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The Relevance of Mobile Applications in the Learning of Physical Education

Lilyan Vega-Ramírez *, **Rubén Olmedilla Notario** and **María Alejandra Ávalos-Ramos**

Department of General and Specific Didactic, Education Faculty, University of Alicante, 03690 San Vicente del Raspeig, Spain; rubenlmdll@gmail.com (R.O.N.); sandra.avalos@ua.es (M.A.Á.-R.)
* Correspondence: lilyan.vega@ua.es; Tel.: +34-965-903-400 (ext. 2099)

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Abstract: Mobile telephony has developed exponentially, offering a multitude of services that could be optimal for the educational field of physical and sports activity (PSA). The objective of this research was to analyze the use of smartphone by 40 Spanish teenagers and assess the degree of satisfaction of the Polar Beat application within the subject of physical education in high school. The instruments used were two quantitative questionnaires and the data were analyzed with the statistical package SPSS 24.0. The teenagers recognized that they use the smartphone for instant messaging, telephone calls and downloads of games and tunes. The Polar Beat application in physical education classes has allowed them a better understanding of the content developed; the students affirmed that their motivation towards PSA increased with the knowledge and use of the Polar Beat app and that smartphones are innovative and effective tools. With all this, the mobile phone could be an educational tool that awakens interest in teenagers and teachers.

Keywords: technology; physical activity; smartphone; gender; high school

1. Introduction

The second half of the 20th century has been characterized by the digital revolution and the technological advances that have produced changes in all areas of society [1]. In this way, information and communication technologies (ICT) have become part of the current culture, integrating education in a transversal way as an element that improves academic performance [2] and new forms of interaction, work and learning are created [3].

We understand ICT, aligned with Cacheiro [4], as the technologies that make it possible to get necessary information at any time and place. Additionally, Roblizo and Cózar [5] consider ICT as an innovative and variable fact that includes everything from the technical to the social, assimilating or retaining all the activities of the human being.

Currently, people would not be able to understand a day to day without our smartphones, our laptops, or our iPods, because we consider them fundamental tools in our daily lives. Since human beings often tend towards to socialization, interpersonal relationships that people seek through the link or the union with the commented devices are favored [6]. Therefore, it is indisputable that ICT is a favorable tool for the development of education, giving technology the importance it deserves within the teaching-learning process, without forgetting the influence it can have on students, teachers and, of course, the educational community itself [7]. This fact represents a challenge for educational establishments, in that they must provide ICT skills to students using active strategies and understanding learning beyond the limits of educational centers [8].

The guidelines of the European Union, in their strategic plan for education and training 2020, request governments to train citizens in key competences since they can guarantee their personal, social, and professional development. One of the skills to develop refers to digital competence, mainly looking

for the creative, critical, and safe use of information, as well as its use to solve real problems efficiently. This implies addressing information management, its interpretation, the media, content creation, risks associated with technologies and problem solving. As we observe, the Education Law in force in Spain refers to the widespread incorporation of ICT into the education system; however, what reflects the educational context is not a close relationship between society and school, due, to a large extent, to teaching resistance to the admission of the mobile device as pedagogical ICT in educational centers [9]. There are three factors that prevent this tool at a global level from being used as a means of teaching or learning in schools: the prohibition in the centers of the use of smartphone, due to educational regulations; the unconsciousness of the students regarding the usefulness of the mobile device in the classroom, putting the ludic approach before the educational one; and, finally, inexperience or incompetence on the part of teachers about the educational capacity of mobile applications [8,10,11]. On the other hand, possible consequences derived from excessive use of ICT have been identified; for example, loss of time for other activities, behavior and mood alterations, decreased social relationships, and decreased academic performance, among others [12,13]

In the case of the subject of physical education (PE), technologies could be a motivating resource towards increasing the practice of PSA in general and, specifically, in women who, as Kirk & Oliver [14], point out, tend to be less willing to practice PE. The WHO [15] reports 75% of teenagers practice less physical activity than recommended, with women being the most disadvantaged groups (85%) compared to men (78%). In relation to gender, several studies carried out in Spain [16–18] indicate that teenage women perform less PSA than teenage men; ICT can increase the level of physical activity and reduce sedentary lifestyles by monitoring physical exercise with digital devices [19,20]. The high prevalence of physical inactivity in teenagers is a danger to current and future health, and therefore it is necessary to expand programs that are effective in increasing physical activity in teenagers [21].

