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# ANALYSIS OF PHYSICAL EDUCATION APPS FOR COOPERATIVE LEARNING THROUGH GAMIFICATION

L. Iglesias Alcón<sup>1</sup>, A. Torres-Toukoumidis<sup>2</sup>, N. Medranda Morales<sup>2</sup>

<sup>1</sup>Universidad Nebrija (SPAIN)

<sup>2</sup>Universidad Politécnica Salesiana (ECUADOR)

## Abstract

Acknowledging the value of mobile learning within the digital ecosystem, the present work seeks to identify gamification elements and cooperative learning in mobile applications for Physical Education course to determine its relevance for health promotion. The methodology considered a grounded theory design to collect the data through non-participant observation of the top 10 mobile applications according to AppStore and Google Play which were evaluated according to the following criteria: cooperative learning, health promotion activity, educational stage, and gamification components. The results proved a trend towards the development of interaction skills, while 70% of mobile applications are willing to improve the physical condition mainly in compulsory secondary education; it was also showed that levels, challenges and leaderboards were the most common gamification components presented on Physical Education Apps. In short, within the playing spectrum, gamification and mobile applications prevail as a tangible opportunity to enhance physical activity on the educational context, meaning that this study brought out the initial track of this nexus allowing future researchers to focus on empirical data and analysis of student perception in relation to these apps.

Keywords: gamification, cooperative learning, health promotion; mobile apps, physical education.

## 1 INTRODUCTION

This project arises from personal interest and the search for knowledge around innovative educational proposals as a form of progress and personal and professional development. In this way, the idea of deepening the study and implementation of innovative methodologies such as cooperative learning and gamification appears.

Education linked to Information and Communication Technologies (ICT) in particular, cannot remain on the sidelines of the great social change that is taking place in the school of the twenty-first century [1]. Indeed, "One of the most evident features of the Information Society, Lifelong Learning and Knowledge is the omnipresence of ICTs and the irreversibility of their penetration in all spheres of life. Physical educators cannot ignore this reality or uncritically abandon us to its irrational and indiscriminate use. It is necessary to know how to do it with criteria [2]. Likewise, we need a Physical Education that responds to the challenges of the new times and establishes guidelines that help us to integrate them as an added value capable of enriching the teaching-learning processes.

Recognizing the amplitude of vicissitudes that make up the school of the 21st century, it has been decided to address innovative methodologies, specifically, gamification and cooperative learning in the applications of Physical Education, a subject that today and according to the review in high impact journals (JCR and SCOPUS) does not contain a consistent theoretical basis and which needs to be deepened.

There are evidenced articles that expose both the cooperative learning and the gamification in Physical Education separately, without combining both, it is for that reason the intention to unify these methodologies in the useful applications to carry out the teaching practice in this subject. To approach this topic, starting from the base that no previous studies have been found relating to innovative methodologies. Among the premises that justify the use of Information and Communication Technologies with powerful methodologies such as those mentioned above will help students to develop new knowledge, new skills and abilities.

On the other hand, it should be considered that using a cooperative methodology within the classroom and more in Physical Education classes can be a very effective way for students to learn and develop. The student is the protagonist not only in the learning process but also in the teaching process. When working in groups, students must improve not only what they do, but also help improve the rest of their

classmates since they are all one [3]. Indeed, what is important is not technology, but the educational use we can make of it. Information and Communication Technologies open a new horizon: we teach how to learn autonomously; we learn how to teach differently.

A several technological tools and instruments could be used in the field of Physical Education, however, the main function of the teacher will be to adapt them in their classes, both inside and outside the classroom, thus getting students to improve their learning thanks to them.

## 1.1 Information and Communication Technologies for Physical Education

In Physical Education many tools applications or technological instruments could be used to improve the teaching-learning process, which is why this subject has been chosen to carry out this study. To carry out this teaching-learning process, the teacher will have to adapt his sessions both inside and outside the classroom, achieving that all students improve their competences thanks to the tasks and these tools.

Adaptation in the educational system will be necessary thanks to active and concise work on the part of the teacher, the latter being the most responsible [4]. In the same way, certain obstacles can be seen, such as the excess of content and a limited number of hours concerning which they will have to endure to adapt optimally.

