical Education: A Commentary on Effective Physical Education Teaching. *Research Quarterly for Exercise and Sport, 85*(2), 144-152. doi:10.1080/02701367.2014.904155
14. Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual review of psychology, 53*(1), 109-132.
15. Erdvik, I. B., Øverby, N. C., & Haugen, T. (2014). Students' self-determined motivation in physical education and intention to be physically active after graduation: The role of perceived competence and identity. *Journal of Physical Education and Sport, 14*(2), 232-241. doi:10.7752/jpes.2014.02035

16. European Commission/EACEA/Eurydice. (2013). *Physical Education and Sport at School in Europe*. Retrieved from Luxembourg: http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/150en.pdf
17. Flipped Learning Network [FLN]. (2014a). Definition of Flipped Learning. Retrieved from http://flippedlearning.org/domain/46
18. Flipped Learning Network [FLN]. (2014b). *Extension of a rewiev of flipped learning*. Retrieved from http://flippedlearning.org/domain/46
19. Gao, Z., Oh, H., & Sheng, H. (2011). Middle School Students' Body Mass Index and Physical Activity Levels in Physical Education. *Research Quarterly for Exercise and Sport, 82*(1), 145-150.
20. Green, K. (1998). Philosophies, Ideologies and the Practice of Physical Education. *Sport, Education and Society, 3*(2), 125-143. doi:10.1080/1357332980030201
21. Gross, D., Pietri, E. S., Anderson, G., Moyano-Camihort, K., & Graham, M. J. (2015). Increased Preclass Preparation Underlies Student Outcome Improvement in the Flipped Classroom. *CBE life sciences education, 14*(4), ar36. doi:10.1187/cbe.15-02-0040
22. Hattie, J. (2009). *Visible learning : a synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.
23. Hattie, J., & Yates, G. C. R. (2013). *Visible Learning and the Science of How we Learn*. Florence, KY, USA: Taylor and Francis.
24. Jacobsen, E. B., Moser, T., By, I. Å., Fjeld, J., Gundersen, K. T., & Stokke, R. (2001). L97 og kroppsøvingsfaget–fra blå praktbok til grå hverdag. *Elevenes og lærerenes erfaringer knyttet til den nye læreplanen i kroppsøving. Hovedrapport, 2*.
25. Kunnskapsdepartementet. (2015). *Læreplan i kroppsøving (KRO1-04)*. Retrieved from http://www.udir.no/kl06/kro1-04/.
26. Lonsdale, C., Sabiston, C. M., Raedeke, T. D., Ha, A. S. C., & Sum, R. K. W. (2009). Self-determined motivation and students' physical activity during structured physical education lessons and free choice periods. *Preventive medicine, 48*(1), 69. doi:10.1016/j.ypmed.2008.09.013
27. Manger, T., & Wormnes, B. (2015). *Motivasjon og mestring : utvikling av egne og andres ressurser* (2. utg. ed.). Bergen: Fagbokforl.
28. McLaughlin, E. J., Roth, T. M., Glatt, M. D., Gharkholonarehe, A. N., Davidson, M. C., Griffin, A. L., . . . Mumper, J. R. (2014). The Flipped Classroom: A Course Redesign to Foster Learning and Engagement in a Health Professions School. *Academic Medicine, 89*(2), 236-243. doi:10.1097/ACM.0000000000000086
29. Missildine, K., Fountain, R., Summers, L., & Gosselin, K. (2013). Flipping the Classroom to Improve Student Performance and Satisfaction. *Journal of Nursing Education, 52*(10), 597-599. doi:10.3928/01484834-20130919-03
30. Moen, K. M., & Green, K. S. (2012). Physical education teacher education in Norway: The perceptions of student teachers. doi:10.1080/13573322.2012.719867
31. Nakai, T., & Metzler, M. (2005). Standards and Practice for K-12 Physical Education in Japan. *Journal of Physical Education, Recreation & Dance, 76*(7), 17-22. doi:10.1080/07303084.2005.10609307
32. Phillips, M. G., & Roper, A. P. (2006). History of physical educatin. In D. Kirk, D. Macdonald, & M. O'Sullivan (Eds.), *The Handbook of Physical Education* (pp. 123-140). London: SAGE Publications Ltd.
33. Project Tomorrow, & Flipped Learning Network [FLN]. (2015). *Speak Up 2014 National Research Project Findings: Flipped Learning continues to trend for third year.* Paper presented at the The School Superintendents Association's National Conference on Education
34. Roach, T. (2014). Student perceptions toward flipped learning: New methods to increase interaction and active learning in economics. *International Review of Economics Education, 17*, 74-84. doi:10.1016/j.iree.2014.08.003

35. Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology, 25*(1), 54-67. doi:10.1006/ceps.1999.1020
36. SHAPE America. (2013). *Grade-Level Outcomes for K-12 Physical Education*. Reston, VA Retrieved from http://www.shapeamerica.org/standards/pe/upload/Grade-Level-Outcomes-for-K-12-Physical-Education.pdf.
37. Solomon, M. A. (2006). Learner cognition. In D. Kirk, D. Macdonald, & M. O'Sullivan (Eds.), *The Handbook of Physical Education* (pp. 226-241). London: SAGE Publications Ltd.
38. Synnestvedt, K. E. (1994). *Skolefaget kroppsøving : fagets bakgrunn og utvikling 1848-1925 : en lære- og fagplanhistorisk studie i norsk allmueskole og folkeskole*. Retrieved from Oslo: http://www.nb.no/nbsok/nb/4a4daf113d2b7b8733b78ac861432286.nbdigital?lang=no
39. Säfvenbom, R., Haugen, T., & Bulie, M. (2014). Attitudes toward and motivation for PE: who collects the benefits of the subject? doi:10.1080/17408989.2014.892063
40. Talley, C. P., & Scherer, S. (2013). The Enhanced Flipped Classroom: Increasing Academic Performance with Student-recorded Lectures and Practice Testing in a "Flipped" STEM Course. *The Journal of Negro Education, 82*(3), 339-347. doi:10.7709/jnegroeducation.82.3.0339
41. Vallerand, R. J. (2007). Intrinsic and Extrinsic Motivation in Sport and Physical Activity: A Review and a Look at the Future *Handbook of Sport Psychology* (pp. 59-83): John Wiley & Sons, Inc.
42. Ward, P. (2013). The Role of Content Knowledge in Conceptions of Teaching Effectiveness in Physical Education. *Research Quarterly for Exercise and Sport, 84*(4), 431-440. doi:10.1080/02701367.2013.844045
43. Wilson, S. G. (2013). The Flipped Class. *Teaching of Psychology, 40*(3), 193-199. doi:10.1177/0098628313487461
44. World Health Organization [WHO]. (2010). *Global recommendations on physical activity for health*. Retrieved from www.cdc.gov/physicalactivity/downloads/pa_state_indicator_report_2014.pdf
45. Østerlie, O. (2015). *Omvendt undervisning i kroppsøving på ungdomsskolen*. NTNU. Unpublished.

TOWARDS A NEW METHOD OF LEARNING IN SPORT: SEMIOTRICITY IN BASKETBALL

OUSSEMA SGHARI, ALI ELLOUMI
University of SFAX, ECUMUS, Sfax, Tunisia

INTRODUCTION

Sport, as a considerable phenomenon with strong economic and even political implications, is increasingly gaining importance in society. It is necessary, then, to be analyzed. In this respect, a new vision was proposed by Pierre Parlebas, who changed the standards of scientific research based on their multidisciplinary dimension. His work introduced a science of driving action, namely that «Praxeology motor», which originates in Logic, Mathematics, Socio-metrics, Linguistics and Semiotics. He asks the question «will Physical Education become scientific or not?» It should be "pedagogy of the motor lines». He developed a lexicon so as to identify the kind of vocabulary he aims to use essentially in the study of motor interactions within games. Among these concepts we find communication channels, their counterparts, gestemes and praxemes as communication context, semiotricity, roles and socio-motor sub-roles networks. Pierre Parlebas has developed the concept of «internal logic» of analysis and modeling of physical and sporting activities and games in general. On the light of Pierre Parlebas' work and the founding scientific community of science of driving action, our job is to explore structures and processes of motor action specifically the communication systems deployed in the field of basketball, a game that is neglected in terms of scientific research.

The objective of our research is thus to disambiguate and clarify communication phase during a basketball game. Focusing on bodily interaction and the meaning of gestures and actions and translating them into the field of physical education. The origin of this research lies in a series of questions and interrogations being asked to a sociology researcher and Physical Education teacher.

- ☒ What is the type of communication done in the course of a basketball game and what happens between players?
- ☒ Can we emphasize the relationship between the players of a same team and that of the opponent team?
- ☒ Can we explore the motor interaction system of basketball?
- ☒ How can we make interaction networks didactics intelligible?

To answer such questions, it is essential to associate all the objective traits of "the Action motor" science which are a fundamental backbone of our research. After having introduced our research, it is essential to keep it within the framework of a consistent theoretical basis.

We relied on the previous work of Pierre Parlebas, Alexandre Obœuf (2010), Pascal Bordes (2007), Ali Elloumi (2000), Luc Collard (2007), Eric Dugas (2011) and other specialists in the field of driving Praxeology. Moreover, this group of researchers provided us with an intellectual luxury. It is considered as a strong scientific community working for the foundation of a science: the science of driving action.

LITERATURE REVIEW

1. THE MOTOR PRAXEOLOGY

1.1 motor Praxeology:

We can remember Pierre Parlebas' definition of Praxeology driving. According to him, it is «the science of action driving, including conditions, modes of operation and the results of the implementation thereof.» (Games, Sports and Institutions -motor Praxeology lexicon- P. Parlebas (1999). The science of driving praxis suggests conducting a coherent and unitary study that showcases all relevant data relating to this specific object. It aims to constitute the field of motor action. The driving Praxeology or the science of driving action is a blend of Philosophy, Mathematics and Psychology. The first root, namely Philosophy, resorted to the term «Praxeology» for the first time by Alfred Espinas in his article entitled «The Origins of Technology». Mathematical roots echo a thorough issue of decision-action and work on games of fortune and the appearance of probabilities calculation. A wider range of ambition is manifested with the psychological foundations: set the concept of action at the heart of any reflection by referring to the work of Piaget on action and his studies on Structural Analysis and Psychoanalysis.

Besides, some other attempts position the concept of action at the heart of social sciences altogether. That is the viewpoint developed by T. Parsons and E. Shills in their book entitled Towards a General Theory of Action, released in 1951. This sociological perspective can be interpreted as a theory of action, which tends to unify primarily the field of social sciences. To tell the truth, a large number of sociologists from Vilfredo Pareto to Alain Touraine have addressed major sociological themes in terms of action. Recently, Raymond Boudon has defined Sociology as «a general theory of action» (*The Logic of The Social - Introduction to Sociological Analysis* - p.257).

1.2 universals:

Sports games offer spectators an incredible variety of situations and behavior. Even within the same game, we can't watch the same match twice. The multiplicity of acts in the game leads to the appearance of an invincible complexity. A question quickly arises to the observer: is it possible to reduce and better control such complexity? To adopt Claude Lévi-Strauss' words, we should understand what he calls 'the underlying order laws to the observable diversity '. This is a supposition, which allows P. Parlebas to press forward the term of 'universal '. This concept has been defined by sociologists as 'operating models representing the basic structures of the operation of any sport and carriers of the game internal logic » Games, Sports and Institutions -Motor Praxeology Lexicon- P. Parlebas (1999). The models are thoroughly identifiable in all sports games. Also, they are universally bound by the internal logic of the game, the space dedicated to it, the rules, the time and space allocated. These models indicate the operating principles of funny situations. They illustrate the players' dynamic driving action.

Seven universals were thus identified: Drive communications (motors communication) network; Brand interactions graph; The system of scores; Network of sociomotors roles; Sociomotors sub-roles network; Gesture codes network; Praxeme codes network

Universals are types that can be found in each sport and demonstrate the operation of every game and existing sport. In our piece of work, we choose the most suitable universals for our objective and analysis.

2. SEMIOTRICITY

2.1 The Semiotricity:

Semiotricity analysis is not the study of the produced action. It's rather the study of the inferred language; the significance of and the message conveyed by this action. We are then faced with an unusual semiology: non-auditory in the substance but motrice that P. Parlebas called 'semiotricity '. It is a compound concept: semio / tricity.

Semiology

Semio refers to semiology, 'the science of communication signs systems and codes ' Games, Sports and Institutions -Motor Praxeology Lexicon- P. Parlebas (1999). We might say that semiology is the study of both verbal and non-verbal linguistic signs. As a term, semiology was first created by Émile Littré. To him, semiology was reported referring to medicine. Afterwards, it was taken over and expanded by Ferdinand de Saussure. Semiology is 'the science that studies the life of signs at the heart of social life'_ (General Linguistics Course, p.33). We note that semiology developed in various fields such as film making, architecture, medicine, and other fields of study because the meaning of verbal and non-verbal signs plays a crucial role when explaining and exploring these same fields themselves.

Motor skills

The second part of this concept (-Tricity) also suggests a hinge between different fields of scientific study. Motor is both a 'field' and a 'driving characteristic' Games, Sports and Institutions -Motor Praxeology Lexicon- P. Parlebas (1999), p. 252). It is a set of bodily functions provided by the loco-motor system and the nervous system allowing movements and displacement. Technically, motor action corresponds to the unit's behavior.

There are different categories of motors: Reflex motor: the gesture is beyond control; Auto motor: the will comes to trigger automated actions; Voluntary motor control: action is thought of before being done

Several works on motor skills are noteworthy in the field of Psychology and especially medicine. What about sport?

Can we say that «semiotricity» is the semiology of the motor?

In our model, semiotricity is a hinge between the two concepts. It is an analysis tool that aims to demonstrate the signs from the nervous system and manifest themselves as physical acts of praxeme order and gestures. In his book, P. Parlebas, the master of this concept asserts that it is a ' *nature and scope of the driving situations envisaged in terms of the implementation of*

a system of signs directly related to driving practitioners' lines ' Games, Sports and Institutions -Motor Praxeology Lexicon- P. Parlebas (1999), p. 252), p.324). Drivelines, therefore, are more than behavior that prevents us from reducing the individual's driving behaviour. The acting individual is irreducible to a body, which moves in a given space by expending energy. However, V. Levis-Strauss (1950) noted "the individual is not the product of his body, but the product of its techniques and representations. In the same sense, Pierre Parlebas says: ' acting is reacting, often the same as pre-acting "(*Sociology Elements in Sport* - Pierre Parlebas (1986)). As far as physical activity is concerned, the practitioner is in perpetual relation with his / her environment. This environment can be either a physical environment or a human one. Our work focuses on the analysis of the human environment as a major component that influences the practitioner in his decision-making, his experience and facilitates the task of reaction phase. We can't deny that it is hard to repeat the same actions in a match but the situations that gather in the same sport are numerous.

The acting subject goes through three stages in the react phase. Firstly, it is necessary to 'read' (decode) the situation. Then, interpret the information in terms of indices (decoding) and group them according to configuration. Finally, choose the practical web in line with his physical and mental skills. This three-stage configuration leads us into a particular type of communication.

2.2 Non-verbal communication:

Non-verbal communication can be understood as all the available means of communication between individuals unable to use language ' (*non-verbal communication* - Jacque Corraze, (1988)). Generally speaking, applying the term of non-verbal communication to gestures, postures, guidance body, somatic, natural or artificial singularities, even objects and remote reports between individuals through which information is emitted. Taking our example of sports games there is a talk about 'motor communication' that is defined as a "driving cooperation, essential and direct interaction" (*Games, Sports and Institutions - lexicon of driving Praxeology* -P. Parlebas, (1999), p.63). As shown in the following diagram, this interaction is done by semiotors codes that can be either gestures or praxemes.

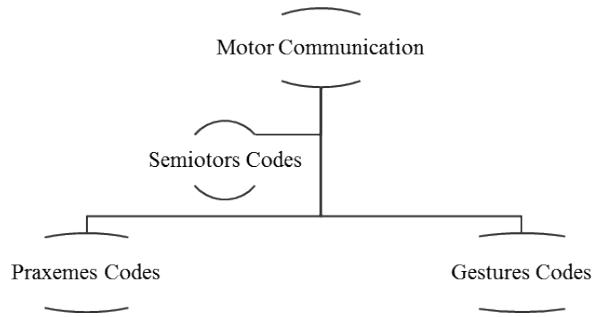


Figure 1: Motor communication

2.3 Gestures and Praxemes:

Within society, each interaction offers a communication. There is consequently a plurality of communication of various types; verbal or non-verbal. In the context of physical activities in general and collective games in particular, communication has an alternative design based on the actions of communicative acts. Some say that "communication can interrupt the action," but we can say that collective sports games are the exception because communication is based on action. These actions are Motor signs translated by movements on the basis of physical environments and others that are part of a tactical model prepared in advance. This praxeme is defined as a "driving player interpreted as a sign and the signifier is the observable behavior that served the tactical project as it was perceived" (*Games, Sports and Institutions - lexicon of driving Praxeology* -P. Parlebas (1999), p.260). We can say that a praxeme for a player is a motor achievement of his task in a tactical model proposed by the trainer or educator.

