

Integration of information and communication technology in the sports field and presentation of some models currently applied

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Abstract

The Object of the study aims to demonstrate the importance of the integration of Information and Communication Technology in sports training and physical education and sports sessions. For this purpose, we used a systematic review method by analysing scientific articles and Congresses and make a selection of handy and less expensive technologies to use in sports training and physical education and sports sessions. After collecting the results and having treated them, we conclude that Information and Communication Technologies or ICT represents an important potential of educational innovations and an almost infinite reservoir of new practices for coaches as for teachers in sports field. The multimedia tools of small size such as tablets, smartphones, digital camcorders, became very practical to inquire on its physical practice and make techniques almost perfected. On this basis, the study recommended to use these technologies that allow athletes and pupils to progress and to reach the objectives of sports training and physical education.

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1. Introduction:

Everyone or almost everyone agrees today to assign to information and communication technologies the role of engine for the improvement of teaching and learning. Furthermore, in this information age in which we live, innovations and changes would be due, in large part, to the integration of ICT into the learning environment.

In the field of sport, ICTs have brought much more to the disciplines on all levels: equipment, media, analysis, techniques, tactics, regulations, etc., which has made it possible to improve these sports for the better.

It is even easier today to measure your performance (distance travelled, average speed, calories burned, heart rate, etc.), or even to improve. Applications, smart clothes, connected bracelets... Data is used more than ever in the service of sport.

Small multimedia tools such as tablets and digital camcorders have become very practical for learning about physical practice, for example in gymnastics. They allow us to quickly visualize the gestures to be reproduced by an image or a video, which allows us makes it possible to compare the gesture performed with the ideal gesture and to be able to correct oneself more effectively. Also, the use of 3d software makes it possible to perform almost perfect techniques with the most sophisticated movements.

The Internet can also allow us to access a large number of physical activities.

All these information and communication technologies allow athletes and students to progress and achieve the objectives of sports training and physical and sports education. But how can we integrate them into training and PE sessions?

This systematic review may be able to provide us with important tools that we can integrate into training sessions and physical and sports education.

1.1. Definition of ICT:

According to the Grand Dictionary Terminologies (2009), ICTs are a *"set of technologies resulting from the convergence of computing and advanced multimedia and telecommunications techniques that have enabled the emergence of more efficient means of communication, by improving the processing, storage, dissemination and exchange of information"*.

Chapron gives the following definition of ICT: *"ICT, Information and Communication Technology: an expression with rather vague outlines, which appeared with the development of communication networks, designating everything that revolves around the Internet and multimedia. It also covers*

the notion of increased user-friendliness of these products and services intended for a wide audience of non-specialists. At the confluence of IT, telecommunications networks and audio-visual, ICTs are aimed at the greatest number". (Chapron, 2006)

2. Method and Materials:

In order to conduct this research, we used systematic review method by analysing scientific articles and Congresses that studied Information and Communication Technologies in the sports field. After that we made a selection of handy and less expensive technologies in order to integrate them in sports training and physical education and sports sessions to help Coaches and Teachers reaching their objectives, and athletes and pupils progressing.

3. Results: In this section we will provide a selection of Technologies used in sports training and physical education and sports sessions:

3.1. ICT in sport:

In nearly ten years, new information and communication technologies have changed our daily lives. Today, no one would imagine living in a "disconnected" world and each passing week sees new applications flourish. Leisure, and especially the field of sports, are the subject of rich and varied developments.

An Olympic victory is now a matter of sport, technology and finance. No technology, even the most advanced, can replace the three essential ingredients for victory: the athlete's talent, the trainer's intelligence and long hours of training. However, winning a gold medal without the help of cutting-edge technology is no longer possible, with the difference between Olympic glory and anonymity being measured in centimetres or hundredths or even thousandths of a second. (Lanotte, 2014)

3.1.1 Some important dates:

End of the 19th century: The drawn steel provokes a whole series of novelties. It transforms the high bars directing the gymnastics towards something much more acrobatic and less in strength. This steel also transforms many machines and engines by combining resistance and manoeuvrability.

In 1911: the newspaper Le Temps already sees in the bicycle with a steel frame and rubber tires a real industrial machine with the most advanced technology.

