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Evaluation of Applications for Mobile Devices on the Practice of Physical Exercise in Adolescents

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Abstract: The use of mobile devices has changed the way we relate to each other, influencing teaching–learning processes and the motivation of adolescents towards these processes. One of the most developed tools has been applications (apps), which are software used on cell phones, tablets or computers. Hence, the aim of this study is to analyze the content of applications for mobile devices that is considered the most suitable complement to Physical Education (PE) classes for secondary school students. A retrospective descriptive study was carried out, collecting information on the main characteristics of 31 free fitness apps: the descriptive, technical, educational and psychological dimensions. The results of this study show that most of the apps for physical activity have recent updates and are mainly related to cardiovascular exercise or strength for two purposes: either for exercise accounting or the creation of training plans for the user. They are intended for users of very heterogeneous ages and, therefore, do not take into account their individual characteristics. They do not have an adequate design to facilitate their didactic use. Therefore, we conclude that the applications evaluated lack the necessary educational potential to be used in the PE classroom. Based on the content analysis carried out, we describe a series of criteria that allow teachers and adolescents themselves to select physical exercise apps, and we propose to carry out research to guide developers when developing digital training/physical exercise content with an educational component that can be used as a complement for adolescents in- and outside the field of PE.

Keywords: mobile application; informal learning; ubiquitous learning; digital skills; physical education; physical exercise

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1. Introduction

The use of smartphones and mobile applications, especially among middle and older age groups, has grown exponentially in recent years [1], as have the areas of healthcare [2–4] and education [5]. These devices have undoubtedly changed not only the way we relate to each other, but also the way we access and use information [6,7]. In the field of Physical Education (PE), Cavallo et al. [8] point out that the influence of technology in the lives of children and adolescents denoted as digital natives and/or the iGeneration is very significant, but its use by professionals is far from being omnipresent [9], and, therefore, the mechanisms that can assist practitioners in using digital technologies to help students learn optimally in PE require further attention [10,11]. Given this situation, it seems important to know the characteristics of the mobile devices that can be used as a complement to PE classes.

The factors that lead users of wearable fitness trackers to start using these devices, as well as to continue to do so (retention), seem very diverse [12]. Some of the characteristics that facilitate adherence included: the provided data are useful, accurate and consistent, the device saves time, the routines are enjoyable, and the device is fun to use, among others.

Within PE classes, beyond adherence to the technological device, it is important that the device is focused on the practice of physical exercise itself, so that the technology is understood as a facilitator [13,14]. In fact, technology could be part of the value perceived by students, directly related to perceived quality or their motivation and, therefore, to satisfaction as well [15]. Therefore, a device's technical and educational characteristics must be appropriate to the target population [16].

In fact, changes in teaching and learning processes both inside and outside the classroom are a consequence of the digital revolution. Hence, the way of understanding education changes fundamentally in terms of access to information and collaborative learning, as well as connecting formal, non-formal and informal spaces [17,18]. Therefore, we face constant coexistence with the use of technologies driven by two basic principles that are part of learning in the 21st century society: ubiquity (U-Learning) and mobility (M-Learning) [19]. Learning is no longer limited to the classroom; it is distributed among multiple spaces that make knowledge instantly available [20]. Ubiquitous technology enables global, instantaneous and interconnected learning that creates interaction between people [19]. In this type of learning, the use of mobile devices plays a very important role [21]. Brazuelo and Gallego [22] concluded that learning through mobile devices facilitates construction of knowledge, resolution of learning problems and development of skills and abilities in an autonomous and ubiquitous manner.

The term app is used as an abbreviation of the term "application" in reference to computer applications for mobile and tablet devices.

For students to acquire digital competency, it is essential to change the teaching method and adapt it to the new reality, necessarily incorporating mobile devices in classroom activities [23]. To this end, initial and continuous teacher training must be focused primarily on the use of new technologies [24].

App classifications are very broad and confusing. The independent platform Educational AppStore [25] proposes that for an app to be educational, it must have certain characteristics, which have been adapted to the context of PE (Table 1).

