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TECHNOLOGY ON THE RUN: PROMOTING ACTIVE BEHAVIOR IN DIVERSE ICT-SUPPORTED PHYSICAL EDUCATION CLASSES

ABSTRACT. Hirsh Alon, *Technology on the Run: Promoting Active Behavior in Diverse Ict-Supported Physical Education Classes* [Technologia jest wszędzie – aktywizacja ucznia podczas lekcji wychowania fizycznego z wykorzystaniem różnorodnych rozwiązań TIK]. *Studia Edukacyjne* nr 47, 2018, Poznań 2018, pp. 343-359. Adam Mickiewicz University Press. ISSN 1233-6688. DOI: 10.14746/se.2018.47.21

Technology in education is defined as one that achieves a practical purpose and that can assist teachers in motivating students. In the past, instructional technology consisted of mainly visual instruction, made up of pictures, films, graphs, charts, and other visual aids. By 1985, the Internet was already well established as a technology supporting a broad community of researchers and developers. Today's children are known as the "iGeneration" due to their advanced technology skills and use. It is estimated that teenagers spend from 15 up to 20 hours each day "multitasking", i.e. using different forms of ICT tools. The use of technology devices turned to be an integral part of sporting performance analysis, allowing coaches and teachers to understand the physical demands on team sport athletes. The advances in ICT in the 21st century involves children that are naturally growing in areas of higher levels access to information. Nowadays, a collection of ICT tools such as pedometers, smartphones, tablets (applications), virtual reality simulators, heart rate monitors, and others, are being used in physical education to enhance engagement, pedagogy and performance. It is critical for children to adapt their capacity to acquire knowledge and develop their skills through technology usage. If these ICT tools are used properly in PE classes, they have the potential to impact teachers' teaching practice and, consequently, student learning. Teachers should possess the skills and behaviors of digital-age professionals, particularly in physical education. Technology usage would be beneficial for increasing physical activity, improving dietary choices and encouraging other health-related behaviors.

Key words: ICT, education, iGeneration

From a black board to the tablet: the path to progress

"If we teach today's students as we taught yesterday's, we rob them of tomorrow".¹ He gave a lot of thought to the purpose of education and the

¹ J. Dewey, *Democracy and education: An introduction to the philosophy of education*, New York 1944, p. 167.

relevant role of the future, present and past. Dewey observed that every new generation required changes to the approach that educators employed.²



Figure 3.2 Miss Bowls's class in an unidentified girls' school, England Date: circa 1905
Image: Southall Board, Flickr



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Unidentified girl's school, England, 1905 Classroom model, 2014 "Literally more than a century little has changed" (T. Bates, *The origins of the classroom design model*, 2015)

² D.J. Natali, *Millennial community college student: Understanding their natural use of technology for learning*, ProQuest Dissertations and Theses, 2014, 100, Retrieved from https://search.proquest.com/docview/1651562885?accountid=10673%0Ahttp://openurl.ac.uk/redirect/athens.edu/?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&genre=dissertations+%26+theses&sid=ProQ:Education+Database&atitle=&title=Millennia.

The principle goal of education in the Schools should be creating men and women who are capable of doing new things, not simply repeating what other generations have done; men and women who are creative, inventive and innovators, who can be critical and verify, and not accept, everything they are offered. This is exact opposite of what is observed in schools nowadays. School years should be a period of preparation of a child for real life.³

In the past instructional technology consisted of mainly visual instruction. Visual instruction made up of pictures, films, graphs, charts, and other visual aids. The focus then shifted from visual to audio-visual instruction with the addition of sound. However, during the 1960's and 1970's some educational leaders began to look at instructional technology as a process rather than just relating it to media. It was defined as a process by which technology is applied to instructional practices to achieve learning outcomes.⁴

The changing emphasis in education energized through the general aims for the cycle Technology Education, which include:

- "To contribute to a balanced education, giving students a broad and challenging experience that will enable them to acquire a body of knowledge, Understanding, cognitive and manipulative skills and competencies and so prepare them to be creative participants in a technological world.

- To enable students to integrate such knowledge and skills, together with qualities of cooperative enquiry and reflective thought, in developing solutions to technological problems, with due regard for issues of health and safety. To facilitate the development of a range of communication skills, which will encourage students to express their creativity in a practical and imaginative way, using a variety of forms: verbal, graphic, model, etc.