From the 1930s: the arrival of aluminium alloys and duralumin sparked a new revolution. This time the work is done on two qualities, lightness and elasticity. This discovery upsets mountaineering in particular.

After the Second World War, these better-known alloys modified many sporting objects, athletics poles, rowing stems, bicycles or even skis.

The mid-1960s: marks a new great revolution in sports technology, the arrival of synthetic fibbers and plastic derivatives.

For example, they are revolutionizing jumps in athletics, the landing areas built of blocks of foam or polyester allow falls on the back. This will lead to the famous Fosbury jump revolution.

The tools for snowshoes, skis, springboards, are redone one after the other with these moulded materials.

1974: With a ratio of 95.7% of matches won, American tennis player Jimmy Connors becomes world number 1 and multiplies records, helped by the first round-headed steel racquet, the Wilson T2000.



Fig 01 : The Wilson T2000 Racquet

The 1980s: Electronics brought about a radical change. The microcomputer is no longer just a calculating instrument helping to invent the technique, it becomes embedded in the machines and a tool helping the athlete.

Computers were first used in the cockpit of sailboats. For example, in French Kiss, a competitor in the 1987 America's Cup, more than 300 kg of equipment and a reaction time of 1.25 seconds enabling the heeling sensors, the anemometer, the speedometer, rudder angle, position of the boat, electronic compass... And to summarize everything on the screens in front of the crew. A revolution still relevant and widely used today, fortunately the volume and weight of the equipment has decreased.

Diving, for example, a sport that has very little equipment, has also been affected. There was a big improvement on the boards that went in the 1980s from wood to aluminium, they give another technique to be higher, faster. (Maliev, 2010)

1993: Scottish amateur cyclist Graeme Obree breaks the world record for the hour of cycling thanks to a bicycle he made using, among other things, parts from his washing machine.



Fig 02 : Graeme Obree

2010: Following too many records broken since their appearance in swimming (1998), 100% polyurethane wetsuits are finally banned, accused of taking precedence over physical achievement.

2010: The bindings of Simon Amman, double gold medalist at the Olympic Games in Vancouver. This binding with a curved metal rod instead of a rubber band attaching the boots to the skis. He won his fourth Olympic gold medal and said "I am an Olympic champion because I am the best jumper, not because I have the best equipment". (Amman, 2010)

2015: For more precise refereeing and not to prevent potential records, "goal line technology" is adopted by the French, German and Italian football championships, in order to ensure that the ball has indeed crossed the goal line .

3.1.2 New technologies in the sports field:

Whether it's filming sporting events as close as possible thanks to drones, or betting on the projection of 360-degree panorama scenes via virtual reality headsets, professional sport should change its appearance in the months and years to come.

Thanks to new high-speed, ultra-high-definition cameras, new means of monitoring performance using biometric sensors, it will be possible to follow your favourite athletes as closely as possible during each match. (Orange Pop, 2015)

Here are some of the most advanced technologies (materials, instruments, methods, software) put at the service of sport.

3.1.2.1 On the performance side:

3.1.2.1.1 Dartfish:

A widely used Swiss device. It consists of a digital camera, a computer and image processing software. It can be used in all fields. In physical preparation, it is mainly used to dissect the movement, see physiological particularities or even visualize the progression or the difference between certain movements.



Fig 03 : Polyurethane wetsuits



Fig 04 : Simon Amman's Skis



Fig 05 : Goal Line Technology



Fig 06 : Drone

It can also be used to try to reproduce as closely as possible a movement made in one's sport. (Dartfish.com, 2010)



Fig 07: Decomposition of a skater's jump with Dartfish at the Vancouver Olympics.

3.1.2.1.2 Kinovea:

It is a free and open-source video analysis software for teachers, coaches, athletes and health professionals.

In sport, this software can allow the student or athlete to:

- View game sequences at variable speeds
- Issue comments associated with a key image
- Draw lines and arrows in the sequence
- Use a freehand pencil with adjustable colours and thicknesses.