Table 1. Characteristics for the selection of an educational app in PE. Adapted from Educational AppStore (2021) [23].

Dimensions	Characteristics
Descriptive dimension	It must be free of charge. It must avoid in-app purchases.
Technical dimension	It should be interactive, transparent and intuitive. It must have a clear user interface that corresponds to the use of the application. It should avoid accidental button activation. It should not offer distractions through advertisements, sounds or pop-up windows.
Educational dimension	It must have clear learning objectives. It should give feedback on the correct execution and mistakes to avoid during the performance of physical exercises. It should reinforce the connection between home and school. It should not have any indication of violence or stereotypes.
Psychological dimension	It should offer rewards or feedback. It encourages the learner to be in control by making decisions.

Motivation to achieve lifestyle modifications is an important variable in order for any intervention in physical activity habits to be effective. First, exergames appeared, demonstrating that these games could enhance health-related learning and even behavior change because they are experiential and interactive; they immerse the player in worlds that offer compelling challenges and immediate feedback on progress [26]. In addition, in the

review by Höchsmann et al. [27], it is suggested that exergames were able to increase physical activity in overweight people. Nowadays, modern cell phones also have an accelerometer, gyroscope and GPS (Global Positioning System), which allows the possibility also to play exergames on mobile devices.

The increasingly frequent use of digital devices can become a strength, especially for the younger population. Hence, the use of physical exercise apps can have fundamental advantages in PE classes compared to a traditional class, as they easily complement physical activity both inside and outside the classroom, in addition to performing exercises in a more individualized and regulated way through levels of difficulty and intensity.

Given the growth and relevance of apps in the processes of learning and adherence to physical exercise, it would be particularly important to introduce this didactic resource in the subject of PE, given the specific technologies of this discipline [28]. Hence, this study aims to analyze the content of applications for mobile devices as a complement for PE classes in adolescents aged 12 to 17 years, a range that coincides with the secondary education stage, by detailing the descriptive, technical, educational and psychological characteristics.

2. Materials and Methods

A retrospective descriptive study was carried out to gather the most relevant information on the main characteristics of physical exercise and training apps, both on a technical and content level [29].

2.1. Procedure

The study was carried out through the following process: determining the objectives of the content analysis, locating the apps, analyzing the apps and synthesizing the findings.

Apps are software applications that are used on cell phones, tablets or computers and can be purchased through services or stores. They can be generated by mobile technology developers, by individuals or by organizations [30]. It is necessary to take into account that there is no consensus on the terminology to describe them; therefore, recent articles propose using the term "app" to refer to specific applications for cell phones [31].

The applications considered were all those related to and catalogued in Health and Wellness. The selection was made by two of the authors separately, D.A.F. and Y.T.I., and when there were doubts, it was reviewed by a third or fourth author, A.G.S. or I.P.P. The place of analysis was Spain during the months of October and November 2021. The most important reason to perform this work was to be able to determine which apps were useful as an educational resource in PE classes. In addition to the keywords of Health and Wellness, all terms related to physical activity were taken into account.

In order to locate apps aimed at physical exercise/training in a systematized way, the two channels that are currently the main sources for mobile devices were selected: Google Play and App Store. Of these, those that were directly related to physical activity, sport or exercise and movement control systems were screened. When the apps appeared on both platforms, both were analyzed to establish if there were any differences in the variables. The search was conducted between October and November 2021.

2.2. Inclusion and Exclusion Criteria

In the search and selection of the apps, the following inclusion criteria were established: they were apps updated or created between 2016 and 2020, the minimum user rating was four stars in both sources, they were free, the user profile was all types of public and they were in the top 100 of popularity of each of the sources in the Health and Wellness category. The exclusion criteria were: being linked to a specific physical support or being private applications of sports centers.

Of the total results obtained, after applying the selection criteria, a total of 31 valid results were obtained (Figure 1).