- To provide a context in which students can explore and appreciate the impact of past, present and future Technology education on the economy, society, and the environment".⁵

The Internet is at once a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location.⁶

The first recorded description of the social interactions that could be enabled through networking was a series of memos written by J.C.R. Licklider

³ D. Gayibkhanova, D. Gayibkhanova, *Education and Schools: Do schools educate? Education vs. Schools: Do schools educate*, 2018 (February).

⁴ L. Needs et al., *Trends in Instructional Technology: Effects on IDT Practices*, 2017 (March), <https://doi.org/10.13140/RG.2.2.10112.43527>

⁵ K. Leahy, P. Phelan, *A review of Technology Education in Ireland; a changing technological environment promoting design activity*, *International Journal of Technology and Design Education*, 2014, 24(4), p. 375-389.

⁶ B.M. Leiner et al., *Brief History of the Internet 1997*, Internet Society, 1997, 44 2, 1-19, <https://doi.org/10.1145/1629607.1629613>.

of MIT in August 1962 discussing his “Galactic Network” concept. He envisioned a globally interconnected set of computers through which everyone could quickly access data and programs from any site. In spirit, the concept was very much like the Internet of today. Internet was based on the idea that there would be multiple independent networks of rather arbitrary design. Widespread development of LANS, PCs and workstations in the 1980s allowed the nascent Internet to flourish. This change from having a few networks with a modest number of time-shared hosts (the original ARPANET model) to having many networks has resulted in a number of new concepts and changes to the underlying technology. A major shift occurred as a result of the increase in scale of the Internet and its associated management issues. To make it easy for people to use the network, hosts were assigned names, so that it was not necessary to remember the numeric addresses. Thus, by 1985, Internet was already well established as a technology supporting a broad community of researchers and developers, and was beginning to be used by other communities for daily computer communications.⁷

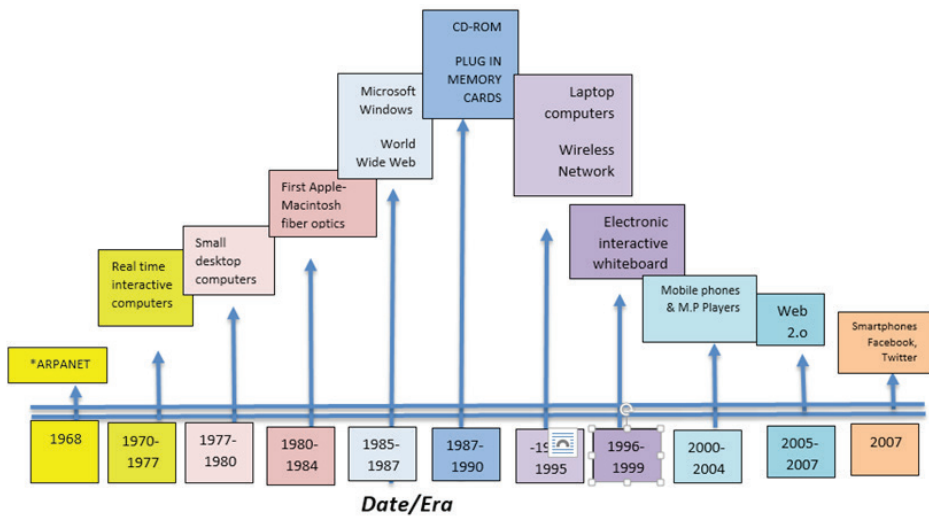
In 1994, a National Research Council report, chaired by Kleinrock, Entitled “Realizing the Information Future: The Internet and Beyond” was released. The Internet has changed much in the two decades since it came into existence. It was conceived in the era of time-sharing, but has survived into the era of personal computers, client-server and peer-to-peer computing, and the network computer.⁸

“Over the past few years,” recounts technology writer Chris Anderson (2010), “one of the most important shifts in the digital world has been the move from the wide-open Web to semi closed platforms that use the Internet for transport but not the browser for display. Thus, Anderson’s account initially undoes the common conflation of the Internet and the World Wide Web. He then stresses that the “post-web future” imagined by those hoping to see a more profitable online world in the years to come is one where highly controllable, task-specific platforms replace conventional web browsers in the process of fulfilling consumers’ interests and needs. This is seen by many as a battle for the soul of the digital frontier.⁹

⁷ Ibidem.

⁸ Ibidem.