Furthermore, the communication in our sports universe is a communication that may operate by the use of a gesture. Examples include the hand gesture for a ball call, the head gesture for an occupation of space, etc. This type of gestures is a 'class of attitudes, facial expressions, gestures, motor behavior made to transmit a request, an indication either a tactical or relational injunction by simple substitution to the word' (*Games, Sports and Institutions - lexicon of driving Praxeology* -P. Parlebas (1999), p.155).

This semiotricity is very complex and it unfolds according to several records. Schematically, it can be sorted out into three type of semiotricity:

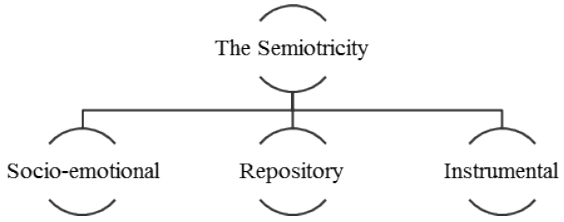


Figure 2: Types of semiotricity

We propose to define the three types of semiotricity:

1) Socio-emotional Semiotricity: it corresponds to the behavior of a reaction to emotional dominant such as the reaction of aggressiveness or friendship, the threatening gesture, posture of spite or shared joy (players exchanging congratulations).

2) Repository Semiotricity: it refers to show practices that refer to social representations, cultural or historical events or that simulate such as mime, body expression or dance in its many varieties.

3) Instrumental Semiotricity: this is a direct socket to the accomplishment of the task ludo-motor underway. Its gestures, postures and drivelines developed in the immediate service of the playful success. In this regard, we will only look at this third type of semiotricity that is strictly the operation of the motor lines. It is clear that the praxemes and the gestures are some favorite tools for the accomplishment of a communication within a team. Obviously, it is a tool used to

increase performance by a pace games. But the question that arises now is as follows: Doesn't the opponent team have a tactical model using turn codes praxeme and gesture? The answer is obviously: Yes. Another aspect of communication within games is thus open. That is the case of the motor against-communication.

2.4 The driving against-communication:

This concept reminds us of the interception of the ideas or speeches in a direct or indirect interaction in everyday life, a sort of deciphering. In team games, based on cooperation and opposition, each team must decipher the codes semiotics of the opposing team. In other words, it is a semiotor of their game model decoding. Pierre Parlebas defines this concept as "opposition power, essential and direct interaction" (*(Games, sports and Institutions - lexicon of Praxeology - motor* P. Parlebas (1999)).) The against-communication is a communication of opposition that may be individual or collective. It can be a gap in the specific communication opponent such as the interception of the ball up to the melee. It usually occurs by the investment of a space and the correct reading of the game.

3.MOTOR INTERACTIONS

Cooperation and opposition are motor interactions, which are involved in the accomplishment of a specific task. Motor interactions, are made by stakeholders explicitly provided for this purpose by the rules of the game. Spoken interaction to clarify communication and the motor against-communication are not just transmissions of information but the 'interactions' and reciprocal exchanges between individuals. Among motor interactions, we can identify two types: direct and indirect motor interactions.

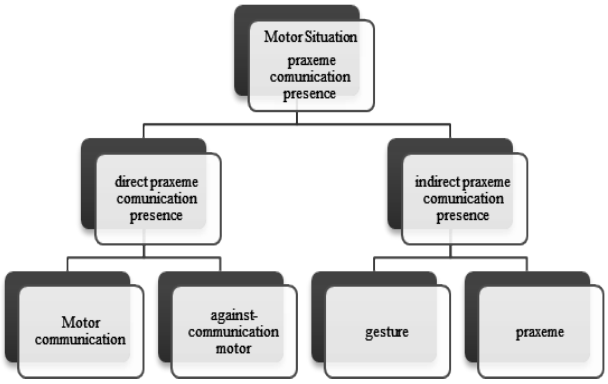


Figure 3: Communication in socio-motor situations (Parlebas, 1999, p65)

The diagram above summarizes socio-motor communication within the socio-motor situations. You can divide communication within sports games into two categories: direct praxeme communication such as motor communication and the against-communication as well as indirect praxeme communication such as gestures and praxemes.

3.1 direct motor interactions

Direct drive interactions are directly observable from the outside. For example, during a team game, players who make passes attest to the cooperation between them. These interactions play a central role in socio-motor situations (sport class, sport combat, tennis, fencing, etc.). On the other hand, psychomotor situations differ in socio-motor situations, because they are devoid of motor interactions. Example of psychomotors: snowboarding, skiing, climbing, etc.

3.2 indirect drive interactions

In socio-motor situations, cooperation and opposition can also occur indirectly. In fact, partners or opponents can communicate through a system of signs that they interpret. These are the gestures and the praxemes that have already been explained in the previous pages. These motor lines seek more or less consciously a real decoding of the behaviour of others and allow anticipation of this or that action

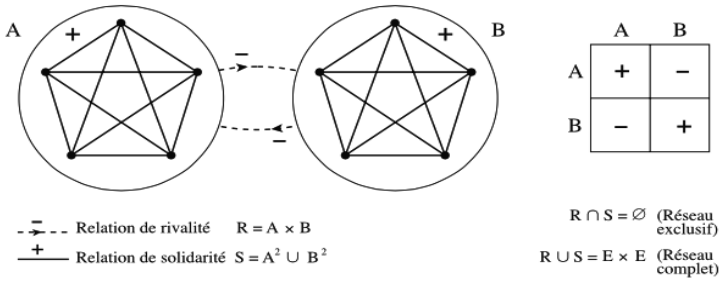


Figure 4: Driving network of basketball (from Parlebas, 1999, p299)

These graph summits' represent here players; continuous lines are possible communication drives and arches symbolize the communication and / or motor counter-narratives authorized by the rules and spirit of the game.

4. INTERNAL AND EXTERNAL LOGIC

4.1 Internal logic:

Each sports game offers conduct motor of the practitioner related necessarily to an internal logic, by systems of constraints and possible rules that depict the players' action while reporting the physical environment, objects, time and relationship with others. It is a 'system of the relevant features of a driving situation and the consequences it causes in the accomplishment of the corresponding motor action.' (*Games, Sports and Institutions - motor Praxeology lexicon* - P. Parlebas (1999), p.216).

In our example, basketball regulations require an artificial medium over to the least equipped to a certain environment: with the object (the basketball), in a very well defined time and with perpetual relationships between partners and opponents.

4.2 The external logic:

It guides us into an external logic relating to the organizational and individual characteristics. Individual characteristics include gender, weight, age, personality and even the interpersonal relationships. Organizational characteristics, on the other hand, include the degree of institutionalization of the practice, mediation, of sensationalism and especially the socio-economic and political issues.

RESEARCH METHODOLOGY

As far as the processes of power communication network, just from the start of our work, we tend to choose question assumptions since our methodological approach is hypothetico-inductive. This approach starts from the practice field to lead subsequently to a result or even a theory. We will borrow the Structuralist method of Sociology that is based on the understanding and comparison of «units». This structuralism applied to the motor is defined by its function of communication in the driving conduct and the element that reflects the complexity of the driving.

Our approach is inspired by the work of P. Parlebas (1986), which offers a real opportunity that objectively explain communication networks in sports games as it is presented at the chapter level three in terms of motor interactions. Beyond questioning, the work of P. Parlebas resulted in a theoretical contribution, which is very relevant. However, in our research, we try to explore the universe of power communication in basketball in a practical and tangible way while we try to remove the ambiguity residing at the level of this communication network known by its complexity. The support of our methodology has been developed using cultural anthropology and its investigating tools. Our approach will be carried out in three parts: observation, interview and analysis of audio-visual documents.

OUTCOMES AND DISCUSSION

The results obtained show the major component of the work during the workout and training session and that of (tactical) communication. Coaches provide an important socio-motor encoding. They take into consideration key elements at the level of their preparation for the competition.

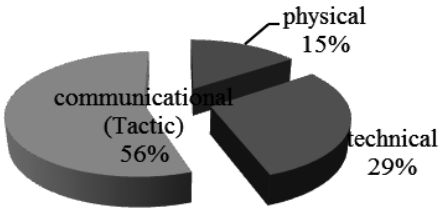


Figure 5: Comparison between the different elements of basketball training

After observations and interviews have been conducted with the coaches of the observed teams, we managed to pick up the gestures and praxemes specific to the universe of basketball. We managed to raise two types of gesture during basketball matches; automated actions where

the gesture was announced following a reflex for example; gesture to indicate to an opposing player in secret or it can be as a request for help in defense or appeal of being attacked. The second type of gestures is voluntary gesture, it is a gesture thought of before being executed, a (meaning) physical demeanor presented as an observable behavior, vehicle a message (meant) or a tactical project prepared in advance.

Concerning praxemes, we managed to identify the following praxemes via video analysis and record their corresponding specifications illustrated in the table below:

Praxemes	Specification and corresponding tactical intentions
Unmarking	Driving action characterized by awareness, in the striker, of its position relative to his direct opponent prohibiting any reception of the ball. The player moves to distance past, oriented to the wearer.
Trapp	Driving action characterized by facing two defenders moving in a reduced interval. It is intended to recover the ball.
Rebound	Driving action characterized by the movement of a player under the hamper, following a shot by his partner.
Screen	Driving action is characterized by the movement of a player to the bearer of the ball and in opposition to the Defender for the purpose of releasing him a strict defense.
Appeal of pass	Driving action characterized by a sudden acceleration of non-carrier who anticipates a possible pass of the holder, which is located at distance of exchange. The intent of the player is to accelerate the game or to take speed to an opponent.
Feint of pass	Driving action who made believe to his opponents that he will achieve a pass, while his real intent is other (dribble, shooting)
Feint of shooting	Driving action of the wearer who falsely to his opponents that he will shoot at the goal, then his real intention was different (dribble or pass)
Body feint	Driving action of the wearer who falsely to his counterparts that he will overflow from one side, while ultimately he wants to spill over on the other.
Fixing	Driving action characterized by moving the ball carrier oriented in an interval formed by two defenders, with the aim that their joint mobilization on him, in order to create a redundant and make the pass in shift to a partner in free space.
Race support	Driving action of a player located in front of the carrier who carries out race to it in order to provide a solution of past.
Support race	Driving action of a player located behind of the carrier who carries out race to it in order to provide a solution of past
Racing cross	Driving action characterized by the race of a player crossing another player of the same team, in order to destabilize the opposing defense.
Race follow-up	Driving action of the player who follows his direct opponent. The latter may be bearing or non -bearing the ball.
Defensive withdrawal	Driving action can be individual or collective, one or more players of the same team will relocate backwards towards the area of defense after the attack phase.
Step back race	Driving action can be individual or collective, one or more players of the same team will relocate backwards towards the area of defense after the attack phase.
Approach race	Defender approaching race of an attacker to reduce the speed and space for maneuvers of the opposing team's players.
Side step	Driving action characterized by lateral displacements on the part of the player, meaning that it reduces space.

Table 1: the seventeen principals praxemes identified in basketball

After you pick up the praxemes in Basketball it is necessary to transmit this work in the world of Sports and Physical Education. However, the question that arises is: **How can we transfer such semiotricity into Physical Education and how to achieve that?**

Basically, the heart of communication in the course of the game lies in the indirect driving interaction. The markdowns, accelerations, cross racing, no ball games are symptomatic signs of a high driving complexity.

Following this learning semiotor, a creation of 'Motor intelligence' comes to light. All of the psychologists of the child in general and the school of Piaget in particular, showed how the motor is the source of intelligence. "All the cognitive mechanisms rely on traction (...) knowledge in its roots imply even a permanent driving dimension still represented at the highest levels" *PIAGET (J). (-motor skills, perception and intelligence. Childhood, N0. 2 pp 9-14, 1956), w*here it is necessary to make the didacticism of semiotricity.

To take the case of a sports game, a playful actor necessarily fits into the networks that we talked about, but the way in which he fits in these networks depend on his personality, motivation, and individual experience. It is clear, therefore, that the sychological determinants are the most important.

Why does the student invest in school? That is, what makes the athlete run? Why does he engage in a boring job? Motivation is one of the greatest riddles of human behavior. Taking roots in childhood, it is what drives us to act when nobody and nothing is required, but also that stimulates the desire at the very heart of difficulty and boredom. It can be raised, the supreme desire of any manager, any therapist, and also any professor. It can also be slowed down by stress, fatigue and remembrance of past failures.

We can say that the didacticism of the semiotricity is strongly related to a key concept in the field of PE: motivation. Then, it must be added a motivating factor for the learning of these praxemes codes and gestures! It is the use of new technologies that can motivate today's student. This is a new perspective that emerges at the end of our work. Physical Education through video analysis illustrates the intended visual memory has a population strongly dependent on new technologies.

CONCLUSION

Our research has attempted to highlight in an exploratory way, the element of praxic communication during a basketball game. This update of the test carried out in the field of motor action proves a diversity of theoretical concepts that we just take and support as well as semiotricity, driving interaction, communication networks praxic direct or indirect (gestures, praxemes and against-communication). We have used in this work a first draft of the praxemes and development gestures deployed during a basketball game by using participant observation to the training of four basketball teams in first Tunisian League.

Then, the interviews being conducted with the coaches of the teams observed for the purpose of understanding the 'secret codes' of communication units: praxic with the gestures or the praxemes. Besides, we tried to ensure the continuity of our investigation without forgetting the information gathered from the written survey and the oral investigation we have fleshed out by the analysis of audiovisual media consisting of three games. On the other hand, we could

pick up 17 major voluntary praxemes and 2 types of gestures for indirect praxic communication and there was also the against-communication translated in anticipation and the decoding of the praxemes presented by the block as direct praxic communication. This direct and indirect praxic communication reflects a **high complexity** level of interaction. It is basically "motor intelligence" through learning semiotics. It also seeks the process of socialization through the psychological determinants (personality, motivation, experience). Finally, the most interesting element is the degree of socialization. The complexity of praxic communication that we found in this analysis also articulates the duels of: meaning / means of encoding / decoding, influence without doubt the degree of socialization of acting subjects and their social integration.

REFERENCES

1. Alain, BLANCHET. (1985). *L'entretien dans les sciences sociale.* (Dupond, Ed.) Paris.
2. BERGER , Peter., & LUCKMAN, T. (1966). *la construction sociale de la réalité.* (A. Colin, Ed.)
3. BOURDIEU, Pierre. (1984). *question de sociologie.* Paris: Minuit.
4. BORDES, Pascal., COLLARD, Luc., & DUGAS, Eric. (2007). *Vers une sicence des activités physiques et sportives* . (Vuibert, Ed.) Paris.
5. BROMBERG, Marcel., & TROGNON, Alain. (2004). *psychologie sociale et communication* . Paris : Dunod.
6. CAILLOIS, Roger. (1958). *les jeux et les hommes* . Paris : Gallimard.
7. COLLARD, Luc. (2005). essai sur les sport de course. *mathématiques& sciences humaines , n°170*, pp. 57-77.
8. COLLARD, Luc. (2008). Inégalité des chances et agressivité motrice . *mathématiques & sciences humaines , n° 182*, pp. 33-46.
9. COLLARD, Luc. (2004). *sport et agressivité* . Méolans-revel: déslris.
10. COLLARD, Luc. (1998). *Sports, enjeux et accidents.* Paris: Presse universitaires de France .
11. CORRAZE, Jacque. (1988). *les communications non-verbales* (Vol. n°33858). (PUF, Ed.) Paris : Presses universitaires de France .
12. DUGAS, Eric. (2011). *L'homme systémique: pour comprendre les pratiquants de jeux sportifs* . NANCY: presses universitaires de Nancy .
13. DE SAUSSURE, Ferdinand. (1972). *Cours de linguistique générale.* Paris : Payot.
14. GUILLEMARD, G., MARCHAL, ,. J.-C., PARENT, M., PARLEBAS, P., & SCHMITT, A. (1984). *Aux quatre coins des jeux* . Paris : Scarabée.
15. GOFFMAN, Erving. (1973). la présentation de soi . In *la mise en scéne de la vie quotidienne* . Paris : Minuit .
16. GOFFMAN, Erving. (1991). *Les cadres de l'expérience.* Paris : Minuit.
17. GOFFMAN, Eerving. (1988). *Les moments et leurs hommes.* Paris: minuit.
18. GOFFMAN, Eerving. (1973). Les relations en public. In *La mise en scène de la vie quotidienne* . Paris : Minuit .
19. GOFFMAN, Erving. (1974). *Les rites d'interactin.* Paris: Minuit.
20. HUIZINGA, J. *homo ludens* . (l. E. XLVII, Ed.) Edition NRF .
21. PIAGET Jean. (1956). *Motricité, perception et intelligence* (Vol. 2). (Enfance, Ed.)
22. LEVI-STRAUSS, Claude. (1974). *Anthropologie structurale.* Paris : Plon .
23. MUCCHIELLI, A. (2006). *Étude des communications: nouvelles approches.* Paris: Armand Colin .
24. MUCCHIELLI, Alex. (2005). *Études des communications: approche par la contextualisation.* Paris : Armand Colin .