The need to find a balance between the use of communication tools and motor practice or to promote different areas of the subject such as motivation, cooperation or significant learning will be the key for adaptation to be ideal. Continuing with these authors we find advantages of the new technologies in the area of Physical Education [5], being these:

- Diversity. With the ICT and the variety that we find in the applications, we can make the process something very motivating and innovative for the students.
- Save time for other activities. Once we have developed the content will make us have more time to do other exercises that allow us to be more efficient.
- Existence of more significant learning. The new technologies will modify and restructure that previous knowledge and experiences, readjusting and reconstructing in this way the learning process.

On the other hand, the main advantages of applying ICT in the Physical Education classroom are [6]:

- Adaptability. They make it possible to adapt to the new school and thus reach students in a more motivating way.
- Time flexibility. They can be used both outside and inside the classroom, which is of great help to working on certain contents that due to lack of time cannot be developed in class.
- Immediacy. It allows obtaining results in a legible and fast way, either at the time of evaluating or at the time of seeing improvements.
- Interactivity. Thanks to the media and with the help of ICT we can develop the different types of existing interactivity (interface, perceptive, selective and content).

Therefore, it means a challenge for teachers to apply them satisfactorily and they consider that mobile applications can encourage participation in sports activities [7]. Finding ways to encourage students is one of the best ways to avoid being sedentary with those hours of physical exercise.

The use of ICTs makes it easier to achieve disciplinary objectives, facilitating the development of digital competences and competencies aimed at "learning to learn". Also, ICTs in Physical Education makes it possible to connect teachers and students anywhere, offering more relationship opportunities than we have right now in school. As in other subjects, thanks to ICT, we find the possibility of customizing learning, adapting it to the heterogeneity of the group, working with it the search for balance between the use of tools and motor practice.

To mention the importance of the motivation of both the teacher in the first instance when carrying out the activities, and the subsequent motivation of the key student to carry out an effective and satisfactory teaching-learning process. The list of motivations for the use of ICTs in the Physical Education classroom "put technology at the service of people, use it to humanize teaching, and turn to teach into a true social pedagogy"[8].

## 1.2 Cooperative learning

Cooperative learning involves the instructional use of small groups for students to work together and make the most of their own and interrelated learning. In turn, it refers to a series of instructional strategies that include student-to-student cooperative interaction on some subject as an integral part of the learning process [9].

On the other hand, cooperative learning is an educational methodology based on working in small groups, usually heterogeneous, in which students join efforts and share resources to improve their own learning and that of the other members of the team [10]. In the definition mentioned above, it can be observed that there is a double responsibility, on the one hand, for the individual's own learning and, on the other hand, for the common learning of the other members of the group.

## 1.3 Cooperative learning in Gamification

The developed experience has evidenced the positive effect that gamification contributes to promoting a greater motivation and effective implication of the students in the classes of Physical Education presenting learning achievements as a key challenge to be solved cooperatively and through a transmedia narrative, known as efficient methodological strategy to extend learning outcomes beyond school [11].

The educational possibilities of the game are inexhaustible if we carry out a panoramic review of its possible contributions to the development of competencies, we find many proposals. Some of these are traditional, popular, cooperative, alternative and sensory games. In summary, cooperative games allow us to tackle interdependence, which is an increasingly demanded competition for our future citizens.

## 2 METHODOLOGY

The general objective of this research consisted of analyzing 10 mobile applications oriented to Physical Education to identify gamification and cooperative learning components in the stages of Primary Education and Compulsory Secondary Education.

Under this topic, an initial sieve is made for the most downloaded mobile applications in AppStore and Google Play. Afterward, they will be filtered using for research those that are more similar, and more data can provide according to the taxonomy of Bunchball. For the accomplishment of this research a design of grounded theory has been made [12], on the one hand, it was proceeded to the revision and detection of the existing literature, extracting and compiling the information of interest, once found this documentation the criteria to follow to analyze the applications counting on the component gamified and of cooperative learning were determined. For the data collection tools, the non-participant observation was used to select the applications and Bunchball taxonomy to determine the criteria [13].