⁹ B. Millington, *Critical Studies in Media Communication Smartphone Apps and the Mobile Privatization of Health and Fitness*, 2014, 31 (February 2015), 37-41, <https://doi.org/10.1080/15295036.2014.973429>



A brief history of ICT (M. Klichowski, *Learning in CyberParks. A theoretical and empirical study*, Adam Mickiewicz University Press, Poznan 2017)

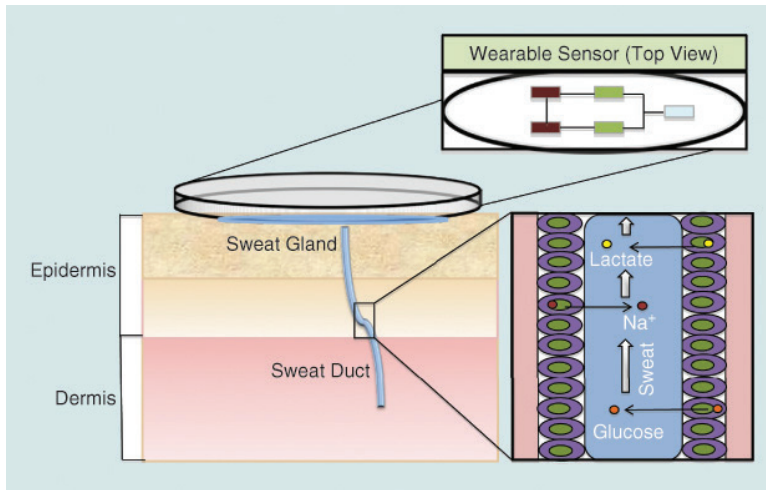
Technology integrated into sport and exercise science

In the past decade, time-motion analysis systems, such as video recording, hand notation, and computer digitizing, have been used to objectively assess human locomotion for determining physiological measures. Also, these systems have been used to improve sport performance. Unfortunately, many logistical issues exist including questionable validity, a labor-extensive nature for collecting such data (e.g., up to 8 hours produces digitized data).¹⁰

The use of technology devices have become an integral part of sporting performance analysis, allowing coaches and support staff to understand the physical demands on team sport athletes. Specific skill-based activities and movements can distinguish the physical demands of one sport from another. Given that a large number of sports include physically demanding activities that involve few locomotors demands (e.g. volleyball jumping, rugby union tackling and soccer goalkeeping), it is likely that research that has focused solely on characterizing the locomotors demands of team sport has underestimated the 'true' physical demands of the sport. Sport scientists now employ wearable sensors to identify sport-specific movements and activities in an effort to better evaluate the demands of a sport and to assist

¹⁰ C.L. Dellaserra, Y. Gao, L. Ransdell, *Use of integrated technology in team sports: a review of opportunities, challenges, and future directions for athletes*, Journal of Strength and Conditioning Research / National Strength & Conditioning Association, 2014, 28(2), 556-573, <https://doi.org/10.1519/JSC.0b013e3182a952fb>

with physical preparation, injury prevention and technical analysis of these activities. Ability of micro sensors detect sport-specific movements and are capable of quantifying sporting demands that other monitoring technologies may not detect. Furthermore, multiple sensor models have the ability to provide researchers with a tool to understand specific movements in greater detail and provide coaches or judges with feedback on correct and incorrect techniques.¹¹



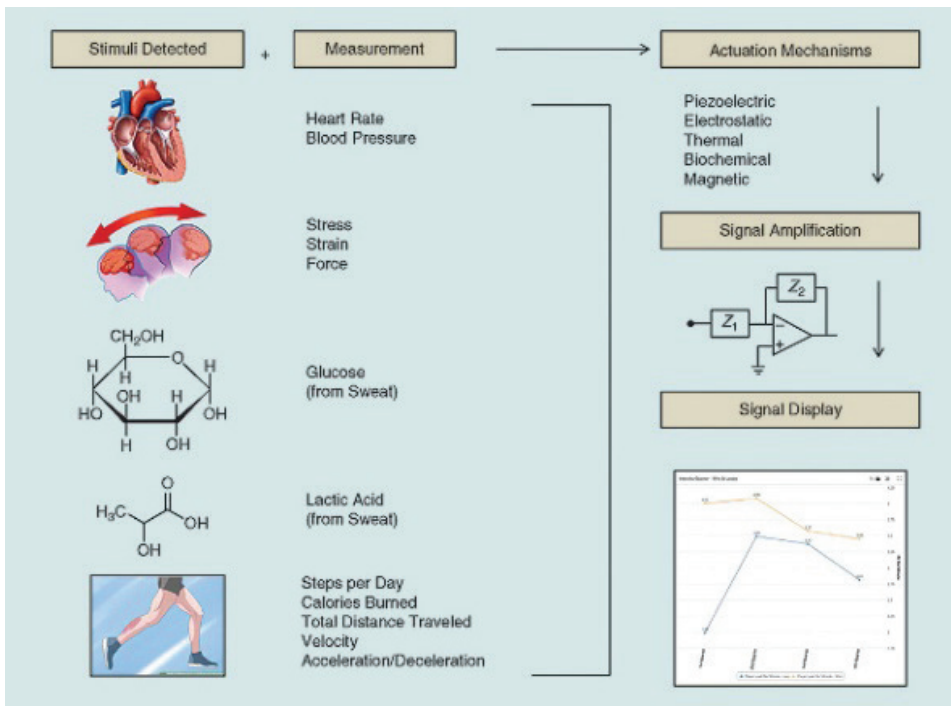
A key challenge to this technology remains: How does one efficiently, accurately, and noninvasively measure the aforementioned analyses from the body? This challenge can be overcome via the measurement of eccrine sweat, which offers significant advantages and disadvantages. Eccrine sweat glands are located in many parts of the body at high densities and thus provide opportune sampling spots. On this front, the use of flexible electronics to create a sensor capable of adhering to the surface of the skin to measure and quantify analyses from sweat is of interest to and highly desired by the sports community (D.R. Seshadri et al., *New integrated technologies* 2017).