25. MUCHIELLI, Alex. (2006). *Les Sciences de l'information et de la communication* . Paris : Hachette .
26. MAUSS, Marcel. (1966). Les techniques du corps. *Sociologie et anthropologie* .
27. MEAD, Goerge Herbert. (2006). L'esprit, le soi et la société.
28. MOSCOVICI, Serge. (1984). Psycologie sociale .
29. OBOEUF, Alexendre., & COLLARD, Luc. (2008). Agressivité motrice. Habitudes et transferts dans trois sports collectifs . *Socio-logos , n°3*.
30. OBOEUF, Alexendre., COLLARD, Luc., & GERAD, Benoît. (2008). Le jeu de la balle assise: un substituant au questionnaire sociométrique? . *Les cahiers Internationaux de Psychologie Sociale , n°77*, pp. 87-100.
31. OBOEUF, Alexendre., COLLARD, Luc., PRUVOST, A., & LECH, A. (2009). La prévisibilité au service de l'imprévisibilité . À la recherhce du «code sercret» du football . *Réseaux , n°156*, 241-270.
32. PARLEBAS, Pierre. (1987). Autour de la balle assise . *revue EPS 1 , n°34*, 3-7.
33. PARLEBAS, Pierre. (1990). Activités phisiques et éducation motrice. *Dossier EPS , n°4*.
34. PARLEBAS, Pierre. (1981). Contribution à un lexique commenté en science de l'action motrice .
35. PARLEBAS, Pierre. (1986). Élements de sociologie du sport . *Presse universitaire de France* .
36. PARLEBAS, Pierre. (1975). Jeu sportif, rêve et fantaisie. *Revue Esprit , n°446*, pp. 784-803.
37. PARLEBAS, Pierre. (1999). Jeux, sports et sociétés . *lexique de praxéologie motrice* .
38. PARLEBAS, Pierre. (2005). Modélisation dans les jeux et les sports . *Mathématiques& sciences humaines , n°170*, pp. 11-45.
39. PARLEBAS, Pierre. (1992). Sociométrie, réseaux et communication . *Presses universitaires de France* .
40. PRETZ, Havre. (1998). *les méthodes en sociologie: l'observation* . Paris : la Découverte .

THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE POSTGRADUATE STUDIES OF PHYSICAL EDUCATION IN THE UNIVERSITY OF LOS ANDES IN VENEZUELA

JOSÉ RODRÍGUEZ
School of Education, Faculty of Humanities and Education, University of Los Andes, Mérida City, Venezuela

INTRODUCTION

Every organization should try as much as possible to ensure that communication is integrated, taking into account the specific characteristics of each organization, seek convergence of different areas, allowing a synergistic action. It is important to ensure that Information and Communication Technologies (ICT) used are a means to achieve the common goal of the organization (Rebeil, 2006).

In 2000 Google introduced AdWords, its system of online advertising and called in February 2001 purchase Google service, Google Usenet discussion and transforms it into Google Groups. In March of the same year Eric Schmidt is named chairman of the board. In July 2001 launched its image search service. In February 2002 launch Google Search Apliance. Google Labs launches in May will close nine years later. In September Google News launches. In December of the same year it launches product search service called Froogle, now called Google Products. In February 2003, Google acquired Pyra Labs and thus the service Blogger blogging. In April presents Google Grants, a free advertising to non-profit organization. In December of that year Google Print, then Google Books is launched. In January 2004 launched the Orkut social network. In March Google Local launches later be integrated with Google Maps. In April, Google introduced Gmail, its email service with 1GB of storage. In October of that year they released Google Desktop, which will be discontinued. He also launched the so-called Google Scholar. On August 18 of that year Google went public in WallStreet. In 2004 he bought the company Keyhole. A year later, in 2005, they brought to light Google Maps and Google Earth. That same year Google bought Android Inc. Vint Cerf, considered one of the fathers of Internet was hired by Google in 2005. Google Code also launched and developed the first Summer of Code. In August presents Google Talk. In October Google launches RSS reader Google Reader feeds. Presented in November and December Google Analytics Google Transit. In 2006 launches Picasa. Acquires Writely in March for later launch Google Docs and presents the same month Google Finance. It presented in April and in August Google Calendar Google Apps, service -oriented companies. In October 2006, Google acquired 1650 million YouTube video page. That same month acquired JotSpot later become Google Sites. A year later, in 2007, Google launched an open mobile operating system Android and created the Open Handset Alliance. In April 2007, Google Double-Click purchased, a company specializing in Internet advertising, by 3100 billion companies. Earlier this month, Google became the most valuable brand in the world, reaching the sum of 66,000 million dollars, surpassing emblematic companies like Microsoft, General Electric and Coca-Cola. Google launches Gears in June later be abandoned because offer more what was later built in HTML5. In July 2007,

Google bought Panoramio, a website dedicated to exhibit photographs that users create and geoposicionan, some of which are uploaded to the site so they can be seen through Google Earth software, which aims to enable the said software users learn more about a specific area of the map, looking at the pictures that other users have taken there. In November presents Open-Social. In February 2008, Google Sites is launched. On September 2, 2008, Google has its own browser Google Chrome and the draft Code Chromium open. In December launched Google Friend Connect. In February Google Latitude is launched. In March, Google Voice features. In September 2009 re- acquires CAPTCHA. In November it introduced the draft operating system open source Chromium OS. In December presents Google Public DNS. In January 2010 Google introduced its first mobile phone, the Nexus One, which runs Android. In February Google makes its intention to deploy a network of high-speed internet officer. That same month acquired Aardvark. In March it acquired Picnik. Google TV launches in May. In October he presented his draft autonomous vehicles. In December presents its second phone, the Nexus S, manufactured by Samsung. In January 2011, Larry Page was named CEO. In May Chromebooks they are presented. The new Google social network called Google + .In August 2011 presented in June, Google acquired Motorola Mobility for 8,800 million euros (12 500 million). Google presents its third Smartphone, the Galaxy Nexus, manufactured by Samsung and it works with the fourth version of Android. In April 2012, Google introduced the Project Glass, a project to create an augmented reality glasses. In the Google I / O 2012, it was announced that the developer version of Google Glass would be available for 2013 while the consumer version would be ready by 2014. In that same event Android 4.1 it was announced and the first tablet from Google, the Nexus 7 manufactured by Asus.

The need for the use of ICT has led to modernization in many universities for educational development, and a change in the way of work of teachers and students therefore have become an indispensable tool in academic life students and teachers, currently considered as an effective factor in improving the teaching-learning process. In this same vein and the agreement of the respective program students postgraduate of specialization in Physical Education attend classes once or twice a week, usually on Friday and / or Saturday, and these professional students active occupationally which results in a way to generate some difficulties or problems in the course of their studies, these may include: the limited availability of time to go to college in order to consult books in libraries, few personal encounters with teachers for consulting work, setbacks occurred to address the classes provided, assertive ignorance of internet searches in the areas of physical education and sports , among others. Considering these factors teachers and students proceeded to promote them the use of ICT in their teaching-learning process. This process used the platform of Google Inc. this being an American multinational company specializing in software and hardware is products and services related to tics and main product of Google is the search engine Internet content the same name, but offers also other services as a service called Gmail email , its mapping services Google maps and Google Earth, the website

YouTube videos, other web utilities such as Google Books or Google News, the Google Chrome web browser, social network Google+. On the other hand, leads the development of Linux -based operating system, Android, oriented smartphones and tablets and is currently working on a project augmented reality glasses, the Google Glass, a fiber optic service; the Google Fiber and autonomous vehicles. It was from 2013 the implementation of tics and was followed until 2015 (Google web page, 2016).

THEORETICAL FOUNDATIONS

Here are the concepts that were directly related to the development of the above study are as follows:

ICT: Are the Information Technology and Communication, ie, are those computational tools and computer processing, synthesize, retrieve and present information represented in the most varied form. It is a set of tools, supports and channels for the treatment and access to information, to shape, record, store and disseminate digital content. For all types of educational applications, ICT are means, not ends. Therefore, they are tools and supplies that facilitate learning, development of skills and different ways of learning, styles and rhythms (Roman, 2014).

Software: software is called to all intangible components of a computer or computer, that is, the set of programs and procedures necessary to enable the completion of a specific task, as opposed to the physical components of the system (hardware). This includes applications such as a word processor, which allows the user to perform a task, and system software as an operating system, which allows other programs to function properly, facilitating interaction with the physical components and other applications (Roman, 2014).

Hardware: It is called hardware or hardware to all the material components of a computer. Hardware is also the physical components of a computer such as CD- ROM hard drive, among others. In this set of electronic and electromechanical devices, circuits, cables, cards, peripherals of all kinds and other physical items are included. Hardware refers to all the physical components, which can be played on the computer, discs and drives, monitor, keyboard, mouse (mouse), printer, plates, chips and other peripherals (Roman, 2014).

Google platform as the years passed was developing, improving and expanding its service offering that greatly favored users Google, some of these were used in this work and expressed below.

Products and services

Google search: It is the first product of the company and flagship product of this. In it can search for sites by the World Wide Web based on a proprietary algorithm.

Google Groups: Google Groups is a veteran web interface system called Usenet forums classified hierarchically. It is also an archive of all shipments made to this network, on which can be searched using the Google engine.

Google News: Google News is an automated service newsgathering. The website of Google News was introduced in beta in April 2002. There are different versions of the site in over 20 languages, along with the news get 700 free and paid sources. The update of each item is 15 minutes, making each time you re-enter the site, a new story appears within its highlights. The promotion of this site consists of being a neutral site in its compiled news, because there is no human intervention, thus there is a neutral point of view each story displayed.

Blogger: Is a service created by PyraLabs, and acquired by Google in 2003, to create and publish a blog online. To publish content, the user does not have to write any code or installing server programs or blogs hosted on Blogger scripting. Los are usually hosted on Google servers within the domain blogspot.com.

Google Books: Formerly known as Google Book Search and Google Print is a service from Google that searches the full text of books that Google scans, converts the text using

optical character recognition, and stores in its database online. The service was known as Google Print when it was introduced at the Frankfurt Book Fair in October 2004.

Gmail: On March 31, 2004 Google launches its service (in beta) Gmail that stood out among the services currently most popular mail to provide 1 gigabyte capacity (this figure is constantly increasing ratio of approximately 36 bytes per second to current reach 10 GB). For a long time, to access a Gmail account was necessary to receive an invitation from another Gmail user. In early February 2007, records in Gmail were completely released, and today it is possible to register without invitations. This courier highlighted, inter alia, by using a simple search system and advanced messages at the same time, similar to the web browser which owes its slogan "Do not organize, find". It also offers additional features such as labels, advanced filters, possibility of multiple accounts for outgoing mail, integrated chat, etc. that make it very attractive. It is currently available in 39 languages.

Hangouts: This is a cross-platform instant messaging service developed by Google Inc. On August 24, 2005, Google launched the beta version of its instant messaging service Google Talk, based on the XMPP protocol. With the launch of Google+, Google launched a service called Hangouts video chat. On May 15, 2013, at Google I / O event, Vic Gundotra announced the new Hangouts, which unify all messaging services Google, replacing Google Talk, Google+ Messenger and Google+ Hangouts. That same day launched for different platforms such as Android (replacing the Google Talk), iOS and Web (via Chrome and Google+).

Google Drive: This is a file hosting service. It was introduced by Google on April 24, 2012. Google Drive is a replacement of Google Docs has changed its docs.google.com link address for drive.google.com among other qualities. Each user has 15 gigabytes of free space to store your files, expandable via payment. It is accessible via their website from computers and applications available for iOS and Android that allow you to edit documents and spreadsheets.

You Tube: Is owned by Google, since its purchase on 14 October 200615 1,650 million. On this website, users can upload and watch videos.

Google Chrome: The browser software company Google. It is the most widely used Internet browser, with a market share of 31.88 %% in late July 2012. It is available for free under specific operating conditions.

Google Plus: Google+ (pronounced and sometimes written Google Plus, sometimes abbreviated as G +, in some countries pronounced Spanish language Google More) is a social networking service operated by Google Inc. The service, launched on June 28, 2011, it is based on HTML5. Users must be over 13 years old to create their own accounts. Google+ is now the second most popular social network in the world with about 343 million active users.

METHODS

The methodology was oriented in applied research, field design and descriptive level. The technique for collecting information was the interview and the instrument an anecdotal record (Navarro, 2009).

Participants

The postgraduate coordination proceeded to dictate induction sessions on using ICTs to 75 students and 18 teachers of Physical Education.

Instruments

Among the equipment they have used a computer and video beam and Google platform.

Google services

Google services and activities used in each one were:

- **Open an account post in e-mail:** Post a passport size picture, send a message to the coordinator and send another message to the teacher of each subject mail.
- **Activate Google +:** After opening the e - mail account in the student proceeded to create their personal profile on Google +.
- **Create a circle:** Include the entire students group and all teachers.
- **Create blog each group:** Integrated 2 to 4 students with their names, where he gave a name to the group, with the aim to raise issues, posting videos of topics, send link to the professor for their respective monitoring and evaluation.
- **Hangout:** Chat information with the group and professors.
- **Talk:** Chat information with the group and professors.
- **Open Google Docs:** Searches of material, theoretical framework and background.
- **Open Google Scholar:** Dominate searches, each teacher will give you a list of books.
- **Open Google Books:** Mastering searches.
- **Activate Delicious:** To build your virtual library.
- **Create virtual library:** Al create master searches with issues related to the work of each module.
- **Skype:** Contact hereby teachers and peers.
- **Open Google Drive:** Upload documents.
- **Activate Dropbox:** Upload very heavy documents.
- **Activate Delicious:** To build your virtual library.
- **The Cloud:** Upload documents.
- **Wikipedia:** Write articles.
- **YouTube:** Create one or more videos on the subject of his undergraduate work and upload, send mail link to each teacher.
- **Seekers and Metaseekers:** Search in Google.
- **Writing techniques surveys:** After having elaborated send them to different evaluators or teachers from other parts of the world (Roman, 2014).

RESULTS

Product of open interviews and applied to the students of the Studies of Postgraduate in Physical Education in Sport Management Mentions and Theory and Methodology of Sports Training the following results were obtained:

- Use appropriate and aware of the ICT.
- Students and teachers given better time to incorporate the use of ICT in the teaching-learning process.
- Among students fluid communication existed thanks to the ICT.

- Students communicated with teachers using ICT, specifically created circles and others.
- Students sent their teachers home work by e-mail.
- Students and teachers contributed to environmental conservation due to poor use of paper and ink to reflect their productions.
- Students and teachers consulted relevant information to the area in other states and / or countries, appropriately, including in other languages through the metasearch.
- Students and teachers made use of new and creative software to carry out the teaching-learning process.
- Students and teachers make use of innovative and creative hardware to carry out the teaching-learning process.
- This study rejected traditional methodological strategies as an example: using sheets of bond paper and others to present their productions.
- Students and teachers enriched their knowledge through consultations in virtual libraries.

DISCUSSION AND CONCLUSION

Stressing that, in order to achieve quality physical education, physical activity and sport, all personnel, professional and volunteer alike, must have access to suitable training, supervision and counseling (International charter of physical education, physical activity and sport, UNESCO, 2015); the results of this study reflect the benefits and positive contributions to have a quality physical education that generated and continue to generate the use of ICT in the students of Physical Education Postgraduate, mentions: Management of Sport and Theory and Methodology of Sport Training, contributions that improve the professional and personal training of those involved having a variety of learning opportunities through the use of information technology, but otherwise this shows that it is possible for some students and teachers this process see truncated as they may lack a own team, and Venezuela purchasing costly hardware and software. In this regard it can be concluded that the use of ICT not only encourages students and teachers in terms of education, but also motivates students in a positive direction, sufficient reason that the incorporation and proper use of suggested ICT in the various subsystems and modalities of the education system, as it has been shown that these tools significantly improve the teaching-learning process and contributes to the integral formation of the person.