Fig 08 : Kinovea

3.1.2.1.3 The Myotest:

A revolutionary accelerometer has been developed in Switzerland, the Myotest. It allows you to measure your performance by muscle group, obtain a muscle profile and optimize training according to the desired result. All the follow-up is done on a computer program which makes it possible to compare the performances and to see the evolution. It saves many hours of training by offering targeted work. (Myotest.ch, 2010)



Fig 09 : Myotest

3.1.2.2 On the health side:

3.1.2.2.1 Connected runner survival kit:

Music and calories burned applications – A bracelet to measure your performance – Glasses to film, or see real-time data (weather, etc.) – Wireless Bluetooth headphones – Sensor to analyse strides, speed and count of sprints. (Orange Pop, 2015)



Fig 10 : Runner kit

3.1.2.2.2 The heart rate monitor:

Aside from a stopwatch, the heart rate monitor is the measuring instrument most used by athletes. It is a real-time heart rate monitor.



Fig 11: Wireless heart rate monitor and diagram of a heart rate monitor strap.

A heart rate monitor is like a band to be placed around the thorax accompanied by a central unit located in a watch. The watch screen displays the heart rate value in real time and records it. (Lanotte, 2014)

3.1.2.2.3 With Anthony Gonzales, even your mouth guards are smart:

After having suffered a shock that was a little too violent during a game of rugby, the American engineer Anthony Gonzales decided to work on the creation of the FITGuard, an intelligent mouth guard. This brilliant invention makes it possible to avoid concussions thanks to a system of LEDs fixed on the front of the device. Now, thanks to Anthony Gonzales' FITGuard, the doctors are therefore immediately informed of the violence of the shock suffered by the player and can choose to send him back to the locker room or let him continue his match. Smart. (Orange Pop, 2015)

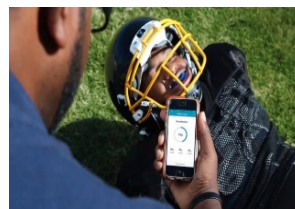


Fig 12 : FitGuard

3.1.2.3 Arbitration side:

Between players and referees, the reconciliation is not looking good. And for good reason! In tennis, rugby or football, refereeing faults continue to multiply to the great despair of athletes and spectators. To remedy this, technologies have been put in place to limit errors of judgment by referees.

3.1.2.3.1 Bulb and electrical wires:

Fencing is the first sport to adopt video refereeing. In 2005, the International Fencing Federation set up the use of possible video thanks to a camera that constantly follows the action. The suits as well as the weapons are designed to help



Fig 13 : Fencing Technology

the referee. In epee and foil only, electric wires are glued to the blade, with a pressure sensor at the end of the weapon allowing, when a hit is made, to make the connection between the electric wires and to light a light bulb placed outside the combat area to confirm the foul. (Karamoko, 2016)

3.1.2.3.2 “Hawkeye” and “Goal-line technology”:

The Hawkeye, literally called the hawk's eye, is one of the international leaders in the field of synthetic images in the sports field. It was in 1999 that the system was developed by Doctor Paul Hawkins, before being used two years later on television. This system consists of watching every movement of the ball using high-speed cameras placed at strategic points on the court. Accurate, reliable and powerful, the Hawkeye also allows players to have a better understanding of their weak points and therefore improve their performance. In Tennis, all the Grand Slam tournaments have adopted it, except Roland Garros for which it is estimated that the referee is able to judge a fault thanks to the trace of the ball apparent on clay. Thanks to the HawkEye, the trajectory of the ball is reproduced in synthetic images and is broadcast on two large screens placed on the court.

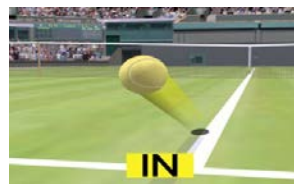


Fig 14 : Hawkeye

In football, the Goal-line technology designed by the German company GoalControl is the latest toy for high-tech enthusiasts. Fourteen high-speed cameras placed all around the field but all aimed at one or the other of the goal cages, capable of capturing up to 500 images per second, make it possible to automatically capture the position of the ball. The videos made are instantly processed in such a way as to leave only the ball and the goal cage visible. A powerful system which theoretically makes it possible to determine every two milliseconds the exact position of the ball on the ground with an accuracy of 5mm. For his part, the referee has a watch directly connected to the system on which he can read the words “Goal” as soon as the system confirms that the ball has crossed the goal line. (Karamoko, 2016)