Sweat analysis – currently used for disease diagnosis, drug abuse detection, and athletic performance optimization is now only possible through a probe that depends on direct chemical concentration with the analytic, creating wearable chemical sensors that can identify and quantify biomarkers from sweat – such as electrolytes (sodium, chloride, potassium, and calcium), metabolites (lactate, creatinine, glucose, and uric acid), small molecules (amino acids, DHEA, and cortisol), and proteins (interleukins, tumor necrosis factors, and neuropeptides) – in a nonintrusive manner and relay corresponding vital signs and signals via Bluetooth to an external receiver

¹¹ R. Chambers et al., *The Use of Wearable Microsensors to Quantify Sport-Specific Movements*, *Sports Medicine*, 2015, 45(7), 1065-1081, <https://doi.org/10.1007/s40279-015-0332-9>.

appears to be extremely promising for sports, as detailed in Figure below. By measuring sweat, researchers and sports physicians can gain a more complete understanding of how physical activity and exertion relate to fatigue and injuries. Specifically, measurement of lactic acid, which is a byproduct of burning glucose without oxygen, provides a thorough indicator of an athlete's ability to cope during rigorous exercise.¹²

Wearable devices already demonstrate success and hold great promise in minimizing sports-related injuries and helping provide a thorough recovery and training platform for athletes. The development of an all-encompassing device capable of measuring both biometric signs (stress, strain, and impact forces) and biovital signs (glucose and lactic acid) is needed and can serve as the next gold standard for this technology. Figure below summarizes the wearable device pathway from detection to signal amplification for biomarkers and biovitals. The exciting opportunities merging wearable technology with data analytics stand as the next frontier for sports medicine.¹³



A schematic summarizing the role of wearables from biomarker and biovital sensing to signal amplification and data analysis (D.R. Seshadri et al., *New integrated technologies* 2017).

¹² D.R. Seshadri et al., *New integrated technologies allow choaches, phyicians, and trainers to better of athletes in real time*, *Journal of Wearable Devices for Sports*, 2017 (February), 15.

¹³ Ibidem.

Paving the Way for technological Pedagogical Utility in physical education

Defining technology in education can help clarify the value of allowing devices to assist in creating an effective learning environment. Technology in education, in its simplest form, is defined as anything that achieves a practical purpose and that can assist teachers in motivating students (e.g., gaining and engaging attention), providing unique instructional capabilities (e.g., providing learning tools and information, tracking learning), supporting new teaching styles (e.g., cooperative learning, problem solving, shared intelligence), increasing teacher productivity (e.g., assessment strategies, “flipped classrooms”), and instructing skills for the information age.¹⁴

Internet technology has significantly contributed to furthering education in the world. The World Wide Web and search engines have made information on demand a reality. Low cost models for supporting learning, such as Massive Open Online Courses, are kindling new hopes in developing countries. Lower cost Internet access devices, such as tablets, phablets, and smart phones have addressed the problem of device affordability to a significant extent.¹⁵

A major cultural influence determined new education approach in the begging of the millennium by the development of the world-wide web. Since then, numerous hardware and software tools to access data on practically every topic were developed along with multiple methods to communicate including peer-to-peer text, video, encyclopedic references, and online learning.¹⁶