REFERENCES

1. Navarro, L. (2009). Investigation Project. 5-16.
2. Niler, M. (2013). Thank: A Biography of the watsons and IBM. ISBN.
3. Rebeil, M. (2006). Strategic communication in the organizations. Anáhuac University. 171-172.
4. Roman, A. (2014). More good time, less bad time. Editorial Vadell Hermanos. 142-143
5. UNESCO (2015). International charter of physical education, physical activity and sport. Preamble 8.
6. www.google.com
7. www.wikinews.com
8. www.wikimedia.com

SCREEN MEDIA USE AND BENEFITS OF MOVEMENT IN THE BRAIN UNDER DEVELOPMENT

LAURA CRISTINA STOBÄUS
UERJ – State University of Rio de Janeiro, Brazil, Rio de Janeiro

INTRODUCTION

Due to urbanization and modernization, global economy, politics, social conditions, communications and environmental changes, and it is possible to observe an expansion of transportation (which caused humans to spend less energy), an increase of buildings as dwellings in urban centers and the reduction of open areas (e.g., public parks). In addition to this growth of indoor areas, there has also been an increase in technology. As a consequence of these continuous changes, new habits have been developed over the years, such as a decline in physical activity and an increase in sedentary activities (Jackson et al., 2003). These habits lead to health problems such as obesity, depression, type II diabetes, among others (WHO, 2011). In Canada and the US, excess weight and obesity have taken epidemic proportions (Goldfield, Harvey, Grattan & Adamo, 2012): arise of 15.2% of children aged 2-5 in the overweight category and of 6.3% in the obese category. Since the 1980s, the expanded use of computerized toys and DVDs with children stories (Kopp, 2011) have produced a new household environment, where children do most activities sitting down. Children in the two-three year old age group need to have sensory and perceptual experiences in many activities. They do it by exploring the environment through their bodies, and for such, they need space and interaction with other children. These ideas are based on the theories from J. Piaget and E. Thelen (for a review, see Anderson et al., 2013). The limited space for playing could affect motor activity opportunities for children. Additionally, the growing interest of parents in leaving their children indoors, watching TV (Veitch, Bagley, Ball & Salmon, 2006), shows a strong influence of parental child-rearing practices and beliefs.

The aim of this chapter is to demonstrate that, for the two-to-three years age group, the development milestones that are reached by physical activities (movement) are extremely important. For such, the benefits of physical activity for the cognitive development will be presented, as well as the influence of genetic and socio-environmental factors. Furthermore, it will present the expansion of brain connections based on physical activities. Later, it will determine how the brain is ripening at that stage, amplifying the neural networks between brain layers and hemispheres, and therefore, emphasizing the need for a rich experience. After that, the authorwill discuss how sensory systems are not mature enough to benefit from activities in screen media and learn through them. In this chapter, the importance of movement in children under the age of three will be reinforced, providing reasons to reaffirm the APA (American Pediatric Association) statements – or your own country's Association - explaining why the media provides no beneficial or educative stimulus.

ACTIVE CHILD: A SYNONYM OF THE BRAIN BEING DEVELOPED

Physical activity is a multidimensional behavior that depends on social, biological, demographic and environmental factors associated with leisure time. As environmental

factors, the quality of playing areas, as well as the time and frequency of play have been mentioned. Biological factors are related to age, gender, ethnicity, body mass, and family obesity risks. Psychosocial factors are related to encouragement, watching TV, time spent in outdoor activities, and parental physical activity (McNeil, Kreuter and Subramanian 2006). Beliefs, attitudes and expectations of a person also exert great influence on their participation in physical activity. Australian parents felt that the issues that had more impact on activities in children leisure time were: child independence level, social aspects, attitudes in games with intense motor activity, facilities available in parks and playgrounds, safety and the environment of urban design (Veitch et al., 2006). In 2005, Burdette and Whitaker have called our attention to the fact that the amount and nature of free play were changing. The amount of time children spend in structured activities has expanded, for instance, by taking extracurricular courses. And, during leisure time, when children can play, move themselves around and perform unstructured activities, they prefer to watch TV, use tablets and computers for playing games - activities that could be seen as passive and sedentary.

There is extensive literature related to physical activity and cognition, among which, attention, memory, reaction time, language, visual-spatial coordination and executive function (Kamijo & Takeda, 2010; Kramer & Erickson, 2007; Loprinzi, Herod, Cardinal, & Noakes, 2013). Studies using electroencephalography (EEG) show an increase in neural activity in the prefrontal cortex and an improvement in visual attention tasks after physical activity (Etnier & Chang, 2009). On a cellular level, physical activity can improve cognitive function by enlarging neurotrophins and growth factors in the brain (neurogenesis), synaptic plasticity and vascular function (Ratey & Loehr, 2011). The cerebellum and the dorsolateral prefrontal cortex play important roles in cognitive functions. The hippocampus plays a central role in learning, memory and spatial skills, and its deterioration precedes and leads to memory impairment, Alzheimer's disease and depression in older adults (Loprinzi et al., 2013). Exercise-related changes in the brain are located in the motor cortex, cerebellum, and hippocampus. The studies mentioned above prove that physical activity is extremely important for brain development and also that it is related to cognitive development and socio-environmental factors. Next, the importance of early experiences on the development of children's brains will be presented.

When children are playing they are spontaneous and less interested in maintaining a single activity (Burdette & Whitaker, 2005). This is due to the developing brain reaching for opportunities to receive stimuli arising from the environment and through the activity of the body. A healthy child is active, moves quickly, and demonstrates curiosity among new objects and diverse tasks. When there is less stimulation from parents and environmental restrictions on natural movement, restraint of movement may happen (Clark, 2005). When the restrictions are removed, children show compensatory movement, proving that motion has a functional need. Smith and Hagan (1980) studied British children aged three and four who were solving tasks at school and consequently sitting for a long time. After the "abstinence" period, they ran to play with a lot of physical movement. In order to maximize the school performance of Japanese children, for instance, there are ten-minute breaks every hour between periods of intense activity (Pellegrini & Smith, 1998). This demonstrates the need for involuntary movement in this age group.

Movement and mobility are the product of environmental factors, heredity, and familiar stimuli. Early experiences in childhood are crucial to improving the motor and cognitive

skills (Clark, 2005). The dynamic interactions between various neural networks will cause the emergence in the motor skill properties. Those neural networks are composed of circuits formed by the frontoparietal cortex, cerebellum, and basal ganglia (Hikosaka, Nakamura, Sakai & Nakahara, 2002). These circuits retain the same motor sequence but with different coordinates, speeds, and levels of attention and awareness. This process is optimized by learning mechanisms, each one unique in the cerebellum and basal ganglia. Motor skills emerge from our experience, not from knowledge, because they do not go through consciousness. Each developmental change results from specific experiences in a specific context (Anderson et al., 2013).The increase in connections between the two cerebral hemispheres occurs at this stage, improving network efficiency, linking areas of the prefrontal cortex, language, hippocampus, cerebellum and basal ganglia (Herschkowitz, 2000). The right hemisphere processes representations of sensory sensations afferent from the whole body while the left hemisphere stores the semantic representation of the child's name and personal qualities. From this integration, originated from both hemispheres, the child has the "self" experience.

At the end of the second year, there is an explosion in the number of words that child understands and produces, which is influenced by genetic factors and by the opportunity to engage in verbal exchanges with caregivers. Another change in the brain during the second year is the myelination of brain-cerebellar connection and the elongation of pyramidal neuron dendrites in layer III to IV. This promotes the transfer and the integration of multimodal information into executive functions. This means that initial connections with the hippocampus, thalamus, basal ganglia and cerebellum are expanded and specialized, giving rise to higher cognitive functions, such as executive functions. They are responsible for controlling the inhibitory actions toward a target and anticipatory behavior, memory, emotional and autonomic responses. From this maturation, the child can regulate himself, can obey and control his impulsivity (Kopp, 2011). It starts with the control of sensory stimuli and modulation in early life and matures in the third year of life, when children act according to the social and moral rules (Berk, Mann & Ogan, 2006). The neurological improvement of self-regulation and all other high cognitive functions are the result of a dynamic exchange between brain activity and experience. The more experiences a person has, the more brain circuits will develop.

By looking at the experience of crawling, one can see the influence of movement on the brain. The onset of sitting and walking amplifies the exploration of the environment and has effects on sensorial and perceptual abilities and social-emotional development (Campos et al., 2000). Infants with one to four weeks of crawling experience demonstrated greater EEG power values in frontal and parietal regions of the brain than middle-level crawling experience group (5-8 weeks of experience) and long-term crawling experience group (nine or more weeks of experience). This EEG power value shows that, in anticipation of new experiences, the brain overproduced synaptic connections (Bell & Fox, 1996). Infants with increased experience in motor skills enhanced their visual exploration of faces and objects, apportionment skills, and understanding of intentional movements as goal-oriented. Balance skills are important for performance on mental rotation, which in the future, will be necessary to improve math skills (Frick & Möhring, 2016). The delayed onset of locomotion in infants, either for neurological or orthopedic reasons, has been shown to postpone the development of spatial-cognitive skills and mental rotation performance (Frick & Wang, 2014).

In summary, the first three years of life mark a period of rapid change in neural, sensory and perceptual systems that will provide support for cognitive and social skills. This lack of physical, perceptual and sensory stimuli coming from a poor environment or fewer opportunities for physical activities may have implications for their development. Associated with this, the increased use of indoor areas, extracurricular courses and the increased use of screen media lead to an overstimulation of fine motor activity. However, fine manual control, bimanual coordination and visual skills are not yet fully mature until adolescence (Diamond, 2000). There is a hierarchy in maturation skills and skip steps could lead to cognitive gaps, which can be observable on later development. The following section will address specific aspects in the use of screens, showing that the child does not have the cognitive and perceptual maturity to use them.

SCREEN MEDIA AND STIMULUS

In the 1960s, television was turned on for about 6 hours per day, increasing to seven hours in the late 1970s and 8 hours in the late 1980s (Wartella & Robb, 2011). In some cultures (such as the US and Latin America, such as Brazil), TV is on throughout the day, even if nobody is watching it (Council on Communications and Media, 2011; Stobäus & Seidl-de-Moura, in press). The same fact is not observed in countries considered "Protected by restrictions" – such as Germany, Belgium, France, among others-because the media experiences of children are restricted to certain limits, with a strong regulation by Government (Helsper et al., 2013). When observing the time spent by children on TV or any electronic media, the same pattern of watching more than two hours can be seen in several countries such as United States (Common Sense Media, 2013; Richert, Robb & Smith, 2011), Canada, Portugal, Estonia, Norway (European Youth Heart Study, Jago et al., 2008) and Brazil (Stobäus & Seidl-de-Moura, in press). Children begin watching TV at three months of age in the US (Rideout & Hamel, 2006), at 6 months in Brazil (Stobäus & Seidl-de-Moura, in press) and become regular viewers of programs for children in the first year of life.

There is a cognitive increase due to exposure to stimuli from the modernization such as new technologies and television, according to Gauvain and Munroe (2009). They studied 192 children aged three, five, seven and nine in Belize, Kenya, Nepal and American Samoa and found that the desire to explore new objects, memory recall, equilibrate blocks, motor skills, perspective taking and structured plays was strongly related to modernity in the four countries studied. In contrast, Schmidt and Vandewater (2008) found children living in communities without TV and discovered that initially they had higher creativity scores when compared to children who had access to TV. Since TV was introduced in their lives, their scores decreased or became similar to children with TV. Vandewater, Bickham and Lee (2006) studied 1712 children aged zero to twelve years old and found a negative relationship between the time that children from zero to two years were watching TV and time spent on creative games. This was confirmed by the work of Cardany (2010), in which children under five who watched TV spent less time in creative play and interacting with their parents and siblings. In an environment with poor stimuli, television can be an alternative to literary and initial language development to the child. Children from poor families who had television in their rooms got the same language scores

as children with economic advantages, which had books and good quality of interactions with their parents (Linebarger & Vaala, 2010). Children from low socioeconomic status and single mothers or mothers with low educational level spend more time in front of the TV (Rideout & Hamel, 2006). Since 2009, the American Academy of Pediatrics (APA, 2013) recommends that parents do not allow children under two years old to watch TV, and limit the time for older children to less than two hours. Instead, they encourage parents to promote interactive activities that promote brain development, such as playing, talking, singing and reading together. Only 32% of parents with children under two years old follow these guidelines (Certain & Kahn, 2002). When talking about media, we refer to TV, videos, web-based programs and DVDs watched in any traditional way or technologies with new screens (smartphones and tablets), even if the television is not seen as new technology, it is still necessary to watch DVDs, use cable TV or the internet. It seems that even children's books will become a material into disuse because many parents read to their children through Ipads or tablets (Radesky, Schumacher & Zuckerman, 2015).

Further studies providing scientific evidence on the risks and benefits of media on child development are still necessary. Questions such as whether the media can disrupt the process of attention, make the child passive, decrease the quality of social interactions, and interfere with both linguistic and cognitive development must be asked. The clear implication is that the time spent sitting, watching TV, is time that is lost for playing, developing language, having social interactions and learning from the real world. This is known as "displacement hypothesis," which was coined by Anderson and colleagues (2013), but in reality it is more than this, it is integrated to the parental believes and practices, values and opportunities in life. Regarding this age group, these activities could be critical to the development of the developing brain. What do we know about child development that can clarify those open questions and thus reaffirm the APA's statements? We know that young children do not learn in the same way as adults or older children (Courage & Setliff, 2009). This includes immature visual processing, information transfer, and mental representation. Learning means capturing and retaining information. The perceptual and cognitive systems of the child are not mature enough to transfer the information coming from screens into spatial and temporal contexts; this will be possible only after 18 to 24 months of age (Richards, 2010). Why does a child not learn when information is presented on a screen (DVD or tablets)? Because: 1) they have immature visual skills. Children under 3 months old cannot see the content of the videos with the same clarity as older children. One must have visual acuity, contrast sensitivity, depth perception and fully-developed color vision, which happens only after six months and fully maturated at two years old (Wartella, Richert & Robb, 2010). Furthermore, it is necessary for the viewer to know the codes and conventions that characterize the television as a communication vehicle. Visual transitions (zooms, cuts, wipes, fade) used to transmit information about content or changes of scenes do not correspond to real life. Children do not make this transposition of information. 2) Another difficulty in learning from videos comes from the transfer of information acquired in a 2D format (two-dimensional video format) to a3D format (reallife). This is due to the perception code (as explained above) and the difficulty of representations, i.e. understanding that there is a symbol and its meaning (Troseth & DeLoache, 1998). Why does the baby look at the video as if he were extremely interested (or hypnotized)? Newborns have peripheral vision, their motion detection is excellent

and their auditory system allows the perception of sounds, music, and voices (Courage & Setliff, 2009). Videos targeting children are produced to have these stimuli incorporated and associated with zooms, cuts, and fades, which together cause them to stare at the screen, which is known as "attentional inertia" (Richards, 2010). At the end of the first year, their attention is directed to the screen when it shows something new (surprise) or familiar (by repetition), but not by an understanding of the content. This understanding will begin at the end of the second year of life. The six-month-old child looks at the TV for 11% of the time available, with 36% of the time for the 36-month-old child and 60% of the time forfive-year-old children. This rises is due to the fact that their level of understanding is increasing (Barr et al., 2007). The benefits or detriments of videos cannot occur before 18 months of age, but may occur from two years on.

The screen media are not a unitary construct and need to be contextualized in multiple levels of analysis. In summary, exposure time must be considered, as well as other variables such as the content of the material (education), its form (interactive or not), the age and cognitive level of those watching it, individual differences (preference and motivation to watch), the context of witnessing (co-watching parents and parental beliefs and attitudes) and what kind of watching it refers to (active or passive; background or foreground) (Cingel & Krcmar, 2013; Vandewater et al., 2005). The massive use of TV and technologies in general may be a sign of a parenting style. It cannot be assumed that parents will increase the stimulation of the child if the TV is turned off (Vandewater, Bickham & Lee, 2006). Effective strategies to reduce the use of media by children need to address the parents, the family environment, and their behavior when using the media (Lauricella, Wartella & Rideout, 2015). The research carried out in Europe (EU Kids Online, Helsper et al., 2013) showed that factors such as cultural differences, information and communication technology, broadcasting and public policy, family dynamics, educational system, traditions, and specific country values contribute to the internet being a space of opportunities, risks and/or losses and thus, everywhere, children need the mediation of their parents.

CONCLUSION

The aim of this chapter is to show that the brain goes through great development in the ages of two and three years old, as well as presenting development milestones (at this age group) that make physical activities be considered as of extreme importance. In order to elucidate this, the benefits of physical activity on cognitive development and the influence of hereditary and socio-environmental factors are presented. It demonstrated how sensory and perceptual systems are not yet mature enough for young children to benefit from the screen media, reaffirming the APA's statements. Children are increasingly using screen media and are playing less outdoors. This decrease of free spaces suggests a lack of environmental exploration in an age of extreme importance for gross motor activities and for the development of their motor and cognitive skills with quality. Maybe there will be a generation with a gap in their development. We can already see a generation presenting balance difficulties, like problems to ride a bike, or what some authors are calling 'motor illiterate'. Research is necessary to prove this.