As for the specific objectives of this research:

- a) Analyze mobile applications aimed at the subject of Physical Education.
- b) Evaluate the cooperative components, health promotion factors and gamified elements in the mobile applications aimed at the learning-teaching process.

Each mobile application was downloaded and reviewed from 29 March 2019 to 4 July 2019.

*Table 1. Mobile Apps of Physical Education selected from GooglePlay and AppStore*

<i>Nr.</i>	<i>Name of the App</i>	<i>Nr. of downloads</i>	<i>Rank in App Store</i>	<i>Rank in Google Play</i>
1	Sworkit	5.000.000+	17	11
2	Classcraft	100.000+	32	59
3	Zombie run	1.000.000+	9	18
4	Geocaching	5.000.000+	11	9
5	Endomondo	10.000.000+	77	62
6	Strava	10.000.000+	11	40
7	Runtastic	10.000.000+	4	8
8	Leverade	100.000+	24	3
9	Classdojo	10.000.000+	22	17
10	SuperBetter	100.000+	3	5

The analysis carried out is based on determining their predisposition towards Physical Education while maintaining the following criteria. Specifically, each of the criteria focuses on the following:

- Cooperative learning. with the work in small groups, being these normally heterogeneous it is possible to achieve that the students join efforts improving in this way their learning, improving also that of the rest of the members of the team. It will be evaluated whether the applications also meet this criterion.
- Health promotion. Physical education has traditionally been considered a privileged subject to promote health, either directly due to the activity carried out in class or indirectly by promoting the outside the school, developing a taste for physical exercise by changing the individual's lifestyle.
- Application according to the educational stage. depending on the school stage and the contents in each cycle, according to the Spanish state these stages range from Infant, Primary, Secondary, Vocational Training to Higher Education, highlighting Compulsory Secondary Education as the most accessible stage to be able to develop in class the learning-teaching process with the mentioned applications.
- Game components: these components are found thanks to the taxonomy of Bunchball (2010).

Also, the elements of games are valued using the taxonomy of Bunchball, for our purposes and later analysis of the applications, diverse actions are used, behaviors and mechanisms of control that are used to gamify an activity, these aspects as a whole, create an attractive and motivating experience that was called game dynamics, with these dynamics the sections to be analyzed within the mobile applications will be established.

That is why we found the following criteria of the taxonomy of Bunchball (2010), with them we answer the mechanics of game-used, being these, activities that satisfy the human desires, creating addictive user experiences that motivate the users to take certain actions. The game mechanisms are tools, techniques, and widgets that are used as building blocks for the classification of a website or an application. Using them individually or together, it is possible to build a motivated user.

The game mechanics analyzed are explained below [14]:

- Points: students are passionate about points, love to win and achieve goals thanks to them, can be used to reward users in multiple dimensions and can be used in different categories. that profit points can have on user behavior, even if there is no monetary value associated with them. People love to be rewarded and feel like they've won something.
- Levels: these are often defined as point thresholds, so users can automatically level up based on their participation or use levels to indicate status and control access to content.
- Challenges: Also known as challenges, trophies, badges, or accomplishments, they allow users to meet goals, reward them for doing so, and then give them a set of goals, giving them the feeling that they are working on something concrete. The objective is to configure the challenges according to the actions it is following and, as mentioned above, to reward the user with distinctive, these being the visible recognition of having reached new levels or completed challenges. One of the keys to making the levels and challenges effective is to provide a forum to showcase your achievements within your user profile page.
- Virtual goods: They are those products that are considered valuable by people, often confer an advantage to users and serve to distinguish them from others.

For the economy of gambling to be effective, it is useful to have a place where you can spend your points, this is one of the reasons why users play more and want to earn more, thereby getting the ability to personalize and reflect an identity of their own.

- Classification table: most games have implemented a table of scores, this is so, as it is considered that they bring "fame" and its name could come to light, also thanks to these tables you can get to indicate the relationship between users and other players. In the context of gamification, the classification tables are used to track and display desired actions, using competition to boost the behavior and progression of users.
- Gifts: the competitions allow users to challenge each other for more points, generating more activity, once this has happened, the user who has obtained a higher score will also receive rewards and gifts, while losers will also receive consolation prizes.