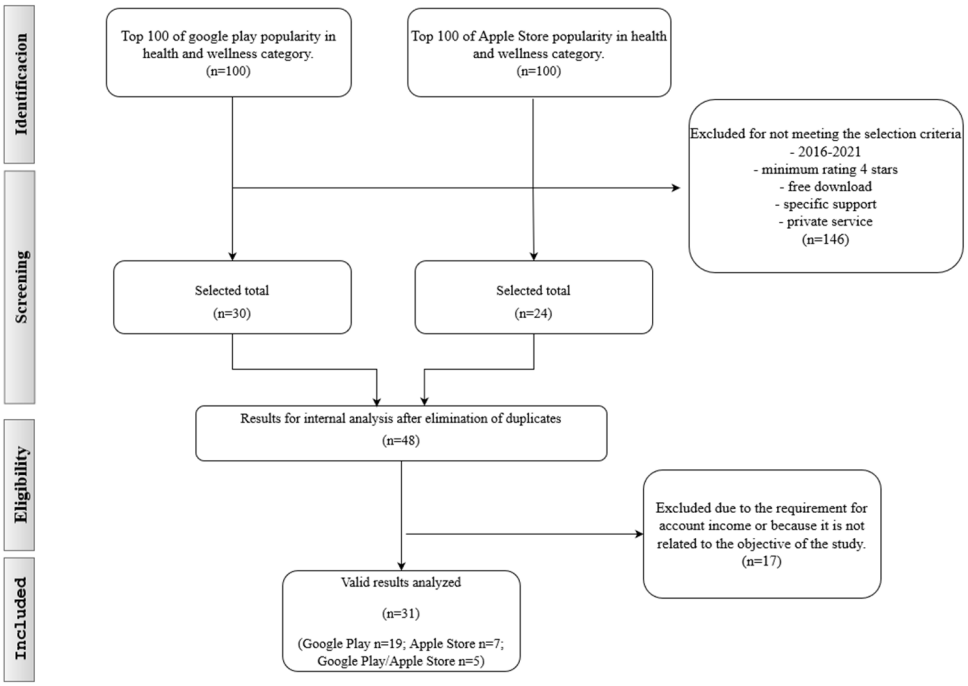

Figure 1. Flowchart of the results selection process.

Based on these criteria, the final apps selected for these analyses are shown in Table 2.

Table 2. List of selected final apps.

Digital Distribution Platform	Mobile Applications	Language
Google Play/Apple Store	Komoot: senderismo y ciclismo [Komoot: hiking and cycling]	Multilanguage 6 languages
Google Play	Contador de Pasos-Podómetro, contador de Calorías [Step counter-Pedometer, Calorie counter]	Multilanguage 33 languages
Google Play	Seguimiento de Pasos—Podómetro [Step Tracking—Pedometer]	Multilanguage 29 languages
Google Play	AllTrails: Sendas de Senderismo Bici Trail Running [AllTrails: Hiking Bike Trail Running Trails]	Spanish
Google Play	Podómetro—Contador de Pasos (ITO Technologies, Inc.) [Pedometer—Step Counter (ITO Te-chnologies, Inc.)]	Spanish
Google Play	Decathlon Coach—Fitness, Run	Spanish/English
Google Play	Podómetro Gratis—Contador de Pasos [Free Pedometer—Step Counter]	Spanish
Google Play	Perder Peso para Mujeres [Weight Loss for Women]	Spanish
Google Play	Podómetro—Contador de Calorías y Pasos [Pedometer—Calorie and Step Counter]	Spanish
Google Play	Bajar de Peso Hombre [Weight Loss Men]	Multilanguage 19 languages
Google Play	Fitness Femenino: Entrenamiento para Mujeres [Women's Fitness: Training for Women]	Spanish
Google Play/Apple Store	Gym WP—Rutinas Para Gimnasio [Gym WP—Gym Routines for Gym]	Multilanguage 3 languages
Google Play/Apple Store	Adidas Running Correr e Sport/Adidas Running by Runtastic [Adidas Running and Sport/Adidas Running by Runtastic]	Multilanguage 13 languages
Google Play	Perder Grasa Abdominal en Casa [Lose Abdominal Fat at Home]	Spanish
Google Play	Fitness online—Ejercicios en Casa y Gimnasio [Fitness Online—Home and Gym Exercises]	Spanish