There seems to be a distinct period in the development of the ability to use digital devices. Before the age of three, the visual-coordination skills, attention and language of a child is not

maturated enough to engage in such devices.The expansion of the child's vocabulary is not affected by the TV, but by the education and the participation of parents in using the child media. It is not the media exposure that negatively influences language acquisition and the development of traditional education, but the absence of interaction at the appropriate age and guidance by the parents. New forms of child rearing are now seen, such as going to restaurants and giving the child a tablet to play or watch videos on in order to remain quiet. Many parents are happy when they are at home involved in household chores and their children are watching TV, sitting and calm. The media substitutes baby sisters or is used as a form of bargaining. For this age group, a good solution would be to clarify to the parents that this phase of "active child", with lots of movement, will pass and that children will gradually decrease their exploration of the environment.

Media technologies are still a new area, where new research methods are being developed to better understand their impacts. New approaches need to be developed, formulated, systematically tested, confirmed or rejected, modified and then retested in different contexts and with different variations. But the importance of physical activity on health and well-being of the individual is an old theme, which has been expanded by new brain imaging techniques. Many children and adolescents do not follow the physical activity guidelines and exceed the recommended amount of time watching TV. This is happening in many countries, but we still have the opportunity to change this path, bringing well-being to our community through knowledge. It is clear how much parents exert influence on the behavior of their children in physical activities andin time spentwatching TV and using other media. It is the role of Physical Educators to explain to parents the importance of physical activity and show that the use of media must be delayed to a stage after three years of age, and provide knowledge to parents that this period is crucial to the child's development. Ideally, it should be postponed until six years old. It is up to governments to implement public development policies for this age group, including generating positive attitudes for the prevention of obesity and excess weight in children and awareness of the use of media. Our urban spaces should be enhanced and valued, with the creation of parks developed with structures that enhance child development.

REFERENCES

1. American Academy of Pediatrics (2013). Children, adolescents, and the media. *Pediatrics*, 132 (5), 958-961. http://dx.doi.org/10.1542/peds.2013-2656.
2. Anderson, D., Campos, J., Witherington, D., Dahl, A., Rivera, M., He, M., Uchiyama, I. and Barbu-Roth, M. (2013). The role of locomotion in psychological development. *Frontiers in Psychol.*, 4, 1-17.
3. Barr, R., Muentener, P., Garcia, A., Fujimoto, M. and Chavez, V. (2007). The effect of repetition on imitation from television during infancy. *Developmental Psychobiology*, 49, 196-207.
4. Bell, M. A. and Fox, N. A. (1996). Crawling experience is related to changes in cortical organization during infancy: evidence from EEG coherence. *Developmental Psychobiology,* 29, 551-561.
5. Berk, L. E., Mann, T. D. and Ogan, A. T. (2006). Make-believe play: wellspring for development of self-regulation. In: Singer, D. G., Golinkoff, R. M. and Hirsh-Pasek, K. (eds.) *Play=learning. How play motivates and enhances children`s cognitive and social-emotional growth*. New York: Oxford University Press, 74-100.
6. Burdette, H. L. and Whitaker, R. C. (2005). Resurrecting free play in young children. *Arch pediatric Adolesc Med*, 159: 46-50.

7. Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J. and Witherington, D. (2000). Travel broadens the mind. *Infancy,* 1, 149-219. Doi: 10.1207/S15327078IN0102_1
8. Cardany, A. B. (2010). Screen media and young children: who benefits? *Gen.Music Today*, 24(1) 50-55.
9. Certain, L. K. and Kahn, R. S. (2002). Prevalence, correlates, and trajectory of television viewing among infants and toddlers. *Pediatrics*, 109, 634-642.
10. Cingel, D. and Krcmar, M. (2013). Predicting children`s media use in very young children: the role of demographics and parent attitudes. *Communication Studies*, 64, 374-394.
11. Clark, J. E. (2005). From the beginning: a developmental perspective on movement and mobility. *QUEST*, 57, 37-45.
12. Common Sense Media (2013). Zero to Eight: Children's media use in America. http://www.commonsensemedia.org/research/zero-t-eight-childrens-media-use-in-america-2013
13. Council on Communications and Media (2011). Media use by children younger than 2 years. *Pediatrics*, 128 (5), 1040-1045.
14. Courage, M. L. and Setliff, A. E. (2009). Debating the impact of television and video material on very young children: attention, learning, and the developing brain. *Child Dev.Perspectives*, 3, 72-78.
15. Diamond, A. (2000). Close interrelation of motor development and cognitive development and of the cerebellum and prefontral cortex. *Child Development*, 71 (1), 44-56.
16. Etnier, J. L. and Chang, Y. K. (2009). The effect of physical activity on executive function: a brief commentary on definitions, measurement issues, and the current state of the literature. *J. of Sport and Exercise Psychology,* 31, 469-483.
17. Frick, A. and Mohring, W. (2016). A matter of balance: motor control is related to children`s spatial and proportional reasoning skills. *Frontiers in Psychology*, 6, article 2049. Doi:10.3389/fpsyg.2015.02049
18. Frick, A. and Wang, S. (2014). Mental spatial transformations in 14- and 16-month-old infants: effects of action and observational experience. *Child Dev*., 85, 278-293. Doi: 10.1111/cdev.12116
19. Gauvain, M. and Munroe, R. L. (2009). Contributions of societal modernity to cognitive development: a comparison of four cultures. *Child Development*, 80 (6), 1628-1642.
20. Goldfield, G. S., Harvey, A., Grattan, K. and Adamo, K. B. (2012). Physical activity promotion in the preschool years: a critical period to intervene. *Int. J. of Envir. Res. and P. H.*, 9: 1326-1342.
21. Helsper, E. J., Kalmus, V., Hasebrink, U., Sagvari, B. and de Haan, J. (2013) Country classification: opportunities, risks, harm and parental mediation. EU Kids Online, The London School of Economics and Political Science, London. http://eprints.lse.ac.uk/52023/
22. Herschkowitz, N. (2000). Neurological bases of behavioral development in infancy. *Brain & Development*, 22: 411-416.
23. Hikosaka, O., Nakamura, K., Sakai, K. and Nakahara, H. (2002). Central mechanisms of motor skill learning. *Current opinion in Neurobiology*, 12: 217-222.
24. Jackson, D., Reilly, J., Kelly, L., Montgomery, C., Grant, S. and Paton, J. (2003). Objectively measures physical activity in a representative sample of 3-to4-year-old children. *Obes, Res*, 11(3), 420-425.
25. Jago, R., Page, A., Froberg, K., Sardinha, L. , Klasson-Heggebø and Andersen, L. (2008). Screen-viewing and the home TV environment: The European Youth Heart Study. *Prev. Med.*, 47, 525-529.
26. Kamijo, K., Takeda, Y. (2010). Regular physical activity improves executive function during task switching in young adults. *International Journal of Psychophysiology*, 75, 304-311.
27. Kopp, C. (2011). Development in the early years: socialization, motor development, and consciousness. *Annual Review of Psychology*, 62, 165-187.
28. Kramer, A. F. and Erickson, K. I. (2007). Capitalizing on cortical plasticity: influence of physical activity on cognition and brain function. *Trends in Cognitive Sciences*, 11, 342-348.

29. Lauricella, A. R., Wartella, E. and Rideout, V. J. (2015). Young children`s screen time: the complex role of parent and child factors. J. of A. Dev. Psychology, 36, 11-17.
30. Linebarger, D. L., and Vaala, S. E. (2010). Screen media and language development in infants and toddlers: An ecological perspective. *Developmental Review*, 30(2), 176-202.
31. Loprinzi, P. D., Herod, S. M., Cardinal, B. J. and Noakes, T. D. (2013). Physical activity and the brain: a review of this dynamic, bi-directional relationship. *Brain Research*, 1539, 95-104.
32. McNeil, L. H., Kreuter, M. W. and Subramanian, S. V. (2006). Social environment and psysical activity: a review of concepts and evidence. *Social Science & Medicine*, 63:1011-1022.
33. Pellegrini, A. D. and Smith, P. K. (1998). Physical activity play: the nature and function of a neglected aspect of play. *Child Development*, 69 (3), 577-598.
34. Radesky, J. S., Schumacher, J. and Zuckerman, B. (2015). Mobile and interactive media use by young children: the good, the bad, and the unknown. *Pediatrics*, 135 (1), 1-3.
35. Ratey, J. J. and Loehr, J. E. (2011). The positive impact of physical activity on cognition during adulthood: a review of underlying mechanisms, evidence and recommendations. *Reviews in the Neurosciences*, 22, 171-185.
36. Richards, J. E. (2010). Video characteristics and infants' attention to television: behavioral and Psychophysiological measures. *Developmental Review*, 30, 203-219.
37. Richert, R. A., Robb, M. B. and Smith, E. I. (2011) Media as social partners: the social nature of young children's learning from screen media. *Child Development*, 82 (1), 82-95.
38. Rideout, V. J. and Hamel, E. (2006). *The Media Family: electronic media in the lives of infants, Toddlers, preschoolers, and their parents*. Menlo Park, CA: The Henry J. Kaiser Family Foundation.
39. Schmidt, M. E. and Vandewater, E. A. (2008). Media and attention, Cognition, and school achievement. *The Future of Children*, 18 (1), 63-85.
40. Smith, P. K. and Hagan, T. (1980). Effects of deprivation on exercise play in nursery School children. *Animal Behavior*, 28, 922-928.
41. Stobäus. L. C. and Seidl-de-Moura, M. L. (in press). Environments for play and technologies' use in 24 to 36 months children from Rio de Janeiro, Brazil. *Child Development*.
42. Troseth, G. L. and DeLoache, J. S. (1998). The medium can obscure the message: Young children's understanding of video. *Child Development*, 69, 950-965.
43. Vandewater, E. A., Bickham, D. S. e Lee, J. H. (2006). Time well spent? Relating television use to children's free-time activities. *Pediatrics*, 117 (2) e181-e191. Doi:10.1542/peds.2005-0812
44. Vandewater, E., Bickham, D., Lee, J. H., Cummings, H., Wartella, E., and Rideout, V. (2005). When the television is always on: heavy television exposure and young children`s development. *American Behavioral Scientist*, 48 (5), 562-577.
45. Veitch, J., Bagley, S., Ball, K. and Salmon, J. (2006). Where do children usually play? A qualitative study of parents' perceptions of influences on children's active free-play. *Health and Place*, 12, 383-393.
46. Wartella E., Richert, R. and Robb, M. (2010). Babies, television and videos: how did we get here? *Developmental Review*, 30, 116-127. Doi: 10.1016/j.dr.2010.03.008
47. Wartella E. and Robb, M. (2011). Historical and recurring concerns about children's use of the mass media. In: S. L. Calvert and B. J. Wilson, *The Handbook of Children, Media, and Development.* UK: Wiley-Blackwell. 7-26.
48. World Health Organization (WHO). (2011) *Obesity and Overweight factsheet from the WHO* [Online]. Available from:http://www.thehealthwell.info/node/82914 [Accessed: 24th February 2016].

ASSISTING PHYSICAL EDUCATION THROUGH MULTIMEDIA ELECTRONIC MATERIALS

HANA ŠERÁKOVÁ, HANA JANOŠKOVÁ
Faculty of Education, Masaryk University, Brno, the Czech Republic

INTRODUCTION

The main goals of physical education are to strengthen health, develop movement skills, influence psyche, morals and attitudes, facilitate experiences and build a positive attitude towards physical activities. Dvořáková references several researches concerning popularity of physical education and the links between popularity of the subject, popularity of the teacher and the class content in the beginning of her book "Školáci v pohybu" (2012). They show that the stronger the teacher´s personality and the more interesting the class content is, the more popular the physical education is with the children.

In physical education didactics, the physical education class is divided into an introduction part that includes greeting, explanation of the class plan, motivation and warm-up (aka the lively part, lively activities), followed by a preparatory part consisting of joint-mobilization exercises, stretching exercises, strengthening exercises and coordination exercises. Then come a main part of the class (practice and training) and a concluding part. Each part has its content and organization. (Dvořáková 2012, Fialová 2010, Vilímová 2009, Belšan 1984, Mužík, Krejčí 1997 et al.). The preparatory part tends to be ranked among the least favourite parts of a class because it´s usually not interesting to children and they often do not know why it is important to warm the organism up and prepare it for further strain. Nevertheless, this part can be done in an interesting and engaging way through motivation and appropriate selection of the individual exercises (Janošková, Šeráková 2015). If the children also gain information about the objective of performing the individual exercises, the connection of the exercise to health, how to perform it properly and what the exercise is called (whether terminologically or motivationally), it will be more accessible to them and they will be able to incorporate it correctly and use it in their warm-up before any physical activity (Sivák 2001, Dvořáková 2012, Mužík, Krejčí 1997). Dvořáková (2012), Mužík, Krejčí (1997), Jebavý (2014) and other authors also agree that ineffective, static and uninspiring exercises (for example lengthy head-circling while standing up) are often used in the warm-up.

Janošková and Šeráková have done a research concerning the preparation and realization of a warm-up for 210 students of the first through fourth year of the Teaching for the First level of primary school study program during the period of 2013-2015 which showed that 67 % of students have difficulties putting together appropriate warm-up. According to 72 % of the students´ responses, the supply of methodical materials focused on warm-up for children of younger school age is insufficient. In the case of internet sources, there are more materials but the respondents thought (in 58 % of the responses) that there is no evaluation of the quality and appropriateness of use for the stated age category.

ELECTRONIC PUBLICATIONS ASSISTANCE IN TEACHING WARM-UP IN PHYSICAL EDUCATION

To improve the quality of teaching and make methodical publications more accessible, reviewed teaching materials were created at the Department of Physical Education of the Faculty of Education MU in coordination with the E-learning Service Centre at MU (http://is.muni.cz/elportal/stech/), which is part of the user support of the Information system of the Masaryk University. The creation of these materials has been supported by a project of the Centre of interactive and multimedia study supports for education innovation and effective teaching from the programme framework Operational programme Education for competitiveness (http://is.muni.cz/elportal/opvk22_2012/).

The first electronic publication that emerged from this cooperation is called "Suggestions for warm-up without accessories for children of younger school age" (http://elportal.cz/publikace/rozcviceni-bez-nacini) and it offers an array of exercises without accessories – stretching, strengthening, dynamic and coordination exercises.

NÁMĚTY NA ROZCVIČENÍ BEZ NÁČINÍ PRO DĚTI MLADŠÍHO ŠKOLNÍHO VĚKU

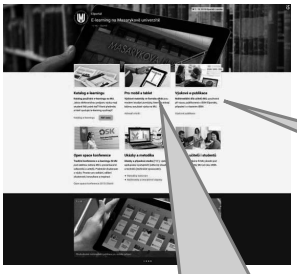
SUGGESTIONS FOR WARM-UP WITHOUT ACCESSORIES FOR CHILDREN OF YOUNGER SCHOOL AGE

MASARYKOVA UNIVERZITA
ELPORTÁL

In a similar way, other electronic publications have been created: "Suggestions for warm-up with accessories for children of younger school age" (now in development) that includes exercising with a big ball, a soft ball, a jumping rope, a pole and a towel for the aforementioned age category and "Suggestions for exercises for children of pre-school age" (also in development).

"Suggestions for warm-up without accessories for children of younger school age" (http://elportal.cz/publikace/rozcviceni-bez-nacini) is available in two formats on the Elportal of the Masaryk University in Brno, as a multimedia teaching publication (ISSN 1802-128X) with its own ISBN and as a publication in the e Pub format for mobile devices and tablets.

In total, 10 HTML pages, 79 tables and 71 video instructions, which the users can play directly on the page, have been composed.



The "Suggestions for warm-up without accessories..." publication has been published on elportal.cz (ISSN 1802-128X) and it has its own ISBN.

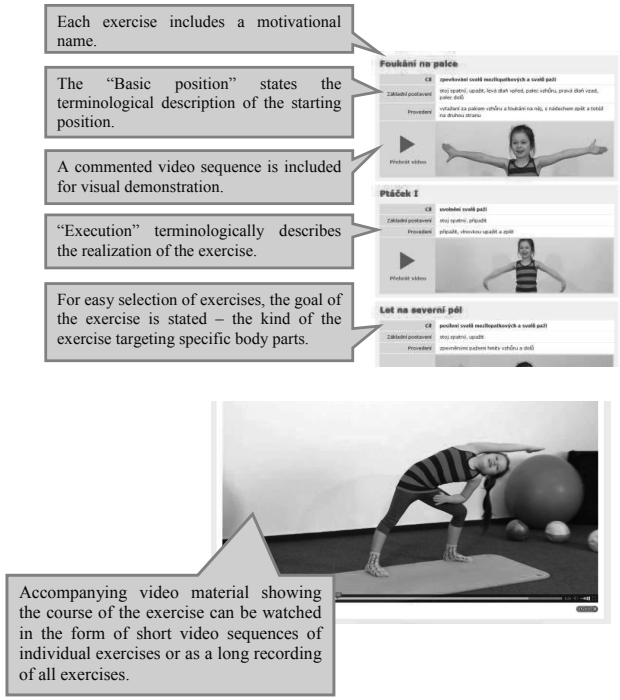
The reviewed electronic publication "Suggestions for warm-up without accessories..." is available also in a version for mobile devices and tablets in the form of an e-book.