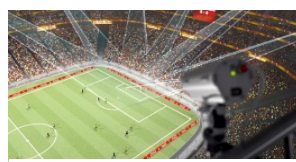


Fig 15 : Goal-line Technology

3.1.2.3.3 Touch pads or touch strips:

In the past, during major competitions, it was preferred to use three timekeepers per lane. Today, swimming is the only sport where the athlete himself stops his time. Thanks to the installation of the touch pads which aims to optimize the precision and recording of the swimmer's times, it is possible, on the one hand, to obtain the most precise results ever obtained to date. For decades, Omega timekeeping, exclusively, has played a leading role in the evolution of these technologies by ensuring fair and more accurate timekeeping. (Karamoko, 2016)

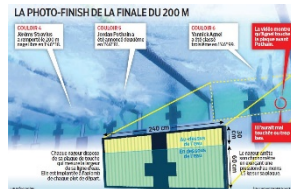


Fig 16 : Touch pads

3.1.2.4 On the leisure side:

3.1.2.4.1 GoPro: This new camera can record up to 120 frames per second in 4K and up to 5.3K at 60 frames per second, and it is resistant to different climates. Available to the general public, the GoPro HERO10Black allows all athletes to share their exploits without the need for a third party to film them, a kind of “selfie of sporting achievement”.



3.1.2.4.2 Drones: The drone, this small remote-controlled flying object, is a small revolution in the world of model making and photography. It is now possible to film your own sporting exploits thanks to a device that tracks you. A great opportunity to share your sporting adventures.



Fig 18 : Drone

3.1.2.4.3 VR headset: This is a device to be placed on the head, allowing you to live 3d video game experiences in virtual reality. It is a technology that immerses the user in the very heart of the experience. You can watch a basketball game as if you were in the room.



Fig 19 : VR headset

3.1.2.5 Disabled sport:

Disability can be an obstacle to physical and sports practice. Advances in science and technology can offer the disabled new possibilities, here are some examples.

3.1.2.5.1 The Exoskeleton:

It is a device that allows those whose muscles are partially paralyzed to be able to move again. Using sensors and motors, these mechanical structures reproduce movements such as walking. Many paralyzed people were able to partially resume walking. The discovery of lighter materials, more efficient computing, the miniaturization of certain components has made it possible to produce exoskeletons light and powerful enough to support human footsteps. (Bequignon, 2016)



Fig 20 : Exoskeleton

3.1.2.5.2 Flyease:

Nike launched the Flyease line of shoes. This shoe opens easily from the back to allow those with motor difficulties to put on their shoes with less effort. Equipped with a zipper at the back, the shoe opens and closes with a single movement, and only asks to slip your foot in. (Bequignon, 2016)



Fig 21 : Flyease shoe

3.1.2.5.3 SOFAO bathing chair:

In a more aquatic register, the SOFAO bathing chair allows those whose mobility is reduced to rediscover the pleasures of water. This chair also offers safety in the water, allowing the swimmer to perform a series of movements and exercises in the aquatic environment. A solution that could be particularly useful in the case of certain rehabilitations. (Bequignon, 2016)



Fig 22 : SOFAO bathing chair

3.2. ICT in Physical Education (PE):

Within the school community, the PE teacher carries out his activities in facilities (gymnasium, stadium) as specific as the classroom, the practical work room or a workshop. But these places of practice are often located on the outskirts or outside the premises of the establishment. This leads to particular forms of integration. (Poirier, 2016)



Fig 23: Use of Tablet in PE

ICT helps to involve students more in the PE session by using tablets or laptops to facilitate the tasks to be carried out. This means that the teacher

will be much more available to intervene with the students and he will see a change in the level of autonomy and motivation of his students.

3.2.1 Examples of technologies used in EPS:

This selection was made from the TICE and EPS of the Academy of New Caledonia in France, and the TICE and EPS show organized by the STAPS of Creteil France.

3.2.1.1 Computer tools:

3.2.1.1.1 KINOVEA: It is a free and open-source video analysis software for teachers, coaches, athletes and health professionals.



Fig 24 : Computer

3.2.1.1.2 Medianalyse: This is a video analysis software dedicated to physical and sports activities. Thanks to a range of simple tools, you can analyse and comment on your students' video productions.