Google Play	Adidas Training by Runtastic	Spanish
Google Play	Sweatcoin: cuenta pasos, recompensa por caminar [Sweatcoin: step counter, reward for walking]	Spanish
Google Play	Ejercicio de Aumento de Altura [Height Increase Exercise]	Spanish
Google Play	Correr, Caminar y Trotar con GPS Rastreador [Running, Walking and Jogging with GPS Tracker]	Spanish
Google Play/Apple Store	Freeletics: ejercicios en casa [Freeletics: exercises at home]	Multilanguage 10 languages
Google Play	Podómetro-Contador de Pasos (Zeopoxa) [Pedometer-Step Counter (Zeopoxa)]	Spanish
Google Play	Pacer Podómetro—Contador de Pasos y Calorías [Pacer Pedometer—Step and Calorie Counter]	Spanish
Google Play	Entrenamiento con Mancuernas [Dumbbell Training]	Spanish
Apple Store	AllTrails: senderismo y trekking [AllT: hiking and trekking]	Multilanguage 4 languages
Apple Store	Nike Run Club	Multilanguage 16 languages
Apple Store	Ejercicios en Casa y Gimnasio [Home and Gym Exercises]	Multilanguage 15 languages
Apple Store	Nike Training Club	Multilanguage 17 languages
Apple Store	Runkeeper	Multilanguage 12 languages
Apple Store	Podómetro ++ [Pedometer ++]	Multilanguage 10 languages
Apple Store	Google Fit: monitor de actividad [Google Fit: activity tracking]	Multilanguage 34 languages
Apple Store/Google Play	7 min workout: J&J	English

2.3. Data Analysis

Four dimensions were established for the data analysis: the technical aspects, the descriptive dimension, the educational dimension and the psychological dimension with their corresponding variables (Table 3). The researchers arrived at this classification through the analysis of articles on the evaluation and content analysis of applications for mobile devices [32,33].

Table 3. Dimensions and variables for the analyzed Apps.

Dimensions	Variables
1. Descriptive dimension	1. Location 2. Agent 3. Year of creation/actualization 4. Cost for the user 5. Age range 6. Language 7. Users' ratings
2. Technical aspects	1. Accessibility/Navigation 2. Visual design 3. Adaptability 4. Interaction 5. Interface 6. Logging 7. Utility

	8. Operative System
3. Educational dimension	1. Type of training 2. Type of information (visual/verbal) 3. Knowledge of the error 4. Adequacy of objectives and contents 5. Curricular blocks
4. Psychological dimension	1. Motivation 2. Stereotypes

In the descriptive dimension, references will be made to the location, which refers to the platform that has been used to host the application; the agent refers to the person(s) responsible for the development of the apps, and the other variables refer to the year of creation, age range of the population to which the application is destined, and the language in which it is published. Users' ratings is the valuation that the user gives to the application and is measured on a scale of 0 to 5 stars.

In the technical dimension, accessibility and navigation are analyzed, i.e., whether users have a good experience while using the product and whether there are any impediments that may limit access to it. In visual design, appearance, integration and engagement were assessed. In terms of adaptability, we checked that the application allows for the control of devices and services through interoperable systems integrated in an intelligent environment to be able to adapt or create new functions. Interaction is related to the design of the interactive services of an application, its systems and its user environment. The interface is everything that the user can see and interact with within the app; it must be simple, clear, familiar, coherent and fast. Logging refers to whether it is necessary to register in order to enter the application. In this case, it was considered useful to have an app that would encourage adherence to physical exercise by offering statistics on pace, distance or time, as well as statistics on progress made and voice complements through the headphones. The operating system can be Apple IOS, Google Android or Windows Phone.