The advances in technology in the 21st century entails that children are naturally growing within arenas of higher levels of information access. It is critical for children to adapt their capacity to get knowledge and to develop their skills through technology usage.¹⁷

The current trends for instructional technology in education are exciting. For instance, mobile and cloud computing have created a new platform which allows for unlimited computing resources. Data processing and storage happens in the Cloud outside of the mobile device. These types of resources not

¹⁴ R.D. Manning, M.C. Keiper, S.E. Jenny, *Pedagogical Innovations for the Millennial Sport Management Student: Socratic and Twitter*, Sport Management Education Journal, 2017, 11(1), 45-54, <https://doi.org/10.1123/smej.2016-0014>

¹⁵ S. Ramani, *The internet and education in the developing world – hopes and reality*, Smart Learning Environments, 2015, 2(1), 8, <https://doi.org/10.1186/s40561-015-0015-x>.

¹⁶ D.J. Natali, *Millennial community college student*.

¹⁷ M. Huda et al., *Empowering children with adaptive technology skills: Careful engagement in the digital information age*, International Electronic Journal of Elementary Education, 2017, 9(3), 693-708.

only save educational institutions money by cutting back on hardware but also keep students engaged outside the classroom. Students can access data any time and from anywhere through mobile devices.¹⁸

The dynamics of technological revolution has both positive and negative effects. Studies have shown that it may potentially affect children negatively manifesting in aggressive behavior, risky sexual attitude, and substance abuse. On the other hand, positive impact may include promoting empathy and acceptance of diversity through modeling prosaically behaviors.¹⁹

Since today's generation is bombarded by media technology, where people live, interact and communicate with each other using digital devices, all information can be easily accessed and forwarded using various digital devices. These include the internet, email, Twitter and Facebook. Moreover, there are a number of digital devices which can be used to support daily information transmissions in this cyber age. It is generally accepted that the use of portable digital devices to enable people in their daily interactions should be cautiously made accessible to children especially the digital gaming devices.²⁰

The student standards of the International Society for Technology in Education (ISTE, 2016), which target the knowledge, skills, and abilities ISTE believes are needed to learn effectively and live productively within today's digital society, are: (a) students demonstrate creativity and innovation through utilizing technology; (b) students communicate and collaborate via digital mediums; (c) students collect, evaluate, and use information via digital tools; (d) students critically think and problem-solve utilizing digital tools; (e) students demonstrate digital citizenship through legal and ethical technology related behavior; and (f) students demonstrate knowledge of technology applications and concepts. By meeting the six standards described above, students may be able to make, share, find, solve, protect, and use technology effectively.²¹

Nonetheless, the relative absence of technology in PE classes are due to numerous barriers that PE teachers face in the process of technology integration, such as the unique content (human movement) and contexts (gymnasium and playground); limited budgets; large class sizes; lack of training and support; ambivalent beliefs and attitudes toward the value of incorporating technology; and lack of knowledge, skill and confidence to adapt technology into their pedagogy, these barriers significantly influence pre/in-service PE teachers' efforts to integrate technology in their classroom.²²

¹⁸ L. Needs et al., *Trends in Instructional Technology*

¹⁹ M. Huda et al., *Empowering children with adaptive technology skills*

²⁰ Ibidem.

²¹ R.D. Manning, M.C. Keiper, S.E. Jenny, *Pedagogical Innovations for the Millennial Sport Management Student*.

²² E. Jones et al., *PE Teachers' Perceptions of Technology-Related Learning Experiences: A Qualitative Investigation*, 2016.

In recent study (2016), it was found that over ninety-percent in Americans college owned a computer and other forms of technology for personal and academic communications and discovered that twelve-million students take at least one class online. By the following years, that numbers will expected to exceed to twenty-two million.²³

Today's children are known as the "iGeneration" due to their advanced technology skills and use, and it is estimated that teenagers spend 15 to 20 hours each day "multitasking" using different forms of technology.²⁴

The rise in educational digital-media technology available at little to no cost for smartphones and tablets presents new opportunities for teachers and students. If what teachers want is to save money while meeting the National Standards with the use of technology, there's an app for that!²⁵

The international Society for Technology in Education (ISTE) and SHAPE America - The Society of Health and Physical Educators, states that teachers should possess the skills and behaviors of digital-age professionals. They also recognizes technology's role, particularly in physical education, as being important by stating that physical education teachers must "demonstrate knowledge of current technology by planning and implementing learning experiences that require students to appropriately use technology to meet lesson objectives"²⁶

In recent years, an array of technologies such as pedometers, smartphones, tablets (applications) virtual reality simulators, heart rate monitors, and Exergames (e.g., Dance Dance Revolution, and Sony Play Station games) are being used in physical education, sport, and physical activity to enhance engagement, pedagogy, and performance.²⁷ To meet lesson objectives, it is essential that educators implement appropriate technology integration with regard to the five National Standards for K-12 physical education.