A motivating element to promote physical activity may be in the use of sports mobile applications. It is worth mentioning the multitude of applications for assisting in the practice of physical activity that we find today on our smart devices, and that are increasingly popular, have the main function of collecting data such as: steps, route and frequency, and daily physical activity, while also allowing this information to be shared with other people [22]. This can be a fundamental tool to control or influence the levels of physical activity that teenagers perform daily [23,24].

It is worth mentioning the multitude of applications that we can find today in our technological devices, which can be fundamental tools to control or influence the levels of physical activity performed by teenagers daily [23–25]. In addition, these types of applications are usually free or have a low economic price. Teenagers are immersed in a technological society, but schools continue to use traditional methodologies [26]. Teachers are reluctant to incorporate the smartphone as an educational strategy [6,9]. Every day the use of M-learning is increased at all educational levels in order to support learning, since the delivery of information is enhanced through multimedia [27]. In this sense, studies carried out within the context of PE have endorsed that ICTs are advantageous in aspects such as increased motivation, facilitating feedback in learning, are applicable to different physical activities, and facilitate autonomy in their practice, among others [28,29]. In this sense, Schwartz and Baca [22] mention that physical activity apps are based on behavioral theory and use gamification elements to ensure the success of the activity, where personal goals and specific comments are established to help carry out the activities, thus increasing motivation. There are also specific applications used in PE to teach, learn, innovate, or research in educational environments that can be used to manage the PE classroom, create ad hoc curricular materials, make educational plans and programs, monitor technical performance, sports, and record activities, among others functions [30].

For all the above, the objective of our study has been, through a pilot study, to analyze the use of smartphones in a group of 40 Spanish teenagers, and assess the degree of satisfaction with the Polar Beat application in relation to the assessment of the app as a methodological strategy in the development of five sessions of Physical Condition and Health within the subject of PE in high school.

Likewise, to assess whether there are gender differences in relation to the use and satisfaction of said application.

2. Materials and Methods

The proposed pilot study has a quantitative design and corresponds to a descriptive and exploratory model. The sample consisted of 40 students (24 girls, 16 boys) in high school (Spain, Alicante), with ages between 15 and 18 years (M = 15.9). The students and the legal tutors were informed that the data from the initial evaluation could be used for research purposes, obtaining informed consent, following the guidelines of the data projection law and the approval of the Ethics Committee of the University of Alicante (UA-2019-07-24).

Three instruments were used to assess the research. First, the questionnaire by Brazuelo, Gallego, and Cacheiro [9], referring to the use of the mobile device and the possibilities it offers, which is divided into seven blocks of content. Second, to know the degree of satisfaction about the usefulness of the use of smartphone in PE classes, 10 items were prepared by the research team with 5-point Liker scale response options (1 = Strongly Disagree, 2 = Disagree, 3 = Indifferent, 4 = Agree, 5 = Strongly Agree). These items were also reviewed by three professors from the Faculty of Education of the University of Alicante (Spain), experts in the field. An Alpha Cronbach reliability test (0.8) was performed.

Finally, the Polar Beat application was used to carry out and develop the content of Physical Condition and Health, referring to the physical capacity of resistance. This application was chosen for being free, for compatibility with Android and iOS, for being able to be personalized, for being simple to use and for allowing control of the distance and duration of effort in addition to collecting training history and developing speed graphs. In addition, this application was the most downloaded by the participants of our pilot study, as we observed in our first results.

2.1. Process

In the first instance, we contacted the educational center where the research was carried out. Once the principal of the school and the PE teachers obtained the permits, informed consent was requested from the parents. After one month, once all the permits were collected by the legal tutors of the students for participation in the research, the students were explained the criteria they should follow. The criteria were the following: (a) have a smartphone; (b) have downloaded the free Polar Beat app; (c) attend 100% of the five sessions with the smartphone.