Fig 25 : Medianalyse

3.2.1.1.3 Dartfish: This is a multimedia image analysis software that can be used by athletes, coaches but also by PE teachers. It also makes it possible to analyse the movement of an athlete or a student.



Fig 26 : Dartfish

3.2.1.1.4 Pico-projector: A small projector that looks like a big one. No bigger than a Dictaphone and held in the palm of the hand, the Pico projector allows:

- Project photos, films,
- Make presentations on a screen,



Fig 27 : Pico-projector

3.2.1.1.5 The interactive whiteboard: The Interactive Whiteboard (IWB) or Interactive Digital Board (IDB) is a device combining the advantages of a touch screen and video projection.

A white touch screen is connected to a computer via a cable. It is able to transmit various information, including the new position of the mouse cursor, by touch. A video projector is responsible for displaying the computer screen on the whiteboard.



Fig 28 : Interactive Whiteboard

3.2.1.2 Tablet and smartphone tools:

3.2.1.2.1 My Jump 2: An application that provides information on jumps using the camera of the smartphone or tablet. By recording a jump, accurately selecting take-off and landing, My Jump 2 calculates the height, flight time, speed, force and power of vertical jumps in addition to other indices.



Fig 29 : My Jump 2

3.2.1.2.2 Sprongo: is an online application for analysing videos with different tools. This makes it possible to share videos and analyse them with others. You will be able to annotate on the image or give your comments on a sports performance.



Fig 30 : Sprongo

3.2.1.2.3 Coach's Eye: Application allowing you to quickly record and review the performance of your students, analyse the performance on the spot and make immediate corrections.

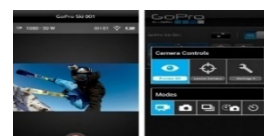


Fig 31 : Coach's Eye

3.2.1.2.4 Teacherkit: a personal organizer for the teacher, it allows to manage his classes, to create trombinoscopes and student files. It's simple and intuitive interface allows you to follow the attendance, exemptions, behaviours, outfits, levels of your students.

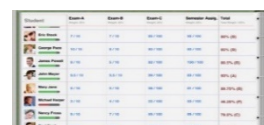


Fig 32 : Teacherkit

3.2.1.2.5 Handball Board, Basket Board, Volley Board, Football Board: Application that allows teachers to present strategies and tactics in all opposition APSAs.



Fig 33 : Handball Board

3.2.1.2.6 iPTB: It is a team sports match statistics application allowing immediate processing of the results concerning ball possessions, shots and goals. Evaluate the collective effectiveness of students. (Diagnostic, formative and summative assessment.)



Fig 34 : iPTB

4. Conclusion:

The purpose of this research is to demonstrate the importance of integrating information and communication technologies in training sessions and physical and sports education (EPS).

Research has shown us that Information and Communication Technologies or ICTs represent an important potential for pedagogical innovations and an almost infinite reservoir of new practices for teachers and coaches alike. They can further adapt learners' work in line with their own learning styles, thus meeting the needs of both strong and struggling learners.

Learners will be more attentive and motivated when computers and the Internet are used in the session. ICT have a positive effect on behaviour, motivation, communication and the construction of cognitive skills.

ICT makes it easier for the teacher and the trainer to explain an exercise or demonstrate using images, 3d figures or videos, which saves a lot of time. And those who do not like sports practice will find an attraction through these technologies.

To implement these technologies in practice, teachers and coaches must be properly prepared. They can take training or introductory lessons in the use of computers and the Internet and the various hardware and software technologies. The same goes for students and athletes, which facilitates their learning and teaches them time management and to have an analytical and critical mind in order to develop on the physical and mental aspect.

This systematic review has provided us with the technologies and means that can help in training sessions and physical and sports education in order to facilitate the task of the teacher and the trainer and consequently a better learning for the students and athletes who will participate in an effective, interactive and independent way.

From this research we recommend to:

- Conduct training for PE teachers and coaches to teach them how to use these technologies.
- Teach students and athletes the use of these technologies in order to interact during the session.
- Provide the teacher and the trainer with the minimum of technologies (Computer, tablet, Data show, Digital camcorder, Digital camera)
- Show teachers, coaches, students and athletes the importance of using these information and communication technologies to facilitate their tasks.
- Set up an ICT teaching program in schools and university to introduce students to the use of these technologies.

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