The Electronic teaching publications and courses page allows for easy orientation in searching publications by fields. "Suggestions for warm-up without accessories..." can be found under the Pedagogy keyword.

Upon entering the publication, you can easily study the individual chapters thanks to the well arranged menu. The Introduction contains basic information on the theory of warm-up for the first level of primary school, the chapters Exercises without accessories, Dynamic and coordination exercises and Stretching can be searched for specific exercises.

The well arranged menu allows for easy orientation in individual chapters. Each of the chapters contains text and video, which explains the execution of the exercises.

Unified textual instructions and video materials help ease the selection of exercises. Each of the offered exercises is completed with motivation, the effect, the terminological description of the starting position and the execution. The execution can also be watched on a video with a commentary.



The overview of activities, time allocations and technical details concerning the realization of the electronic publications is stated in tables 1 and 2. In total, 6 people took part in the development of the materials (two technicians of the E-learning Service Centre IS MU, two authors and two instructors). The stated details characterize the work and time allocations for the development of the "without accessories" publication in completion, and the "with accessories" and "for pre-school children" publications in part (to the date of December 1, 2015)..

Tab. 1 Overview of activities and time allocations during the electronic publications realization – executed by two technicians of the E-learning Service Centre IS MU

Filming – total hours	37
Number of video cameras	2
Studio lighting	yes
Sound recording	instructor´s lapel microphone
Video length – total hours	24
Editing – total hours	12

Processing of the recorded video (synchronization, unifying the colours across recordings from different video cameras and across recordings from different filming days), preparation and insertion of subtitles and processing of the first part including the multimedia e-book – total hours	129

Tab. 2 Overview of activities and time allocations during the electronic publications realization – executed by the publication authors (Hana Janošková a Hana Šeráková)

Filming – total hours	37
Video length – total hours	24
Editing preparation – total hours	71
Editing – total hours	12
Preparation of descriptions, motivations, effects, introductions – total hours	168
Processing gymnastic descriptions	64
Proofreading of the final treatment	18

CONCLUSION

Modern electronic study materials allow for easy orientation in the field and they bring new ideas and viewpoints to already used methods. The presented methodical material "Suggestions for warm-up without accessories for children of younger school age" meets high standards of demonstrativeness, expertise and technical work. New modern technologies improve the quality of the teaching process of physical education at the Department of Physical Education of the Faculty of Education of the Masaryk University and they are reviewed very positively by the students.

REFERENCES

1. BELŠAN, P. *Tělesná výchova pro 1. a 2. ročník základní školy*. 4, změněné vydání. Praha: SPN, 1984. 375 s. *Centrum interaktivních a multimediálních studijních opor pro inovaci výuky a efektivní učení. Projekt OpVk 2012–2015* [online]. Brno: Masarykova univerzita [cit. 2015-12-1]. Elportál. Dostupné z: < http://is.muni.cz/elportal/opvk22_2012/>.
2. DVOŘÁKOVÁ, H. *Školáci v pohybu*. 1. vyd. Praha: Grada Publishing, a.s., 2012. 144 s. ISBN 978-80-247-3733-1.
3. FIALOVÁ, L. *Aktuální témata didaktiky: Školní tělesná výchova*. Praha: Karolinum, 2010, 151 s. ISBN 978-80-246-1854-8.
4. JANOŠKOVÁ, H., ŠERÁKOVÁ, H. *Náměty na rozcvičení bez náčiní pro děti mladšího školního věku* [online]. 1 vyd. Brno: Masarykova univerzita, 2015 [cit. 2015-12-2]. Elportál. Dostupné z: <http://is.muni.cz/elportal/?id=1319456>. ISBN 978-80-210-8076-8, 978-80-210-8077-5 (epub). ISSN 1802-128X.
5. JEBAVÝ, Radim, KAPLAN, A. HOJKA, V. (2014). *Rozcvičení ve školní tělesné výchově (I. část)*. Těl. Vých. Mlád., roč. 80, č. 5/2014, s. 11 – 15. ISSN1210-7689.
6. MUŽÍK, V., KREJČÍ, M. *Tělesná výchova a zdraví*. 1. vyd. Olomouc: Hanex, 1997. 144 s. ISBN 80-85783-17-7.
7. SIVÁK, J. et al. *Telesná výchova 1. – 4. ročník ZŠ, štandardy, metodika, testy*. 1. vyd. Bratislava: PdF UK, 2001. 118 s. ISBN 80-8046-123-6.
8. VILÍMOVÁ, Vlasta. *Didaktika tělesné výchovy*. 2. přeprac. vyd. Brno: Masarykova univerzita, 2009. 144 s. ISBN 978-80-210-4936-9.

TRX TRAINING IN PHYSICAL EDUCATION

PAVEL ŠMELA
Comenius University, Faculty of Physical Education and Sports, Bratislava, Slovak Republic

The benefits of Physical Education

The compulsory Physical Education is becoming still less and less attractive for students despite the fact it is only physically active subject in relation to other subjects. It relieves tension and stress, boosts physical and mental energy, and enhances well-being through the release of endorphins, which helps to stay focused during the rest of the school day. The parents of today are lacking physical activity as well and therefore kids do not form the habit to do regular exercise at home. As a result students do not develop an interest in Physical Education (Řepka, 2005, Šmela, Peráčková, 2012).

The new approach can be seen in upbringing and education of child. Quality health and physical education programs can be life-changing for today´s young people. From a global perspective, the attention must be focused on adopting a positive attitude towards the long-life physical activity (Frömel, Novosad, Svozil, 1999). The content and form of teaching physical education at schools should be based on the actual demand on students with a view to their activation and implementation of activities into the extracurricular sports activities (Šmela, 2014).

It is inevitable to react promptly to new trends in education of physical activity. It should be designed to meet the needs of wide range of student interest. It is necessarily emphasize the importance of physical activity in the developed countries. The physical activity becomes a part of culture, promote well – being of people and the whole society. Investing in sports brings positive results for society and becomes an important component in economics (Slezák, Melicher, 2007).

Functional 3D training

Not only in sports, but also in daily activities, we have to move in multiple planes of motion at once. Negative of traditional resistance training on machines, but also free weights training is that, these kind of training limit the planes of motion during exercise (Tash Fitness, 2016).

Inspiration for functional 3D training are movements and knowledge from rehabilitation and physiotherapy training. Functional training is modelled on the basis of results of muscle function test results. The aim of 3D training is improve physical fitness and muscular coordination. It is also perfect means how to build healthy lifestyle in all age groups. The next benefits of this training is that it is possible to use also with indisposed individuals people. Many of its exercises are based on common everyday activities. These exercises require coordination and fluid (Pastucha, Filipcikova, Bezdickova, 2012, Kyselovičová, 2014).

The emphasis is quality of perceived movements of this training. Because our body during daily activities moves as an integrated unit, therefore also character of training has to be as close

is possible. Individual structure of exercises should help carry our common daily activities with lower risk of injury. Benefits of 3D functional training are to greater muscular balance and strengthening of the spine stabilization system. Effect of 3D training is also in positive impact on articular stability and contributes to preventing musculoskeletal injuries. Regular functional training tries to memorize muscular function and get better everyday physical activites (Dylevský, 2009).

"Functional 3D training is an effective method for strengthening the postural muscles of the human body increasing articular stability, strengthening the ligaments and increasing the stability of muscle groups-especially of the back muscles during training for improving the lung capacity. The method of functional training is also of considerable significance in activating the pelvic floor muscles and the pelvic-trochanteric muscles for gynegymnastics and incontinence prevention in the falls in the case of patients with neurodegenerative diseases and in the therapy of obesity in children and adults" (Pastucha, Filipcikova, Bezdickova, 2012).

TRX - Training Resistance Exercise

TRX exists in different forms for hundred years. Systematic bodyweight training exercise was already practiced by Roman legions. The creator of TRX is Randy Hetrick, who employed his experiences from the quality army trainings (Hajnovič, 2010).

"The TRX system is a unique suspension system, which uses movement in all three planes for exercising with the possibility of adjusting the level of difficulty and the incorporation of additional balancing tools. Suspension training is characterized by one or more hands or feet supported by a single anchor point while the opposite end of the body is in contact with the ground. It uses own body-weight as resistance and takes advantage of stability to load and unload exercises" (Kapanji, 1974).

TRX system integrates many different physical movements in different anatomical levels. In TRX, the body uses more kinds of muscular groups in one exercise. (Jebavý, 2014).

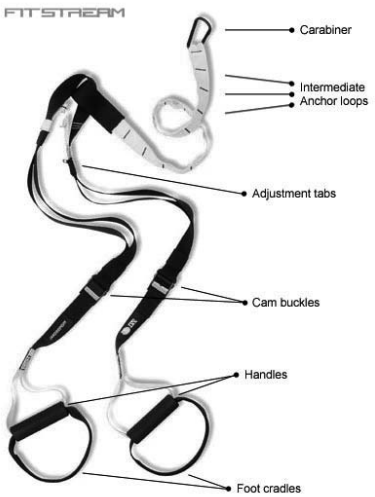


Fig 1. TRX (Training Resistance Exercise)

During all exercises the body must be engaged as one coordinated system. In particular, the core muscles are activated to maintain the required positions during dynamic movements in the exercises. To coordinate these three-dimensional exercises, neuromuscular coordination is one key aspect of TRX training. (Gaedke, Motar, 2015).

The benefit of this exercise is mainly in collaboration of the all muscles, the whole body as one unit.

Thanks to reinforcement of postural muscles and collaboration between specific muscular groups in TRX are trained not only muscles but also their antagonists, agonists and synergists, which helps to improve the correct body posture.

TRX is important for the development and obtaining more flexibility and therefore it allows to use gravity as a component to improving flexibility and unification of movement.

Resistance exercises performed in unstable body positions have been hypothesized to increase the muscular strength and muscular endurance of the core musculature, which may translate to more powerful and efficient movement patterns and less risk of Indry. The entire system has great use, apart from in cardio and strength fitness training, mainly in smooth physiotherapy for muscle imbalance, disorders of knee stability, chronic "low back pain" conditions, strengthening the deep stabilization system of the body, strengthening the pelvic floor muscles and so on (Bettendorf, 2010).

Principles of exercises TRX

Sláma (2011) formulates several rules when exercising the TRX:

- The correct technique of the exercise is possible only if the exercise is controlled in all the points. In case of jerky movements there is a risk of injury, in particular of the back muscles.
- The prerequisite for the fluent execution of the exercise is the determination of the correct body position before the execution of the exercise itself.
- The sequence of the exercise must be finished with steady level of the technique. If the exerciser does not have enough strength to finish the sequence, he or she is allowed to choose the less difficult variant of the exercise.
- The straps must remain tight for the full duration of the execution of the exercise. Loose and slack straps decrease the difficulty of the movement and the quality of the training.
- For one's own safety and comfort, the straps should not be scratching the arms. This happens in case of incorrect execution of the pressures to the chest (push-ups) with the hanging by the hands.
- During the altering movement of the first and the second strap, it is necessary to watch the straps, so they do not slip in the TRX loop. Both the straps need constantly to be equally weighted.
- During the exercise the body needs to be kept straight for the involvement of the deep stabilization system. If this is not happening, there is a possibility of the injury of the back muscles and the exercise is not effective.

- The execution of the exercise in the forearm plank position is more stable, it demands less strength of the upper part of the body and less energy input.

The exercise on the TRX uses six basic positions:

1. Stance facing the anchor point
2. Stance with the back against the anchor point
3. Stance with one side against the anchor point
4. Lying position
5. Forearm plank position / Front support
6. Lying position on the right or left side

Levels of exercises TRX

In his article, Dubina (2013) presents the ways to increase the difficulty of the exercising on the TRX. The TRX system enables the sequence of the exercises to include the changes of the weight, the decrease in the stability, or the combination of both, which is perceived as the intensity. There are three basic methods of adjusting the difficulty of the exercising on the TRX, which are using different physical principles:

1. Vector Resistance Principle – the change of the angle of the body. The sharper the angle of the body is, the more increased is the difficulty of the exercise.

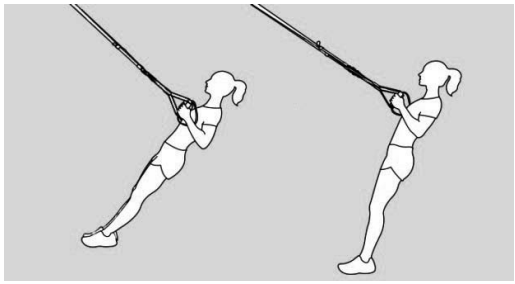


Fig 2. Vector Resistance Principle

2. Pendulum Principle – the change of the initial position relative to the anchor point.

The TRX in the neutral position under the anchor point is oriented directly downwards. The shift from the initial position to the other side relative to the neutral position causes a swing of the TRX in the direction of the movement thanks to the gravity. This facilitates the execution of the exercise with less strength and vice versa.

3. Stability Principle – the change of the size and the position of the basic supporting point. The stability is the function of the relation of one's centre of gravity and his or her basic supporting point.

This means that the more the centre of gravity shifts away from our basic supporting point, the less stable the position is and the body tends to overturn or to rotate. These rotational forces have to be joined by force in order to stabilize the position of the body (Dubina, 2016).

The ration of the weight always must come out of the individual dispositions and the purpose, for which is the exercise applied. That means the gradual increase of the weight

according to the individual abilities and not to tend to haste anything at the expense of the health aspects. If one wants to increase gradually the level of the physical condition, the increase of the weight must correspond with it. In any case, it is convenient to make the diagnostics, or rather the data archiving, which testifies of the achieved parameters (Kristofic, 2007).

EXAMPLES OF EXERCISES TRX:

Fig 3a Squat – start

Fig 3b Squat – movement

Fig. 4a Lunge with jump – start

Fig. 4b Lunge with jump – movement

Fig. 4c Lunge with jump – movement

Fig. 5 Plank

Fig. 6a Mountain Climber – start

Fig. 6b Mountain Climber – movement

Fig. 7a Low Row – start

Fig. 7b Low Row – movement

Fig. 8a Chest Press - start

Fig. 8b Chest Press - movement

Fig. 9a Lower Back Stretch - start

Fig. 9b Lower Back Stretch – movement

Fig. 10a Standing Figure-Four Stretch - start

Fig. 10b Standing Figure-Four Stretch – movement

Fig. 10c Standing Figure-Four Stretch - movement

This article was created with support VEGA 1/0429/16 grant „New Technologies in Physical and Sport Education and Their Effects on an Affective and a Cognitive Development of Secondary School Pupil “

REFERENCES

1. Bettendorf, B. (2010). *TRX Suspension Training Bodyweight Exercises: Scientific Foundations and Practical Applications*. San Francisco: Fitness Anywhere Inc.
2. Dubina, L. (2016, March 28). *3 způsoby jak změnit obtížnost cviku na TRX*. Retrived from: http://www.trxsystem.cz/3-zpusoby-jak-zmenit-obtiznost-cviku-na-trx/
3. Dylevský, I. (2009). *Speciální kineziologie*. Praha: Grada.
4. Frömel, K., Novosad, J., Svozil, Z. (1999). *Pohybová aktivita a sportovní zájmy mládeže* (1st ed). Olomouc, Univerzita Palackého v Olomouci.
5. Gaedke, A., Motar, T. (2015). TRX Suspension Training: A New Functional Training Approach for Older Adults – Development, Training Control and Feasibility. *International Journal of Exercise Science*, 8(3), pp. 224.
6. Hajnovič, M. (2010). *TRX: Závěsný trénink*. Diploma Thesis. Brno: FSS MU.
7. Jebavý, R., Zumr, T. (2014). *Posilování s balančními pomůckami* (2nd ed). Praha: Grada.
8. Kapanji, I.A. (1974). *The Physiology of the joints. The Trunk And The Vertebral Column* (2nd ed.). (pp. 15-17; pp. 100-101; pp. 112-113). Edinburgh & London & New York: Churchill Livingstone.
9. Krištofič, J. (2007). *Kondiční trénink.* Praha: Grada Publisching.
10. Kyselovičová, O. (2014). Moderné technológie a prostriedky a ich využitie vo vyučovaní a pri motivacii žiakov k pohybovým a športovým aktivitám. In Antala, B., et al., *Telesná a športová výchova a súčasná škola* (pp. 267 – 262). Národné športové centrum v spolupráci s Fakultou telesnej výchovy a športu UK v Bratislave, Bratislava.
11. Pastucha, D., Filipcikova, R., Bezdickova, M., et al. (2012). Clinical anatomy aspects of functional 3D training – case study. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Republic*, *156*(1), 63–69.
12. Řepka, E. (2005). *Motivace žáků ve školní tělesné výchově.* České Budějovice, Jihočeská univerzita.