In the educational dimension, the type of training (strength or cardiovascular) was measured, and the type of information refers to the way in which information about performance is transferred to the users of the applications. Through visual information (drawings, videos, etc.) and/or verbal information (giving verbal instructions on the execution), knowledge of the error refers to whether the application, in addition to providing information on the execution, also provides information on the errors that should not be made when performing an exercise (i.e., be careful with the knees; do not bring the kneecap forward with respect to the toe; do not descend more than 90°; etc.). The adequacy of objectives and contents aims to establish coherence between the theoretical objective of the application and what it actually offers. The curricular variable blocks analyze whether the app covers any curricular content of the subject of PE in secondary education.

In the psychological dimension, motivation and the presence of stereotypes were assessed. For motivation, we measured whether rewards were offered, whether there was access to training data, observing improvement over time and sharing results on social networks, among others. In stereotypes, it was assessed whether behavioral patterns are used according to gender.

3. Results

3.1. Descriptive Dimension

With respect to localization, we refer to the digital dissemination platforms where the applications are distributed and promoted; here, 61.29% of the apps are developed for Google Play, 16.12% for Apple and 22.58% are developed for both sources (Figure 2).

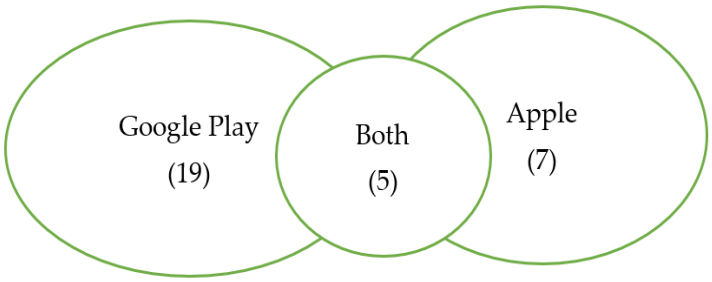

Figure 2. Absolute frequency of scores obtained by the location.

The agents responsible for the development of the apps are mostly companies. Leap Fitness Group developed 29%, while the remaining 71% are entities that create one or two apps, as in the case of AllTrails, Adidas or Nike.

As for the last update of these apps for mobile devices; most of the apps were updated in 2021, for a total of 30 apps (97%), while only one (3%) was last updated in 2020.

All selected apps had to meet the requirement of being free to download. Of these, a total of 19 (61%) are absolutely free, while 12 (39%) offer a micropayment service to enjoy a number of extra features or services.

The age ranges of the apps for mobile devices are mostly set as adapted to various ages. There are no apps specifically recommended for teenagers between 12–17 years old.

A total of 16 apps (57%) have no age restriction or age guideline. A total of 10 apps (36%) are set for ages four and over, while one app (4%) is for ages nine and over, and another single app (4%) is for ages 17 and over.

With respect to language, most of the localized apps are in Spanish (48.38%), although 45.16% are published in multilanguage. Only 3.22% are only in English, and the same percentage are in Spanish and English.

The rating of the apps by the users is very homogeneous, as expected since only apps with a score higher than 4 stars were chosen. In total, an average score of 4.62 points was obtained. Figure 3 shows how the frequencies are distributed, and no app reaches a score of 5 stars.