In addition, prior to the beginning of the five sessions of Physical Condition and Health, a protocol was established and explained to the students, as well as a working guide for the development of the different sessions. In the first PE session they were given the first questionnaire to understand aspects about physical activity, their use of the smartphone and the knowledge they had about ICT and its link with PE. In the fifth session, after carrying out the intervention (February 2019), the 10 items on the satisfaction of the application used for the practice of the activity were passed on to the students. To develop the intervention during the five PE sessions (Table 1) where the Physical Condition and Health block was developed, specifically the development of resistance, the free Polar Beat mobile application was used for an operating system.

2.2. Statistic Analysis

For the analysis of the data, the statistical package Statistical Package for the Social Sciences (SPSS) 24.0 was used. The statistical techniques used were a descriptive analysis and the Chi^2 test for non-parametric tests of free distribution for the comparison of means.

Table 1. Development of the content Physical Condition and Health, according to sessions.

First Session
Presentation of the unit. Initial questionnaire. Explanation of the use of the *Polar Beat* through videos. Reaction of simple resistance tasks and through forms played for the initiation of application management.
Second Session
Theoretical explanation and practical implementation of two resistance-training systems: continuous running and fartlek. Practical performance of exercises using the methods explained considering the support of the Polar Beat to have information on the duration and distance traveled individually.
Third Session
Theoretical explanation and practical implementation of two resistance-training systems: interval training and speed-resistance. Practical performance of exercises using the methods explained considering the support of the *Polar Beat* to have information on the duration, the distance traveled, and the speed of the race along with the extraction of graphs of this information.
Fourth Session
Development and implementation of an 8-station time circuit consisting of activities associated with resistance. Time control and total speed of work with the application. Extract and analyze individual training history carried out in the activities carried out up to this moment per session and in total according to the duration, distance traveled, and speed of execution. Sharing in small groups of the extracted data.
Fifth Session
Design and application of a work plan for the development of resistance by choosing a method as explained and using the *Polar Beat* application to present the total time, duration and speed worked in the session. Complete the 10 issues associated with the satisfaction of the *Polar Beat*.

3. Results

3.1. Use and Possibilities of the Mobile Device

After analyzing the data of the first questionnaire on the use of the mobile device and the possibilities it offers, we determined that 100% of the students had a smartphone with Bluetooth, GPS and Wi-Fi connection. Mainly, the teenagers use their devices for social networks and instant messaging applications (women 87.3%; men 88.7%), to a lesser extent for calls from family and friends (women 5.9%; men 6%) and, finally, to take photos and videos (women 6.8%; men 5.3%). Regarding the possibilities offered by smartphones to read documents (Word, Excel or PowerPoint), 22.5% of students did not know this medium (women 25%; men 18.8%), while 77.5% knew this fact (women 75%; men 81.3%). Regarding the download of applications such as games or melodies, and downloads of applications to perform physical exercise, some differences between genders were found, without these differences being significant, as shown in Table 2.

Table 2. Downloading applications and gender.

Downloading		Women %	Men %
Apps for games or music	Almost never	37.5	31.2
	Sometime	20.8	18.7
	Many time	41.6	50
Apps for physical education	Almost never	45.8	37.5
	Sometime	25	25
	Many time	29.1	37.5

The most downloaded mobile applications related to physical activity were: Polar Beat (36.54%), Runtastic (15.38%), Nike training (13.46%), others (8.62%), and do not have (26.9%).

Concerning the level of knowledge about ICT, 37.5% (women 33.3%; men 43.8%) claimed a low level, 32.5% (women 25%; men 43.8%) claimed to have a high level, and the remaining 30% (women 41.7%; men 12.5%) indicated an average level of knowledge. Considering the Internet as an educational tool, 52.5% of teenagers said that their teachers use it many times, 25% said sometimes and 22.5% said that teachers use this tool few times. Regarding the perception of the use of the Internet by their PE teachers as a learning strategy, 80% of the participants admitted that they almost never use it and the remaining 20% said that they used it sometimes. According to the students, the main functions of the smartphone for PE classes are the use of videos and photographs to analyze the exercises (50%), the use of mobile applications related to the training record (30%), the use of Google maps and readers of QR codes for orientation activities (10%), and finally, for other utilities (10%).