Continuing with Bunchball and with the desire to answer the question why do people find motivation with games? The same author answers that it is due to the dynamics that these games have, that is, people have fundamental needs and desires, for example, desires for reward, status, accomplishments, self-expression, and altruism. These needs are universal, spanning generations, demographics, cultures, and genders.

Game designers have known how to address these types of needs, which is why thanks to gamification can be applied more broadly if you adjust the set of mechanisms around a website, an application or a community, you can get to create an experience that drives the need to meet the needs mentioned above.

- **Reward:** humans are motivated if there is any added value or reward within the performance of an action. With gamification, the main reward mechanism is obtained through the obtaining of points. To obtain these virtual goods, level up and even complete achievements, a series of wishes are produced on the part of the user where satisfaction is produced and with it the desire to improve and continue playing is generated.
- **Status:** human beings generally need the respect and esteem of others, status, recognition, fame, prestige, and attention. Status and esteem present the human desire to be accepted and valued by others. People need to engage to gain recognition through activities that give them a sense of contribution, to feel accepted and self-worth. All elements of game mechanics drive the dynamic state, but the main motivator is to have reached the highest level.
- **Achievement:** some people are motivated by the need to achieve and surpass prolonged, difficult and repeated efforts to achieve that goal. Achievement-motivated people tend to seek challenges and set difficult (but achievable) goals. Their most satisfying reward is recognition of their accomplishments.
- **Self-expression:** Many want and need opportunities to express their autonomy and originality. This is complemented by the human desire to show their identity, style, and personality, also showing an affiliation with a group. The use of virtual goods is a common way for players to create their own identity, whether they win prizes, receive gifts or buy them directly with real money.
- **Competition:** Individuals, as mentioned above, may be motivated by competition. It has been shown that higher levels of performance can be achieved when a competitive environment is established, and the winner is rewarded. This is because we get a certain satisfaction from buying our performance with that of others. All elements of game mechanics take advantage of this desire, even self-expression, but the use of ranking tables is essential to show competitive results.
- **Altruism:** gift-giving can be considered an important source of motivation if within the application community where the people who compose it seek to foster relationships. In gamification, giving is an incredibly powerful retention mechanism, since, if you receive a gift from someone who involves you in the game, and then you are encouraged to send gifts to other users, you are creating an acquisition loop.

### 3 RESULTS

The following mobile applications are therefore analyzed: SworKit, Classcraft, Zombie Run, Geocaching, Endomondo, Strava, Runtastic, Leverade, Classdojo, SuperBetter, Munzee. With these applications the improvement of the teaching-learning process could be favored, varying and improving the activities carried out, allowing the learning to be more significant and simple in order to carry out complex tasks, for example, certain applications are found that explain how to carry out the activities, which will allow the student to correct positions learning autonomously at the desired pace.

As for the Physical Education criteria that were found once the 10 applications were analyzed, the following results were obtained:

**Cooperative learning:** to carry out this methodology, the following five ingredients must exist positive interdependence, individual responsibility, face-to-face interaction, interrelation skills, and group processing. In Classcraft or Classdojo applications there are many facilities for this to happen, however, in the rest of applications it will depend on the work of the teacher who can come to exist cooperative learning, since without the existence of the ingredients mentioned above it is possible to carry out cooperative activities, but not cooperative learning, finding the difference in that cooperative activities serve to have fun, but cooperative learning is a clear methodology.

As for health promotion: all of them are applications that respect this criterion, since they promote physical activity from different activities and forms, thereby promoting the health of the users. 70% help to improve physical condition, while 20% promote activities in the natural environment, finally 10% of these applications help to improve basic aspects of nutrition with their activities and advice.

Educational stage: 60% of the applications analyzed are oriented to Compulsory Secondary Education (SworKit, Zombie Run, Endomondo, Strava, Runtastic, Leverade, SuperBetter), while 10% can be used in Primary Education, mentioning the remaining 30% of applications that can be used in both educational stages, being the teacher's task the correct use in function also of the curricular elements that we can find in each one of them.