13. Sláma, L. (2011). *Využití TRX – závěsného tréninku u hráče ledního hokeje*. Bachelor Thesis. Brno: Faculty of Sport Studies MU.
14. Slezák, J., & Melicher, A. (2007). Školská telesná a športová výchova je jedinečným prostriedkom pre výchovu žiakov. In Labudová, J., et al., *Tvorba kurikula telesnej výchovy v rámci transformácie vzdelávania v Slovenskej republike* (pp. 53-76). Bratislava: UK FTVŠ.
15. Šmela, P. (2014). *Vliv kondičního programu v školní tělesné výchově na motivaci ke cvičení žáků vybraného gymnázia na Slovensku a v Rakousku*. Dissertation. Bratislava: FTVŠ UK.
16. Šmela, P., Peráčková, J. (2012). Účinnosť tematického celku kondičné cvičenie na gymnáziu. In Telesná výchova & šport, 22(2), pp.2-6. Slovenská vedecká spoločnosť pre telesnú výchovu a šport s podporou FTVŠ UK, Bratislava
17. Tash Fitness. (2016, March 28). *Trx Premier Ilinois*. Retrived from: http://tashfitness.com/classes/TRX-Suspension-Training
18. TRX. (2016, March 28). *What is TRX Suspension Training?* Fitness Anywhere, Ind., San Francisco. Retrived from: http://www.trxtraining.com/suspension-training

Figurate

1. Kettlebell Instructor Digital Certification, 2012, Jordan Training Academy, Cambridgeshire, United Kingdom.
2. Trubiroha, A. (2013) *Využití funkčního tréninku a TRX v kondiční přípravě fotbalistů*. Bachelor Thesis. Brno: Faculty of Sport Studies MU.

TEACHERS' PERCEPTIONS OF THE BENEFITS OF ICT IN PHYSICAL EDUCATION

ANA VILLALBA, MARÍA DOLORES GONZÁLEZ-RIVERA
Faculty of Medicine and Health Science. University of Alcalá. Madrid, Spain

THE BENEFITS OF ICT IN PHYSICAL EDUCATION

Information and communication technologies (ICT) offer many benefits in education, both in terms of ICT as an educational resource in the teaching-learning process, as well as for the student's own learning process (Karsenti & Lira, 2011). Physical Education (PE) is not exempt from these benefits. However, due to its unique characteristics and the singular nature of the classroom environment, it is a great challenge for teachers to promote a greater integration of ICT (Villalba & González-Rivera, 2016). Various authors demonstrate the difficulties that teachers face when integrating technology into PE, as well as the different approaches that can be used to overcome said difficulties (Pyle & Esslinger, 2014). For these reasons, the use and application of technology in the PE classroom has been difficult and remains to be consolidated, given the motor component of the subject and its limitations in terms of space, available class time, and a lack of teacher training (Gibbone, Rukavina & Silverman, 2010; Villalba & González-Rivera, 2016). Although PE preservice teachers have little initial training in ICT (Sipilä, 2013; Villalba & González-Rivera, 2016), they seem to have developed a good critical attitude when it comes to ICT and they perceive the benefits of including them in the classroom as an educational resource (Karsenti & Lira, 2011). However, these authors recognise that there are few teachers who seem to realise the potential of ICT for developing students' skills. In this regard, teachers' knowledge, attitudes and perceptions regarding ICT will be determining factors for their integration into the curriculum (Quintero & Hernández, 2005; Villalba & González-Rivera, 2016). Shan Fu (2013) recommends that all teachers integrate technology through all learning areas and at all levels.

In this context, this study's purpose is to examine teachers' perceptions of the benefits of integrating ICT into PE in secondary education by the extent to which they perceive said benefits. This analysis will enable a deeper understanding of their benefits and promote greater pedagogical use for a better integration of ICT. Furthermore, this study analyses the perception of these benefits in relation to the teachers' age, given that several studies have found that younger teachers are more disposed to including technology than older teachers (Bisgin, 2014; Hammond et al., 2008; Oblinguer & Oblinguer, 2005).

The Benefits of ICT as an Educational Resource

Access to digital information is one of the potential benefits of using ICT as an educational resource (Collins, 2011), and they are used as a tool for exploring learning topics, solving problems, and reinforcing critical thinking skills (Brush, Glazewski & Hew, 2008; Somekh, 2007).

One of the main benefits of using ICT in teaching is the possibility of automating assessment processes, providing immediate, personalised, and constant responses and feedback through different channels (Ávila & Tello, 2004; Collins, 2011; Repáraz, Echari & Naval, 2002). Graham, Holt-Hale and Parker (2013) see ICT as a resource that helps assess physical abilities in PE, for example, by making the teacher's grading system available on different mobile devices such as tablets or smartphones. ICT can increase teachers' ability to provide support, choice, and flexibility to students (Bisgin, 2014).

Furthermore, technology allows students to improve their academic performance and promotes interaction and a meaningful change in attitudes toward content and toward the activities carried out using technology (Cabero, 2007; Collins, 2011).

Stidder and Hayes (2006) indicate that PE preservice teachers are frequent users of ICT, they are confident in applying them in their teaching, and are prepared to incorporate them into other aspects of their professional role (Tearle & Golder, 2008). For example, teenagers today are very familiar with the use of mobile devices in the PE classroom and said use presents a series of benefits such as mobility, versatility, and breaking free of spatial barriers (Izquierdo, 2013). Additionally, they allow students to access a variety of information sources, with the aim of improving their knowledge on the subject itself and connecting it to other content areas related to physical activity and sports (Stanescu, Stoicescu & Ciolca, 2011).

ICT are able to create learning contexts based on the use of strategies such as planning, self-control, and self-evaluation (Repáraz et al., 2002). Also, students can use ICT to self-evaluate their motor performance, analysing their skills by creating and editing videos (Pyle & Esslinger, 2014), which also allows them to analyse their own movement (Collins, 2011). Technology makes it possible for this type of evaluation to be more authentic and meaningful for students and teachers (Kovar, Combs, Campbell, Napper-Owen & Worrell, 2012).

The Benefits of ICT for the Students' Own Learning Process

Karsenti and Lira (2011) indicate that ICT are a resource through which students can begin to learn independently. Along these lines, Repáraz et al. (2002) state that ICT enable conventional teaching-learning processes to be more dynamic and flexible, thereby providing students with a degree of autonomy and self-regulation that would be difficult to achieve in the traditional classroom, monitoring and adapting the educational processes to their specific needs and learning speeds (Yaman, 2008).

Furthermore, they strengthen both individual and cooperative work at the same time, motivating the discovery of fields of knowledge that students want to learn more about. Therefore, ICT promote collaborative learning in a distance learning environment. Koc (2005) mentions that the use of ICT allows students to communicate, share, and carry out collaborative projects anywhere, at any time. Students not only acquire knowledge together, but they also share different learning experiences with each other, with the aim of expressing themselves and reflecting on their learning (Shan Fu, 2013).

The students' motivation is the benefit that appears most frequently in research (Christmann & Badgett, 2003; Collins, 2011; Karsenti, Savoie-Zajc & Larose, 2001). Some authors indicate that ICT in PE increase motivation for the material being taught and make learning more

stimulating, making the physical activity fun (Ávila & Tello, 2004; Juniu, 2011; Zavatto et al., 2012). Another benefit of ICT is that they promote a creative learning environment (Shan Fu, 2013). Additionally, their use in PE keeps students significantly active – one of PE teachers' main goals and one that is sometimes difficult to achieve (Pyle & Esslinger, 2014). These authors state that ICT also allow teachers to promote physical activity and sports, providing students with opportunities to participate in physical and sports activities outside of school hours.

METHODOLOGY

Participants

The real sample size is 400 secondary education Physical Education teachers in the region of Madrid, Spain (254 men, 63.5% and 146 women, 36.5%). Of this group, 252 work in public schools (63%) and 148 in private schools (37%). With regard to age (M: 44.1; SD: 9.065), distribution into groups was as follows: 20-29 years old (n=20; 5%), 30-39 years old (n=121; 30.25%), 40-49 years old (n=138; 34.5%) and 50 years and over (n=121; 30.25%).

Instrument

Structured interviews were carried out using the "EFYTICS" questionnaire, created ad hoc for this purpose. The content validity of the questionnaire was performed in the following phases: Delphi method with 19 university professors and PhDs who are experts in ICT in PE; an expert panel comprising 10 independent specialists; and a pilot study where the questionnaire was administered to 40 PE teachers. There were no significant changes made after the pilot study or pre-test. The final version of the questionnaire consisted of 37 closed-ended questions. To achieve the study's objectives, the item *teachers' perception of the benefits of incorporating ICT into PE classes* was selected. The interaction of this item was studied in relation to age. This question was formulated with a Likert scale of 1-5 (with 1: strongly disagree; 2: disagree; 3: neither agree nor disagree; 4: agree; and 5: strongly agree). The reliability index for this question obtained by calculating Cronbach's alpha (alpha = 0.940) showed excellent internal consistency.

Procedure and Data Analysis

The methodology followed in this research was quantitative and descriptive in nature and multi-stage probability sampling was used (Bryman, 2004). The research was approved by the University of Alcalá (Madrid) Ethics Committee. The interviews were carried out by a single interviewer (the study's main researcher) and were performed individually and in person for each one of the randomly selected teachers. The interviews were carried out in the teachers' schools and lasted an average of twenty minutes.

The data have been tabulated and systematised by computer. Univariate and bivariate descriptive analyses were performed, as was an inferential analysis using contingency tables that include the Pearson chi-squared value and its significance, as well as the Phi correlation coefficient, using an SPSS program package for Windows (V 19.0).

RESULTS

The study found that PE teachers perceive all of the benefits of ICT that were analysed at percentages greater than 46% for agree and strongly agree (table 1). In terms of the perception of ICT *as an educational resource,* 87.6% agree or strongly agree that ICT allow for access to more information, 78.6% perceive that they imply new methodologies for teachers, and 69.4% said they help consolidate content in the PE course. However, the least perceived benefits (for agree and strongly agree) were interaction (54.4%), encouraging greater dedication to the subject (51.4%), and the possibility of including all students (46%). Furthermore, in terms of the benefits that obtained the highest percentages in relation to the *student's own learning process,* a high percentage of teachers (72.2%) agree or strongly agree that ICT are an appealing resource for students and increase their motivation, encourage digital competency (68.7%), and encourage cooperative work among students and with the teacher (60.2%). The least perceived benefits (among agree and strongly agree) were the student's holistic education (55%), encouraging creativity and originality (51.6%), and participation in physical activity and sport outside of school hours through ICT (40.9%).

Table 1.

Teachers' perceptions of the benefits of ICT in Physical Education

	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree		M	SD
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*		
ICT as an educational resource												
Facilitate analysis and development of practice in PE	6	1.5	35	8.8	130	32.5	164	41	65	16.2	3.6	0.9
Allow for access to more information	2	0.5	7	1.7	41	10.2	187	46.8	163	40.8	4.3	0.7
Instant availability and use	22	5.5	33	8.3	106	26.5	147	36.7	92	23	3.6	1.1
Possibility to include all students	32	8	74	18.5	110	27.5	124	31	60	15	3.3	1.2
Encourage interaction between the teacher and students and among students	19	4.8	45	11.3	118	29.5	158	39.4	60	15	3.5	1
Encourage inter-disciplinary learning with other subjects	9	2.3	32	8	111	27.7	168	42	80	20	3.7	0.9
Imply new methodologies for teachers	5	1.3	13	3.3	67	16.8	182	45.4	133	33.2	4.1	0.9
Help consolidate content	10	2.5	23	5.8	89	22.3	208	52	70	17.4	3.8	0.9
Provide greater feedback	10	2.5	31	7.8	118	29.5	173	43.2	68	17	3.6	0.9
Promote a greater dedication to the subject by students	18	4.5	29	7.3	147	36.8	149	37.2	57	14.2	3.5	1
ICT in relation to the student's own learning process												

Encourage cooperative work	14	3.5	23	5.8	122	30.5	178	44.5	63	15.7	3.6	0.9
Are appealing and increase students' motivation	4	1	17	4.3	90	22.5	176	44	113	28.2	3.9	0.9
Encourage digital competency	8	2	23	5.8	94	23.5	157	39.3	118	29.4	3.9	1
Encourage individual work at home	12	3	48	12	105	26.3	166	41.5	69	17.2	3.6	1
Allow for participation in physical activity and sport outside of school	20	5	69	17.3	147	36.8	113	28.2	51	12.7	3.3	1
Strengthen creativity and originality	17	4.3	39	9.8	137	34.3	149	37.2	58	14.4	3.5	1
Allow for a holistic education	10	2.5	42	10.5	128	32	158	39.5	62	15.5	3.5	0.9

By age (table 2), the most perceived benefits were access to more information, the implication of new methodologies, and the consolidation of PE content, although with different percentages (between 95% and 68.5%) and in the same order, except in the 30-39 year old group, where the third most valued benefit was inter-disciplinary learning (67.8%). It is worth noting that the least valued benefit for 30 years old and over (among agree and strongly agree) is the inclusion of all students, with percentages above 44.2%. The results show that there are significant differences between the variables: encourage interactivity (phi (φ)=0.693; p=0.044), inter-disciplinary learning (phi (φ)=0.683; p=0.042) and ICT imply new methodologies for teachers (phi (φ)=0.327; p=0.048) and there is a considerable relationship.

Table 2.

Teachers' perceptions of the benefits of ICT in Physical Education as an educational resource according to age

	Age	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree		X^2
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	
Facilitate analysis and development of practice in PE	20-29 años	0	0	0	0	7	35	8	40	5	25	33.708
	30-39 años	1	0.8	13	10.7	34	28.1	53	43.8	20	16.6	
	40-49 años	1	0.7	9	6.5	45	32.6	57	41.3	26	18.9	
	50 años o +	4	3.3	13	10.7	44	36.4	46	38	14	11.6	
Allow for access to more information	20-29 años	0	0	0	0	1	5	8	40	11	55	39.700
	30-39 años	0	0	5	4.1	10	8.3	51	42.1	55	45.5	
	40-49 años	1	0.7	1	0.7	9	6.5	68	49.3	59	42.8	
	50 años o +	1	0.8	1	0.8	21	17.4	60	49.6	38	31.4	
Instant availability and use	20-29 años	1	5	0	0	4	20	7	35	8	40	32.059
	30-39 años	7	5.8	13	10.7	26	21.5	44	36.4	31	25.6	
	40-49 años	6	4.3	8	5.8	36	26.1	59	42.8	29	21.0	
	50 años o +	8	6.6	12	9.9	40	33.1	37	30.6	24	19.8	

Possibility to include all students	20-29 años	2	10	4	20	3	15	7	35	4	20	24.611
	30-39 años	9	7.4	25	20.7	29	24	35	28.9	23	19	
	40-49 años	11	8	25	18.1	41	29.7	45	32.6	16	11.6	
	50 años o +	10	8.3	20	16.5	37	30.6	37	30.6	17	14	
Encourage interaction between the teacher and students and among students*	20-29 años	1	5	3	15	3	15	5	25	8	40	38.546
	30-39 años	6	5	14	11.6	34	28.1	47	38.8	20	16.5	
	40-49 años	4	2.9	16	11.6	36	26.1	61	44.2	21	15.2	
	50 años o +	8	6.6	12	9.9	45	37.2	45	37.2	11	9.1	
Encourage inter-disciplinary learning with other subjects*	20-29 años	0	0	2	10	4	20	6	30	8	40	43.172
	30-39 años	1	0.8	7	5.8	31	25.6	56	46.3	26	21.5	
	40-49 años	1	0.7	10	7.2	37	26.8	64	46.4	26	18.9	
	50 años o +	7	5.8	13	10.7	39	32.2	42	34.7	20	16.6	
Imply new methodologies for teachers*	20-29 años	0	0	0	0	3	15	5	25	12	60	42.694
	30-39 años	0	0	4	3.3	17	14	58	47.9	42	34.8	
	40-49 años	2	1.4	4	2.9	17	12.3	67	48.6	48	34.8	
	50 años o +	3	2.5	5	4.1	30	24.8	52	43	31	25.6	
Help consolidate content	20-29 años	1	5	1	5	3	15	10	50	5	25	29.550
	30-39 años	0	0	12	9.9	29	24	64	52.9	16	13.2	
	40-49 años	3	2.2	7	5.1	28	20.3	75	54.3	25	18.1	
	50 años o +	6	5	3	2.5	29	24	59	48.8	24	19.7	
Provide greater feedback	20-29 años	0	0	2	10	5	25	7	35	6	30	24.345
	30-39 años	2	1.8	10	9	35	22.5	59	53.2	15	13.5	
	40-49 años	3	2.2	12	8.7	36	26.1	62	44.9	25	18.1	
	50 años o +	5	4.1	7	5.8	42	34.7	45	37.2	22	18.2	
Promote a greater dedication to the subject by students	20-29 años	0	0	2	10	6	30	7	35	5	25	29.658
	30-39 años	5	4.1	6	5	38	31.4	54	44.6	18	14.9	
	40-49 años	5	3.6	13	9.4	55	39.9	48	34.8	17	12.3	
	50 años o +	8	6.6	8	6.6	48	39.7	40	33.1	17	14	

$p \leq 0.05$ *

In terms of teachers' perceptions with regard to the students' own learning process, by age (table 3), teachers in all age ranges see ICT as appealing and motivating for students (between 62.8% and 90%), followed by the benefit of encouraging digital competency (between 70% and 73.6%), except for those over 50 years old (58.6%). Older teachers perceive the benefit of students' individual work to a greater extent than digital competency (58.7%). However, between 20-29 years old and 30-49 years old, the benefit of cooperative work is the third most highly perceived (63.6% and 60.1%, respectively). The least perceived benefit for teachers over 29 years old (among agree and strongly agree) was encouraging participation in physical activity and sport outside of school (between 37% and 41.3%). The results show that there

are significant differences between the variables: strengthen creativity and originality (phi (φ)=0.687; p=0,05) and appealing and increase students' motivation (phi (φ)=0.686; p=0,042) and there is a considerable relationship.