3.2. Degree of Satisfaction of Using the Polar Beat Application

The results on the satisfaction of using the Polar Beat application on the smartphone during the five sessions of PE are shown in Table 3.

Table 3. Satisfaction of high school students with Polar Beat in physical education. ICT = information and communication technologies, PE = physical education.

Items	1	2	3	4	5	M (SD)
1. The way the teacher presents the material motivates me.	0%	2.5%	12.5%	32.5%	52.5%	4.3 (0.80)
2. I feel motivated to apply the knowledge acquired.	0%	0%	10%	80%	10%	4.0 (0.45)
3. It motivates me to do physical activity outside the educational center using ICT.	0%	0%	17.5%	32.5%	50.0%	4.3 (0.76)
4. The use of the app in PE is an innovative and effective method.	0%	0%	20%	15%	65%	4.4 (0.81)
5. The use of the app in PE helps me to better understand the proposed activities.	0%	0%	0%	77.5%	22.5%	4.2 (0.42)
6. The use of the app in PE helps me to capture the essentials of the activities.	0%	0%	32.5%	60%	7.5%	3.7 (0.58)
7. The use of the app in PE allows me to correctly apply the theoretical concepts to the practical part of the proposed activities.	0%	0%	12.5%	50%	37.5%	4.2 (0.66)
8. The use of the app in PE allows a smooth rhythm in the activities.	0%	0%	0%	77.5%	22.5%	4.2 (0.42)
9. The use of the app in PE allows a better interaction between the teacher and the student.	0%	2.5%	10%	60%	27.5%	4.1 (0.68)
10. The use of the app in PE allows working more intensely in the activities.	0%	5.0%	45%	40%	10%	3.5 (0.74)

Regarding motivation, students reported agreeing that the way they present the activity motivates them (M = 4.2), just as they feel motivated to apply the acquired knowledge (M = 4.0), with a higher score for the item "the use of the app motivates me to do physical activity outside the educational center using ICT" (M = 4.3).

Regarding methodological aspects, we observed that students also agreed that the use of apps is an innovative and effective method (M = 4.4), that the use of apps in PE helps them to better understand the proposed activities (M = 4.2), and that the apps help them correctly apply the theoretical concepts developed in PE classes (M = 4.2). Regarding the issue "the use of the app in PE helps me to capture the essentials of the activity", they are indifferent (M = 3.7).

With respect to the elements of organization of the class, the students agree that the use of the app allows a more fluid rhythm of the activity (M = 4.2), and there is a better interaction between the teacher and the student (M = 4.1); likewise, they valued in an indifferent way the questions on which the use of the app allows them to work more intensely in the activities (M = 3.5).

When segregating the sample by gender, we observed some significant differences (Table 4). These differences were associated on the one hand with the methodological aspects, in the item "the use of the app in PE helps me to capture the essentials of the activity", with M = 3.9 for girls and M = 3.5 for boys with a difference significant of 0.001 ($p \leq 0.05$), and in the item "the use of the app in PE facilitates me to correctly apply the theoretical concepts to the practical part of the proposed activities", with M = 4.3 for girls and M = 4.1 for boys with a significant difference of 0.036 ($p \leq 0.05$). On the other hand, we observed that there were also significant differences in aspects related to the organization of the class, specifically in the item "the use of the app in PE allows a better interaction between the teacher and the student", with M = 4.2 for boys and M = 4 for girls with a significant difference of 0.017 ($p \leq 0.05$), and in the item "the use of the app in PE allows me to work more intensely in activities", with M = 3.7 for girls and M = 3.3 for boys with a significant difference of 0.035 ($p \leq 0.05$).

Table 4. Gender differences to the satisfaction of the use of the Polar Beat application in PE classes.