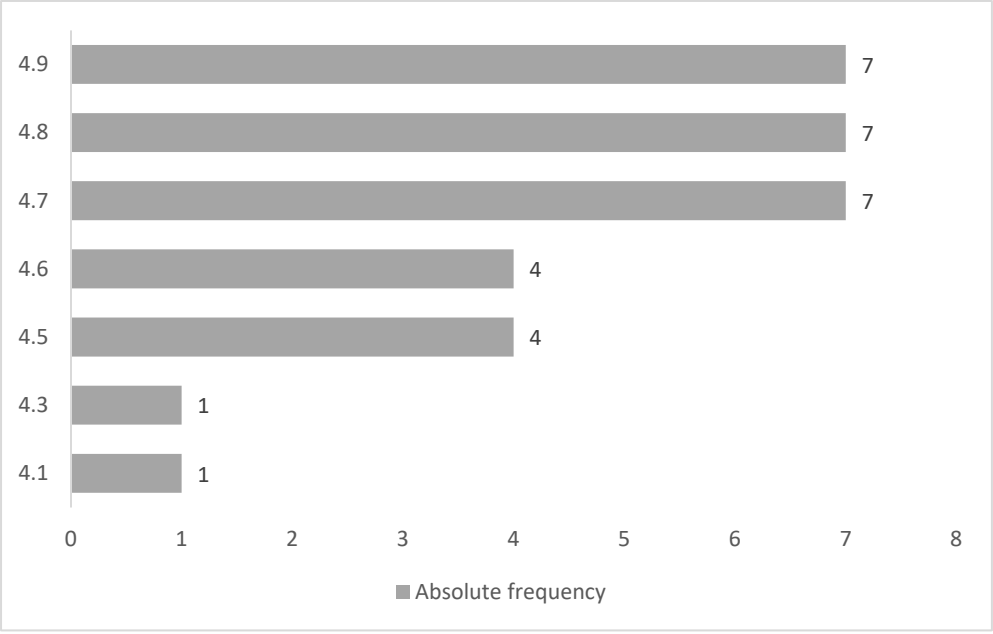

Figure 3. Absolute frequency of scores obtained in the applications by Users' ratings.

3.2. Technical Aspects

To measure accessibility and navigation, the following were taken into account: the application should be intuitive and easy to use; its design is attractive; its information is easy to find; the access parameters are very accessible; information is offered instantaneously; the font size of the text; clear and simple content; and the navigation mechanisms should be simple. Based on these criteria, six of the apps analyzed were excellent (19%), 10 were good (32%), 13 were poor (42%) and two were deficient (6%).

Regarding visual design, most of the applications were rated as good (13 apps, 42%) and excellent applications (16%). Conversely, 42% were rated as bad or poor (12 bad, 39%; 1 poor, 3%).

Adaptability was measured by the ability to adapt functionalities or create them from scratch according to user characteristics. It was poor in 12 of the apps (39%); deficient in five (16%), good in six (19%) and excellent in only eight (26%).

Alternatively, interaction was rated as excellent in four apps (13%), good in 10 (32%), poor in 15 (48%) and deficient in two (6%).

Of the 31 applications, 18 did not require registration (58%), while the other 13 did (42%). Only 35% of the 31 applications were rated as useful.

The interface was rated as excellent in seven apps (23%), good in eight (26%), bad in 14 (45%) and poor in two (6%).

With respect to logging, of the 31 applications, 18 did not require registration (58%), while the other 13 did (42%).

Only 35% of the 31 applications were rated as useful. In other words, the level of coherence between the objectives offered by the application and the exercises it actually offers is very low.

Finally, the operating system required is diverse, with Android 5.1 and iOs 12.2 or later standing out (Table 4).

Table 4. Frequencies of the operating systems required by the apps.

Operating System	Absolute Frequency	Percentage Frequency
Android 4.1 and later versions	2	6%
Android 4.4 and later versions	8	26%
Android 5.0 and later	6	19%
Android 5.1 and later	1	3%
Android 6.0 and later	1	3%
Android 7.0 and later	1	3%
iOS 11.0 or later/Android 4.4	2	6%
iOS 11.4 or later	1	3%
iOS 10.0 or later	1	3%
iOS 12.0 or later	1	3%
iOs 12.2 or later	1	13%
iOs 13 or later	4	6%
iOS 13.7 or later	2	6%
Total	31	100%

3.3. Educational Dimension

Table 5 shows the results of the educational dimension broken down by application.

The type of training is mostly cardiovascular, although half of the applications also have strength training.

Table 5. Educational results of APPS.