Game components: The Taxonomy of Bunchball, it has been possible to analyze the game dynamics, which turn boring activities into motivating, see as an example all the analyzed applications that monitor the physical exercise. It should be mentioned that both Zombie Run and Classcraft are the ones that use these game components the most. There is a very high gamified component in the rest of them, 100 % of the applications use points, levels, challenges and classification tables allowing, as described above, to satisfy the wishes of the users and, above all, creating gratifying experiences making them participate in motivating narratives in order to seek improvement and with that improvement there is also the promotion of health. 30% of the applications allow the achievement of virtual goods, while a 20% option to give gifts to other members. The above is in the X-axis of the table, on the other hand in the Y-axis is found as Classcraft and Classdojo have 100% in the criteria when using rewards, status, achievement, self-expression, competition, and altruism. 100 % use rewards, achievement, and competition, while 80 % have status within the application and finally with 30 % are observed self-expression and altruism according to the taxonomy of Bunchball.

#### **4 CONCLUSIONS**

It should be pointed out that thanks to this analysis it has been possible to see how cooperative learning, in spite of being a methodology widely used by teachers, is not present in practically any of the applications seen, due to the fact that it is a methodology with specific requirements for its attainment and subsequent development in the classes. It should also be pointed out that gamified elements have been found that can lead to motivation for physical activity and teaching as such, allowing the creation of autonomous students with decision-making power in the face of the wide range they can find in any search engine or application shop.

The new generations of students are very advanced in technological knowledge, so it is important to be able to adapt these technologies to education to take advantage of this knowledge and thus provide a motivational bonus in the classroom.

In this way, the European Higher Education Area (EHEA) tries to formalize the use of new technologies in the classroom, which can mean an improvement in the collaborative and cooperative work of students thus promoting their autonomy progressively, but with the support of teachers, either telematically or face-to-face. Many studies support the need to include ICT in education, adapting and renewing the teaching models currently in use and always without forgetting the "obligation" to continue with research that continues to provide new forms and uses that allow all students to take advantage of the advantages of its use.

The inclusion of ICT in the field of Physical Education is more difficult than in other areas of Education due to the scarce number of hours in the teaching of the subject and the practical nature of it. But the benefits of its introduction in the classes are very wide and the need to find a balance between the use of communication tools and motor practice must be part of the curriculum of the teaching staff. The use of mobile applications, not only in the adult population but especially their increasing use by young people requires the need to introduce an educational use of them. The options of education can be very diverse and useful.

Without a doubt, it has been possible to verify how the work of the teacher is vital for the learning-teaching process to be carried out correctly, there are applications which allow the construction of activities to carry out a methodology such as cooperative learning, as well as gamification applications which favor motivation in the process mentioned above. This aspect, the work of the teacher, will allow all the components of cooperative learning to work so that the didactic units that carry out these are not only collaborative activities but also work this methodology effectively.

Another noteworthy aspect of the study was the assessment of health promotion that can be made thanks to the use of these analyzed applications. However, the study has presented some limits, as there is an important difference between educational applications and applications that can be used in the classroom. Also, it could be said that this methodological proposal of using cooperative learning and gamification could be of great help when it comes to the physical and personal development of the students, since carrying out team activities or working in groups also allows us to develop social skills. By unifying these methodologies in the classroom, thanks to these mobile applications will have to perform a work by the teacher which will serve to make activities and teaching units which have the ingredients of cooperative learning, on the one hand, helping the game components that are implicit in mobile applications, both the analyzed as the endless of them with their respective changes that will be found over the years.

With these applications we could try to increase and encourage participation in sports activities, both outside and inside the classroom, making the learners are autonomous when it comes to choosing which activity, exercise or training they like most and so on.

Likewise, this study has raised new questions, always in favor of using ICT both inside and outside the classroom and in this way using all the advantages that these precisely offer us, but without ignoring the negative and harmful aspects that can be developed by not using them correctly. For future research there is an opportunity to carry out each of the applications in a practical context, analyzing which components could be used so that the learning-teaching process is carried out correctly depending on the educational stage in which it is working.

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