Items	Gender	1 %	2 %	3 %	4 %	5 %	Mean	Chi^2
1. The way the teacher presents the material motivates me.	M	0	6.3	12.5	31.3	50	4.2	0.672
	W	0	0	12.5	33.3	54.2	4.4	
2. I feel motivated to apply the knowledge acquired.	M	0	0	6.3	87.4	6.3	4	0.626
	W	0	0	12.5	75	12.5	4	
3. It motivates me to do physical activity outside the educational center using ICT.	M	0	0	31.3	25	43.7	4.1	0.169
	W	0	0	8.3	37.5	54.2	4.4	
4. The use of the app in PE is an innovative and effective method.	M	0	0	18.8	25	56.2	4.3	0.348
	W	0	0	20.8	8.3	70.8	4.5	
5. The use of the app in PE helps me to better understand the proposed activities.	M	0	0	0	75	25	4.2	0.757
	W	0	0	0	79.2	20.8	4.2	
6. The use of the app in PE helps me to capture the essentials of the activities.	M	0	0	62.5	25	12.5	3.5	0.001 *
	W	0	0	12.5	83.3	4.2	3.9	
7. The use of the app in PE allows me to correctly apply the theoretical concepts to the practical part of the proposed activities.	M	0	0	6.3	75	18.7	4.1	0.036 *
	W	0	0	16.7	33.3	50	4.3	
8. The use of the app in PE allows a smooth rhythm in the activities	M	0	0	0	75	25	4.3	0.757
	W	0	0	0	79.2	20.8	4.2	
9. The use of the app in PE allows a better interaction between the teacher and the student.	M	0	6.3	12.5	31.2	50	4.2	0.017 *
	W	0	0	8.3	79.2	12.5	4	
10. The use of the app in PE allows working more intensely in the activities.	M	0	6.3	68.7	12.5	12.5	3.3	0.035 *
	W	0	4.2	29.2	58.3	8.3	3.7	

* significant difference ($p \leq 0.05$).

4. Discussion

The aim of our pilot study was to analyze the use of smartphones in a group of 40 high school students, as well as to teach how to use the Polar Beat mobile application to work with physical condition and health content, finding out the degree of satisfaction with the use of it in the performance of physical activities, and if there were gender differences.

As we already know, technologies have burst with great force in today's society, so much that according to studies carried out, it is estimated that in 2017, the global figure of users who made use of the Internet reached almost 3.5 billion. In addition, the total number of subscriptions to smartphones was close to 8 billion, without forgetting that 70% of young people from all over the world who are online are between 15 and 24 years old, or that the percentage of young people between those same ages that use the Internet (71%) is significantly higher than the total population that makes use of it (48%) [31]. For this reason, it is not surprising that this means of communication, surpassing traditional, digital, and analogue media, has become the most universally widespread [32]. In our research we

also see this trend confirmed in both genders, since all students have a private smartphone and almost 100% have data service to access the Internet on their device, without forgetting that they all have a Wi-Fi connection. That technology advances faster and faster is a fact, and the emergence of new instant messaging applications that allow you to talk with family or friends for free are leaving calls and SMS (short message service) behind. Making a comparison between our study and that carried out by Ballesta, Cerezo, and Veas [33], whose participants were of similar ages to ours, we observed how the percentage of calls and messages has been reduced. While four years ago sending and receiving messages occupied 23.1% in the subjects of the study, our results show that a minimum number of them make and receive calls and SMS. Paying attention to the perception that students have about the use of technological media by their teachers as an educational tool, we found that slightly less than half of students appreciate that they are rarely used. The lack of use by the teacher may be related to their reduced ICT training, so they would not be able to achieve full integration of the technology [34]. In educational centers, there is an increasing amount of computer equipment, but these should not only serve as support materials for the teacher, but also as a teaching medium used on a regular basis between the students and the teacher, requiring teachers to keep updated and trained [35]. In contrast, many educational centers lack the digital services necessary to support learning activities, either because of their context or because of the lack of economic resources [36]. According to the results of the study by Fernández and Ladrón de Guevara [37], 95% of PE teachers agree that the consequences of the use of ICT in the teaching-learning process are positive. In addition, 47% of these teachers use ICT as a pedagogical tool in their PE classes; however, many of our participants confirm that their PE teacher almost never uses them. The technological devices have many free or low-cost applications, are easy to use, and can be used in research to determine the levels of physical activity performed by students, among other characteristics [25]. As for the mobile application to help us in our intervention, there were two fundamental criteria: that it be free so that all students could participate, and that it offered reliable and attractive data, to attract the attention of the students. We were aware that totally free applications are often accompanied by lower quality, as warned by Cowan et al. [38].