Teachers have many choices when it comes to integrating technology into physical education. Many are using heart rate monitors or pedometers to track student activity, while others are implementing fun techno-games like Dance Revolution to keep students motivated and engaged.²⁸

Implementing technology within all areas of education is an objective that can be found in strategic plans at all levels of education. Physical education teachers have more access to technology that can be integrated into their

²³ Ibidem.

²⁴ B.J.M. Krause, Y. Sanchez, *Meeting the National Standards: There's an App for That!* 2011, 27.

²⁵ Ibidem.

²⁶ E. Jones et al., *PE Teachers' Perceptions of Technology-Related Learning Experiences*.

²⁷ X. Zhu, L.A. Dragon, *Physical activity and situational interest in mobile technology integrated physical education: A preliminary study*, *Acta Gymnica*, 2016, 46(2), 59-67, <https://doi.org/10.5507/ag.2016.010>

²⁸ E. Jones et al., *PE Teachers' Perceptions of Technology-Related Learning Experiences*.

classrooms and gymnasias to enhance instruction, assist with assessment, and create more efficiency in record keeping.²⁹

Physical education,-teacher education (PETE) programs are encouraged to be active in introducing and integrating technology resources that assist in meeting lesson objectives and positively affect student learning.³⁰

Technology is being incorporated into the undergraduate sport and exercise science coursework such as exercise physiology, biomechanics, and motor development. Specifically, technology was used by instructors to demonstrate scientific principles and concepts related to human movement. The technology was also described as a tool used by students to fulfill required assignments and learning activities.³¹

The use of technology in higher education is growing almost daily. There is a technology's potential to enhance teaching effectiveness and students' learning. Those who are involved in education have encouraged physical education (PE) teachers to integrate technology in their pedagogy. Yet, many teachers reported they have had difficulty integrating technology despite the fact that technologies are available.³²

Some Institutes established technology related standards indicating knowledge and skills necessary for teachers to integrate technology. These standards have challenged teacher education programs to restructure or enhance existing curriculum to prepare teachers to have the knowledge, skill, and dispositions to incorporate technology effectively in teaching. However, studies have reported that pre/in-service PE teachers often do not feel sufficiently prepared to incorporate technology into their classroom in meaningful ways (Jones et al., 2016).

With a growing number of technologies are available in the market, many PE professionals have, in recent years, begun to introduce the application of various technologies into PE classrooms. Such technologies include, but are not limited to, pedometers, heart rate monitors, physical activity watches, iPads, various mobile apps, and video games. If these technologies are used properly in PE classes, they have the potential to affect teachers' teaching practice and, consequently, student-learning.³³

- *Pedometer*: the word pedometer comes from Japan and is translated "10,000 step meter."

²⁹ K. Scrabis-Fletcher, *Preservice Physical Education Teachers' Technological Pedagogical Content Knowledge*, *Physical Educator*, 2016, 73(4), 704-718.

³⁰ *Ibidem*.

³¹ E. Jones et al., *PE Teachers' Perceptions of Technology-Related Learning Experiences*.

³² *Ibidem*.

³³ *Ibidem*.

- Pedometers function by using a pivot-armature motion detection, thus recording an increment or step, every time the instrument is 'jarred' in the vertical plane of motion.

- The use of pedometer in PE classes - Using pedometers in physical education classes offer a controlled and economical method of establishing patterns of physical activity in younger children. While the pedometer is limited in the amount of information it can provide, it is inexpensive and simple to use. The pedometer allows the researcher to measure physical activity. While measuring physical activity using pedometers, it may not truly represent activity levels and patterns. Children wearing the pedometer may be tempted to attain as many steps as possible, while others may try to change their behavior knowing they are participating in a study. Children who are not accustomed to using to a pedometer may find it novel, and may be motivated to perform differently than if not wearing one.³⁴