Mobile Applications	Cardiovascular Training	Strength Training	Visual Feedback	Verbal Feedback	Error Feedback	Suitability of the Objectives	Adequacy of the Contents
Komoot: senderismo y ciclismo	Yes	No	No	No	No	Good	Good
Contador de Pasos-Podómetro, Contador de Calorías	Yes	No	No	No	No	Good	Good
Seguimiento de Pasos—Podómetro	Yes	No	No	No	No	Good	Good
AllTrails: Sendas de Senderismo Bici Trail Running	Yes	No	No	No	No	Good	Good
Podómetro—Contador de Pasos (ITO Technologies, Inc.)	No	No	No	No	No	Good	Good
Decathlon Coach—Fitness, Run	Yes	Yes	Good	Good	Yes	Good	Good
Podómetro Gratis—Contador de Pasos	Yes	No	No	No	No	Good	Good
Perder Peso para Mujeres	Yes	Yes	Good	Good	No	Poor	Poor
Podómetro—Contador de Calorías y Pasos	Yes	No	No	No	No	Good	Good
Bajar de Peso Hombre	Yes	Yes	Good	Good	No	Good	Poor
Fitness Femenino: entrenamiento para mujeres	Yes	Yes	Good	Good	No	Poor	Deficient
Gym WP -Rutinas Para Gimnasio	Yes	Yes	Poor	Poor	Yes	Good	Good
Adidas Running Correr e Sport/Adidas Running by Runtastic	Yes	No	No	No	No	Deficient	Good
Perder Grasa Abdominal en Casa	Yes	Yes	Good	Good	No	Poor	Poor
Fitness Online—Ejercicios en Casa y Gimnasio	Yes	Yes	Excellent	Good	Yes	Good	Good
Adidas Training by Runtastic	Yes	Yes	Good	Excellent	Yes	Excellent	Excellent
Sweatcoin: cuenta pasos, recompensa por caminar	Yes	No	No	No	No	Good	Good
Ejercicio de Aumento de Altura	Yes	Yes	Poor	Poor	No	Deficient	Deficient
Correr, Caminar y Trotar con GPS Rastreador	Yes	No	Poor	No	No	Good	Good
Freeletics: ejercicios en casa	Yes	Yes	Excellent	Good	No	Good	Good
Podómetro-Contador de Pasos (Zeopoxa)	Yes	No	No	No	No	Good	Good
Pacer Podómetro—Contador de Pasos y Calorías	Yes	No	No	No	No	Good	Good
Entrenamiento con Mancuernas	Yes	Yes	Good	Good	No	Good	Good
AllTrails: senderismo y trekking	Yes	No	No	No	No	Good	Good
Nike Run Club	Yes	No	Good	Good	No	Excellent	Excellent
Ejercicios en Casa y Gimnasio	No	Yes	Poor	No	No	Deficient	Deficient
Nike Training Club	Yes	Yes	Excellent	Excellent	Yes	Excellent	Excellent
Runkeeper	Yes	No	No	No	No	Deficient	Deficient
Podómetro ++	Yes	No	No	No	No	Good	Good
Google Fit: Monitor de Actividad	Yes	No	No	34f No	No	Poor	Poor
7 min workout: J&J	Yes	Yes	Excellent	Excellent	Yes	Excellent	Excellent

As for visual and verbal feedback, we can see in Figure 4 that most of the applications do not offer feedback of either type. However, in those that do, it is mostly of good or superior quality. Thus, with regard to error feedback, the result is lower, as it is included in only six apps (19%).