Table 3.

Teachers' perceptions of the benefits of ICT in Physical Education in relation to the student's own learning process according to age

	Age	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree		X^2
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	
Encourage cooperative work	20-29 años	1	5	1	5	5	25	8	40	5	25	26.110
	30-39 años	3	2.5	8	6.6	33	27.3	55	45.5	22	18.1	
	40-49 años	3	2.2	7	5.1	45	32.6	61	44.2	22	15.9	
	50 años o +	7	5.8	7	5.8	39	32.2	54	44.6	14	11.6	
Are appealing and increase students' motivation*	20-29 años	0	0	1	5	1	5	9	45	9	45	36.800
	30-39 años	0	0	4	3.3	26	21.5	56	46.3	35	28.9	
	40-49 años	0	0	5	3.6	29	21	59	42.8	45	32.6	
	50 años o +	4	3.3	7	5.8	34	28.1	52	43	24	19.8	
Encourage digital competency	20-29 años	0	0	1	5	5	25	7	35	7	35	35.523
	30-39 años	1	0.8	5	4.1	26	21.5	45	37.2	44	36.4	
	40-49 años	1	0.7	11	8	25	18.1	60	43.5	41	29.7	
	50 años o +	6	5	6	5	38	31.4	45	37.2	26	21.4	
Encourage individual work at home	20-29 años	2	10	3	15	2	10	7	35	6	30	25.876
	30-39 años	2	1.7	18	14.9	28	23.1	54	44.6	19	15.7	
	40-49 años	3	2.2	15	10.9	42	30.4	55	39.9	23	16.6	
	50 años o +	5	4.1	12	9.9	33	27.3	50	41.3	21	17.4	
Allow for participation in physical activity and sport outside of school	20-29 años	2	10	4	20	0	0	9	45	5	25	32.989
	30-39 años	6	5	21	17.4	45	37.2	32	26.4	17	14	
	40-49 años	6	4.3	26	18.8	55	39.9	35	25.4	16	11.6	
	50 años o +	6	5	18	14.9	47	38.8	37	30.6	13	10.7	
Strengthen creativity and originality*	20-29 años	1	5	1	5	5	25	6	30	7	35	44.073
	30-39 años	4	3.3	15	12.4	34	28.1	50	41.3	18	14.9	
	40-49 años	5	3.6	12	8.7	52	37.7	48	34.8	21	15.2	
	50 años o +	7	5.8	11	9.1	46	38	45	37.2	12	9.9	
Allow for a holistic education	20-29 años	0	0	2	10	5	25	6	30	7	35	38.216
	30-39 años	1	0.8	14	11.6	41	33.9	49	40.5	16	13.2	
	40-49 años	3	2.2	12	8.7	41	29.7	61	44.2	21	15.2	
	50 años o +	6	5	14	11.6	41	33.9	42	34.7	18	14.8	

$p \leq 0.05$ *

It should be noted, as can be observed in tables 2 and 3, the percentages for agree and strongly agree are higher among teachers 20-29 years old (with the most positively viewed benefit at 95% and the least at 55%), and lower among teachers 50 or over (with the most positively viewed item at 81% and the least at 41.3%).

DISCUSSION

The study found that all the benefits analysed were perceived by PE teachers with high percentages (above 40.9%). The most positively viewed benefits of ICT *as a teaching resource* were access to information, the implication of new methodologies, and the consolidation of the subject's content. With regard to access to information, Brush, Glazewski and Hew (2008) indicate that ICT are a very useful resource for students, as they facilitate access to information, as well as understanding and discovery of content. In terms of the implication of new methodologies, Collins (2011) indicates that the teaching process with technological support means teachers must use new methods and roles. Specifically, Stanescu et al. (2011) state that ICT in PE are a resource that helps teachers improve a variety of teaching styles and a tool for supporting explanations (Collins, 2011). As for the consolidation of PE content, this benefit is supported by various studies that find that ICT improve students' academic performance and allow them to dedicate more time to the learning activity (Christmann & Badgett, 2003; Karsenti, et al., 2001). Moreover, ICT keep the students focused on the topic and contribute to the comprehensive, efficient management of the PE class' curriculum.

The next most perceived benefits, with percentages between 59.7% and 62%, are promoting inter-disciplinary learning, the possibility of providing more feedback, and the instant availability and use of ICT. With regard to the benefit of inter-disciplinary learning, Stanescu et al. (2011) indicate that by using ICT, possible connections and applications to other learning areas (such as anatomy, physiology, health and well-being) are promoted. Furthermore, Ávila and Tello (2004) and Repáraz et al. (2002) state that ICT provide teachers with the opportunity to give students immediate, constant, and individualised responses or feedback through different information channels. Additionally, Izquierdo (2013) mentions the mobility and versatility of functions offered by ICT. The rest of the most highly perceived benefits, with percentages between 46% and 57.2%, are the ease ICT offer for analysing and developing the practice of the subject itself, the interaction between teacher and students and among students, the promotion of a greater dedication to the subject by students, and the possibility of including all students.

These benefits are also considered in prior literature, which hold that ICT offer a great deal of programs that help improve PE teaching (Stanescu et al., 2011), offer an additional communication channel (Cabero, 2007), allow for dedicating more time to the learning activity (Christmann & Badgett, 2003; Karsenti et al., 2001), as well as the possibility of including all students through ICT, as they have an impact upon students with learning difficulties or differences in their sensory abilities (Bisgin, 2014).

With regard to the benefits of ICT for the *students' own learning process,* the most highly perceived are the promotion of the students' motivation, promotion of digital competency, and cooperative work. In terms of students' motivation, the results support the scientific literature, which shows that it is the aspect that appears most frequently in terms of benefits and advantages of technology in teaching, as ICT make learning fun and stimulating (Ávila & Tello, 2004; Christmann & Badgett, 2003; Juniu, 2011; Karsenti et al., 2001; Zavatto et al., 2012). As for promoting digital competency, Sipilä (2013) states that integrating ICT into the educational context promotes the acquisition of digital competency in all subjects (Ilomäki,

Kantosalo & Lakkala, 2011). In this regard, Ávila and Tello (2004) indicate that ICT promote both personalised learning as well as cooperative learning. Koc (2005) mentions that the use of ICT allows students to communicate, share, and carry out collaborative projects instantaneously. Moreover, Shan Fu (2013) states that students not only acquire knowledge together, but they also share a multitude of varied learning experiences.

The rest of the benefits in terms of the students' own learning process include encouraging individual work, a holistic education, and participation in physical activity and sport outside of school hours. As regards individual work, Yaman (2008) indicates that ICT provide students with a degree of autonomy that would be difficult to achieve in the traditional classroom. Furthermore, ICT promote creative learning and offer a wide variety of innovative ways of satisfying learning needs (Shan Fu, 2013). It should be noted that the benefit of participating in physical activity and sport is the least perceived of all the benefits in all age ranges. In this regard, teachers must reflect upon this benefit, as ICT may have great potential for promoting physical activity and sport (Pyle & Esslinger, 2014).

By age, the results show that the highest percentages in terms of perceiving the benefits of ICT are among teachers aged 20 to 29 years, and the lowest are among those aged 50 and over. In this respect, the research done by Bisgin (2014) found that teachers over 40 years of age are the least willing to use technology, and therefore have a less positive attitude towards it. Furthermore, studies done by Hammond et al. (2008) and Oblinger and Oblinger (2005) indicate that younger teachers are more willing to adopt new technologies than older teachers, who have less experience with technology or who are more committed to traditional teaching methods. Similarly, Lane and Lye (2011) suggest that older teachers who did not grow up with technology may be more resistant to including it in the teaching process and therefore require more training and support.

CONCLUSIONS

This study has provided an analysis of the benefits of ICT in PE as perceived by teachers, including an analysis by age. These results support prior literature on the possibilities that ICT offer in PE. The fact that this analysis has examined which benefits are more and less highly perceived has allowed for a more complete analysis of the benefits of ICT in PE. The study found that the lowest perceived benefits (which still had a high percentage of agree and strongly agree responses) are: that ICT promote greater participation in physical activity and sport, the possibility of including all students, promoting greater dedication to the subject, and interaction among students and between students and teachers. Specifically, these views may be due to the unique characteristics of PE, which pose an even greater challenge for teachers trying to integrate ICT (Gibbone et al., 2010).

By age, it can be seen that younger teachers (20-29 years old) have a more positive perception of the benefits analysed here than teachers over 50 years of age. This, as indicated in the scientific literature (Bisgin, 2014; Hammond et al., 2008; Oblinguer & Oblinguer, 2005), may be because this group of teachers is not as familiar with the use of ICT as their younger counterparts. Therefore, ongoing training courses should be adapted to teachers' needs according to their age.

Given that teachers' attitudes and perceptions of ICT are determining factors for their integration into courses (Qintero & Hernández, 2005), further research on all the benefits of ICT is required in order to achieve greater integration in PE from different approaches and directions. For example, possible future research could: analyse these benefits with other variables such as teacher experience, gender, and type of school; analyse the benefits from the students' point of view; carry out this analysis through qualitative research, which would allow for an in-depth examination of the reasons why teachers perceive these benefits to a greater or lesser extent; and compare these considerations with other countries.

REFERENCES

1. Ávila, J.A., & Tello, J. (2004). Reflections on curricular integration of new communication technologies. *Comunicar, Revista Científica de Comunicación y Educación*, 22, 177-182.
2. Bisgin, H. (2014). Analyzing the Attitudes of Physical Education and Sport Teachers towards Technology. *Anthropologist*, 18 (3), 761-764.
3. Bryman, A. (2004). *Social research methods*. New York: Oxford University.
4. Brush, T., Glazewski, K. D., & Hew, K. F. (2008). Development of an instrument to measure preservice teachers' technology skills, technology beliefs, and technology barriers. *Computers in the Schools,* 25, 112-125.
5. Cabero, J. (2007). Las necesidades de las TIC en el ámbito educativo: oportunidades, riesgos y necesidades. *Tecnología y Comunicación Educativas*, 21 (45).
6. Christmann, E.P., & Badgett, J.L. (2003). A Meta-Analytic Comparison of the Effects of Computer-Assisted Instruction on Elementary Students' Academic Achievement. *Information Technology in Childhood Education, (*1), 91-104.
7. Collins, O. The Use of ICT in Teaching and Learning of Physical Education. Continental J. Education Research, 4 (2), 29-32.
8. Gibbone, A., Rukavina, P., & Silverman, S. (2010). Technology integration in secondary physical education: teachers' attitudes and practice. *Journal of Educational Technology Development and Exchange, 3* (1), 27-42.
9. Graham, G., Holt-Hale, S. H., & Parker, M. (2013). Children moving: A reflective approach to teaching physical education. New York: McGraw-Hill.
10. Hammond, M., Crosson, S., Fragkouli, E., Ingram, J., Johnston-Wilder, P., Johnston-Wilder, S., Kingston, Y., Pope, M., & Wray, D. (2008). *Why do some student teachers make very good use of ICT? An exploratory case study.* Coventry: University of Warwick.
11. Ilomäki, L., Kantosalo, A., & Lakkala, M. (2011). *What is digital competence? In linked portal.* Brussels: European Schoolnet.
12. Izquierdo, A. (2013). Códigos QR flexibles: un proyecto con dispositivos móviles para el trabajo de calentamiento en educación física. *Revista Digital de Educación Física*, 23.
13. Juniu, S. (2011). Pedagogical uses of technology in physical education. *Journal of Physical Education, Recreation & Dance*, *82* (9), 41-49.
14. Karsenti, T., Savoie-Zajc, L., & Larose, F. (2001). Les futurs enseignants confrontés aux TIC: changements dans l'attitude, la motivation et les pratiques pédagogiques. *Èducation et Francophonie*, 29 (1).
15. Karsenti, T., & Lira, M. L. (2011). Are Quebec's Future Teachers Ready to Use ICT in Class? The Case of Prospective Teachers in Quebec, Canada. *Revista Electrónica de Investigación Educativa, 13* (1), 56-70.
16. Koc, M. (2005). Implications of learning theories for effective technology integration and preservice teacher training: A critical literature review. *Journal of Turkish Science Education,* 2, 2-18.

17. Kovar, S. K., Combs, C. A., Campbell, K., Napper-Owen, G., & Worrell, V. J. (2012). *Elementary classroom teachers as movement educators.* New York: McGraw-Hill.
18. Oblinger, D., & Oblinger, J. (2005). *Is it age or IT: First steps toward understanding the net generation*. In D. Oblinger & J. Oblinger (Eds.), Educating the Net Generation (2.1–2.20). Washington, DC: EDUCAUSE E-book.
19. Pyle, B., & Esslinger, K. (2014). Utilizing Technology in Physical Education: Adresing the Obstacles of Integration. *Delta Kappa Gamma Bulletin*, *80* (2), 35-39.
20. Quintero, A., & Hernández, A. (2005). El profesor ante el reto de integrar las TIC en los procesos de enseñanza. *Enseñanza*, 23, 305-321.
21. Repáraz, C., Echarri, L. & Naval, C. (2002).Posibilidades didácticas de las Tecnologías de la Información y la Comunicación (TIC) en la docencia presencial. *ESE. Estudios sobre educación*. 3, 133-147.
22. Shan Fu, J. (2013). ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Education and Development using Information and Communication Technology,* 9 (1), 112-125.
23. Sipilä, K. (2013). Educational use of information and communications technology: teachers' perspective. *Technology, Pedagogy and Education*, *23* (2), 225-241.
24. Somekh, B. (2007). *Pedagogy and Learning with ICT. Researching the art of innovation*. New York: Routledge.
25. Stanescu, M., Stoicescu, M., & Ciolca, C. (2011, April). Computer use in physical education and sports teaching. *The 7th international scientific conference elearning and sotfware for education*. Bucharest (28-29).
26. Stidder, G., & S. Hayes. (2006). A longitudinal study of physical education trainee teachers' experiences on school placements in the south-east of England (1994–2004). *European Physical Education Review,* 12 (3), 317–38.
27. Tearle, P., & Golder, G. (2008). The use of ICT in the teaching and learning of physical education in compulsory education: how do we prepare the workforce of the future?. *European Journal of Teacher Education*, *31* (1), 55-72.
28. Villalba, A., & González-Rivera, M.D. (2016). *Integration of ICT in Physical Education for the improvement of the educational intervention: perception and proposals.* In J. E. González (Coord). Trends and innovation in higher education. Florida (USA): JAPSSPress.
29. Yaman, Ç. (2008). The abilities of physical education teachers in educational technologies and multimedia. *The Turkish Online Journal of Educational Technology*, 7 (2).
30. Zavatto, L., Pennington, B., Mauri, S., Skarda, N., Marquis, J., Alverna, D., & Crawford, S. A. (2012). Does technology in physical education enhance or increase the time available to engage in physical activity? *Journal of Physical Education, Recreation & Dance*, *8* (7), 53.