- *Heart rate monitors*: Heart rate measurement and monitoring has played an integral role in the field of exercise science. Hence, there have been many technological advances that have led to the development of a wide variety of user-friendly heart rate monitors. Most of these classic heart rate monitors consist of a chest strap (transmitter) positioned around an individual's thoracic region that communicates with a watch (receiver) worn on the wrist that displays a continuous reading of heart rate. Such classic devices have been validated and have been shown to give consistent and reliable readings of heart rate at rest and during physical exertion.³⁵ A heart rate monitor is superior for measuring the quality and intensity of an exercise and has the added benefit of tracking the participant's heart rate during physical activity. This can be helpful because it correlates with the cardiac output of the heart as well as the oxygen consumption. These measurements can be incorporated in the analysis of weight and body mass index. The heart rate monitor ultimately provides an extra aspect that can be analyzed and applied to larger populations. Heart rate monitors are available with displays that show the current heart rate and other exercise parameters of the user.³⁶

- Multimedia blogging in physical education Web-based delivery *self-reflection exercise on the Activity and Motivation in Physical Education* - A class blog was utilized as a means for PE students to reflect on and showcase their performances through creating multimedia posts on these skills and receiving

³⁴ J.S. Horst, *Reproduced with permission of the copyright owner. Further reproduction prohibited without permission*, 2007 (July).

³⁵ C.M. Lee, M. Gorelick, A. Mendoza, *Accuracy of an infrared LED device to measure heart rate and energy expenditure during rest and exercise expenditure*, 2011.

³⁶ S.J. Hensen, *Measuring Physical Activity with Heart Rate Monitors*, *American Journal of Public Health*, 2017, 107(12), e24-e24, <https://doi.org/10.2105/AJPH.2017.304121>

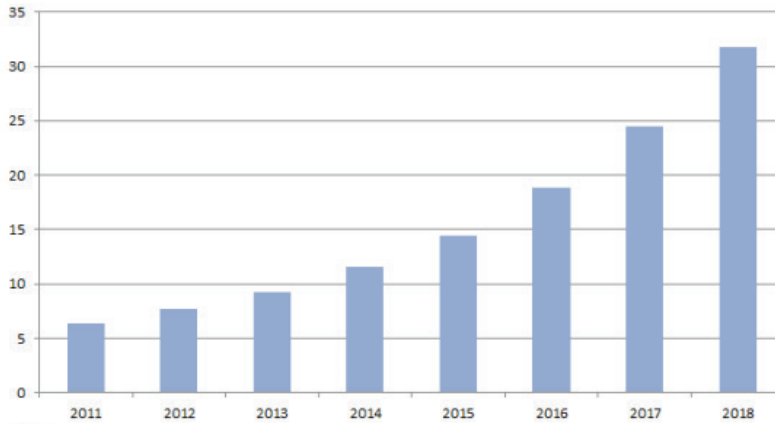
comments from their instructors, peers and an external expert. The effectiveness of multimedia blogging was evaluated. An emerging.

- Technology that emphasizes the interactive aspect of health communication, can be used as an advocacy tool, and may help to improve health literacy skills in students is the web-log or blog. Blog postings on the Internet encourage comments and feedback that can be then linked back to the original posting, thus, a two-way interaction.³⁷

Development of smart phones applications related sports

Forecast for wearable tech revenue growth

In billions of U.S. dollars



Source: IHS Inc.

“The market for wearable technology will reach \$70 billion by 2025.” The wearable electronics business has already geared up to grow, the dominating sector will continue to remain the healthcare sector. It has most of the big names like Apple, Adidas, Accenture, Samsung, Roche, Fujitsu, Reebok, Nike are gearing up for most promising developments in wearable electronics (M. Krifty, *Tech Trend 2016: Advanced wearable technology defining the future*, 2016).

With the growth of the market for smart devices, it was estimated that worldwide store revenue for mobile applications will reach US\$188.9 billion in 2020. In a recent market survey by comScore (2016) it was reported that mobile usage now represents 65% of all time spent on digital media, with mobile applications dominating that usage, whereas desktop computer usage has decreased markedly since 2013.

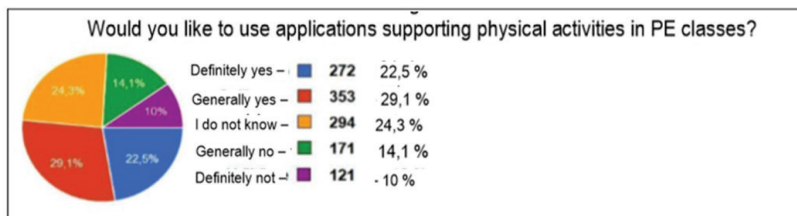
³⁷ C.C. Cox, *Blogging for Health Literacy and Health Advocacy*, 2006, 3-6.