The fact that our satisfaction questionnaire provided to students after the intervention period had favorable results in each and every one of the items, highlighting to a greater extent the increase in motivation and the consideration of mobile devices as an innovative and effective learning method, leads us to link the results with the statement of Esteve and Gisbert [27,39] about the performance of ICT use from the student's point of view. These authors argue that ICT is essential to motivate students to commit 100% to the learning process. Apps provide motivation to increase the weekly duration of physical activity [40]. Likewise, focusing on the greatest motivation with the use of the smartphone in sessions of PE, it is verified that the learning of any subject through ICT achieves the result that the student enjoys it and perceives it with greater degree of importance [41]. Along these lines, taking into account gender differences in terms of the satisfaction perceived by the participants, it is determined that the use of the app is a more motivating element for women than for men, both in PE classes and outside the educational field. This fact could favor the increase in the practice of PSA in teenagers who are disadvantaged today [12].

On the other hand, ICTs allow us to create environments that approach new forms of learning in society, exercised as facilitators of learning and in the construction of knowledge and social interaction [42]. In this line, Llorens, Vega, and Ávalos [43] argue that the use of ICT in PE sessions involves positive aspects for the student in increasing interest in their learning process. In our case, the results show that the use of the app makes it easier for students to better understand the theoretical concepts and capture the essentials of the task; this leads us to link the results with the statement [11], to maintain a fluid pace of the proposed activities, and better understand the meaning of practice in the PE classes, premises that significantly indicate women. Likewise, Tømte [44] and Oberst, Chamarro, and Renau [45] state that women are more aware of the instructional value, educational value, and interrelation potential that technology can promote, unlike men who perceive them primarily as

means for entertainment. Also, it has been shown that the use of apps for the development of physical activity has a positive effect on healthy behavior [46].

Other parameters in which the degree of satisfaction of the students is reflected coincide to a large extent with Fernández, Herrera, and Navarro [47]. They state that there is an increase in the involvement of students in the task defendants, in addition to the development of their initiative, where the achievement is an increase in the level of effort and the ability to carry out activities that traditional methods did not achieve from our participants. In relation to gender, for women the use of the app helps them to intensify their efforts in the tasks posed in the PE sessions. As Klenk, Reifegerste, and Renatus [29] state, the possibility of registering the activity offered by the app could be an incentive to increase the performance in physical conditioning. On the other hand, the significant differences in men are oriented to the fact that their use serves to improve interaction with teachers.

The limitations presented by this study focus on the small representation of the sample, and the duration of the intervention in terms of the number of PE sessions applied for the use of the app. Therefore, these findings approximate the object of study being able propose future lines of research where participants are increased, various educational centers are involved, and the possibility of designing an experimental research design.

5. Conclusions

The main conclusions that are drawn from this pilot study refer to the fact that the use of smartphones and this application has an extended use in the teenager population, as was is observed in our pilot study and other investigations. Likewise, the use of the Polar Beat application in the PE classes, specifically in the development of the content of Physical Condition and Health (resistance), has been valued satisfactorily by the participants, with greater satisfaction in women. Also, from our study it can be deduced that the use of Polar Beat motivates our participants towards the practice of physical activity both inside and outside the educational environment, with a greater effect for girls. Regarding methodological aspects, the Polar Beat application provided our participants a better understanding of the theoretical contents of the subject developed in the PE class, with a significant difference in favor of women. In addition, it promoted optimal work environments towards the fluidity of the activity and the interrelation with the teacher.

Unquestionably, the promotion of sports in the school population both through extracurricular activities and through physical activity outside the school is necessary.

Students are immersed in technologies and use smartphones for everyday aspects within their day-to-day routines. This fact must be exploited to develop digital competence within the educational context and outside of it, linking it with the practice of physical and sports activity and associating it with an improvement in health.

These early findings raise the need for the technology to support the monitoring of physical activity as well as its learning process and self-control that can healthily benefit care throughout life. In addition, these first indications encourage us to continue with the development of this research with a more representative sample and increase the time of educational intervention. The future intention is to propose an experimental design with a control group, where in addition to considering the gender variable, the age and practice or not of physical activity outside the school will be considered.

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