The top five popular categories of mobile applications that U.S. smart device owners use are games, weather, social networking, maps/navigation/search, and music.³⁸

In 2013 there were over 40,000 apps categorized as health and fitness available through iTunes and Google Play. The use of apps grew 35% every year. A large part of modern culture centers on the use of technology, and though this technology often contributes to sedentary behaviors, it could be beneficial in increasing physical activity, improving dietary choices, and encouraging other health-related behaviors. A variety of mobile apps can be considered health-related; however, not much is known about the use and user's satisfaction of these health and fitness apps. Health and fitness apps that focus on exercise and nutrition often allow users to track dietary and exercise information on the go, in real-time, and allow mobile access of information on exercise and diet.

Some health and fitness apps are designed with GPS, social networking capabilities, and sensor based technology that provides feedback on physiological functions. Information provided by health apps could be beneficial to personal trainers, fitness instructors, and wellness coaches as they work with clients to improve their health. Apps may prove useful as an exercise adherence tool and encourage clients to monitor or track their diet and exercise on their own. In a study conducted by Krebs and Duncan (2015), showed a little over half of the U.S adults had downloaded a health-related mobile app and the majority did not pay for apps they used. It was found that students may not be using fitness and nutrition apps as much as expected considering the large number of students that own mobile devices.³⁹

In a recent study⁴⁰ students (n = 1211) and a group of teachers (n = 331) from primary and secondary schools from selected regions in the Czech Republic, were asked about their preferences concerning the utility of Smartphones applications.



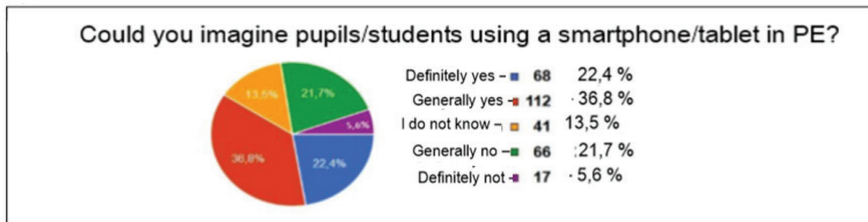
Use of PA apps in PE- pupils

³⁸ C.M. Lee, M. Gorelick, A. Mendoza, *Accuracy of an infrared LED device to measure heart rate.*

³⁹ E. Jones et al., *PE Teachers' Perceptions of Technology-Related Learning Experiences.*

⁴⁰ P. Palička, L. Jakubec, J. Zvoníček, *Mobile apps that support physical activities and the potential of these applications in physical education at school*, *Journal of Human Sport and Exercise*, 2016, 11 (Special issue 1), S176-S194, <https://doi.org/10.14198/jhse.2016.11.Proc1.08>

In the same study teachers' preferences concerning the utility of Smartphones applications were asked, particularly of their opinion on interconnecting digital technologies with PA in general and also their idea about the use of mobile apps in PE by pupils and the teachers themselves.



Teacher perception of pupils using mobile technologies in PE

In conclusion it was indicated that the majority of the teachers are in favor of using mobile technologies in PA and that some of them have already integrated them into PE classes. Furthermore, PA apps are a popular choice for pupils; they came fourth, right after social networks, games and music applications. This is, moreover, demonstrated by the popularity of PA apps, which took second place, right behind applications like maps and navigation.⁴¹

Use of these apps will continue to rise as mobile technology becomes more entwined with everyday life. Use of health-related fitness apps could potentially result in a society that is more health conscious. Benefits of using mobile apps include the ability to personalize the app to fit one's needs and having the content available anytime and anywhere.⁴²

Conclusion

ICT TOOLS are relatively new for interventions associated with health and physical activity in physical education. From a research point of view, this issue seems advisable also by reason of the ever-increasing number of all kinds of educational ICT tools that are expending in the market. Despite the popularity of PA mobile apps, their efficiency in enhancing the PA rate has still not been clearly demonstrated. Academic literature has yet provided us with a taxonomy of PA ICT tools that would take into account a connection to the education system. For these purposes an academic review was conducted

⁴¹ Ibidem.

⁴² M. Jones et al., *Use of Fitness and Nutrition Applications by College Students*, Missouri Journal of Health, Physical Education, Recreation & Dance, 2017, 27, 63-71. Retrieved from <http://ezproxy.library.dal.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s-ph&AN=125030943&site=ehost-live>.

to inflight the extent to which ICT tools are prevalent among pupils and teachers, its stand on that issue and the level of literacy in regards to the use of these means in promoting PA.

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