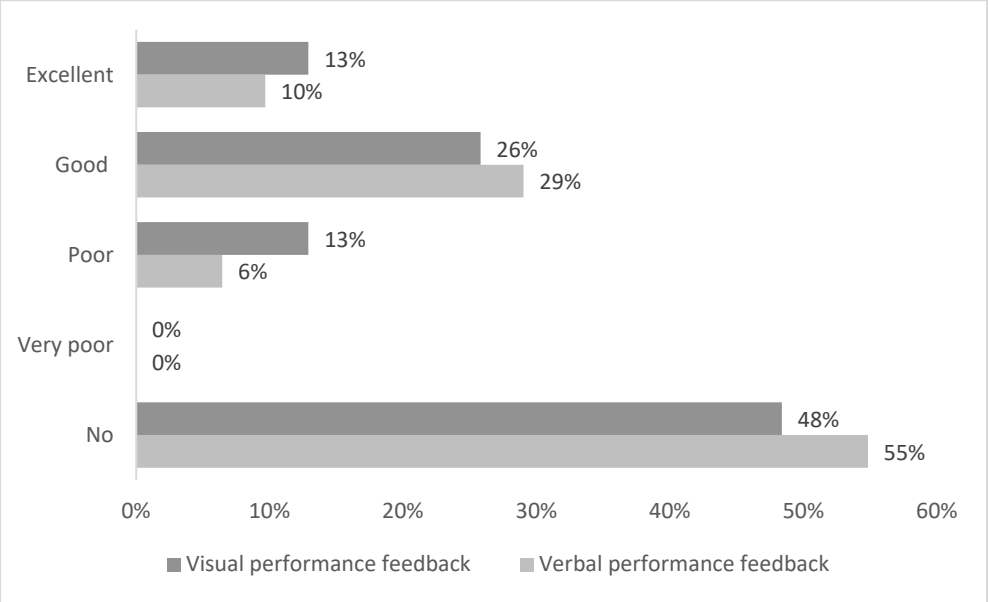

Figure 4. Percentage frequency of the visual and verbal feedback obtained in the applications.

When analyzing the suitability of the objectives, 69% show good suitability (22 apps) and 3% demonstrate excellent suitability (one app). A lower percentage obtained bad and poor suitability with 13% (four apps) and 16% respectively (five apps).

A similar relationship occurs with the adequacy of the contents, which are rated as good in 61% of the apps (total of 19 Apps) and excellent in 13% (total of four apps). Thus, 74% of the apps are rated as adequate in terms of content, compared to 26% of results in which they are considered poor (13%; four apps) or deficient (13%; four apps).

Regarding the contents of the curriculum, we found that 93.55% were related to cardiovascular training and 45.16% to strength. We did not find any apps related to body expression content (Figure 5).

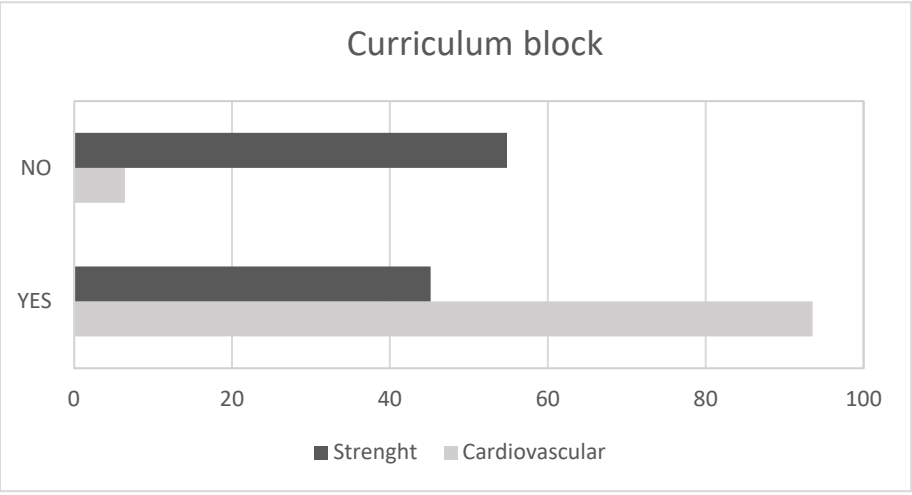

Figure 5. Percentage frequency of the curriculum block obtained in the applications.

In general, we have been able to identify two main categories in this type of application: those oriented to the accounting of exercise, and those oriented to the creation of training plans for the user. We could also make a third, much smaller category (two apps) dedicated to the realization and sharing of routes in the natural environment.

Within the first category, we find applications with generally more basic designs and content that take advantage of the different sensors of the device (smartphones, bracelets or watches) to show the user quantifications of their daily exercise levels through simple variables (steps, km, heart rate). This type of application is usually free and slightly gamified (including personal daily/weekly goals that are translated into achievements), offering little or no information about the correct execution or error feedback.

Among the apps evaluated, we could highlight "running, walking and jogging with GPS" that generates weekly goals based on our individual profile, shows our routes on the map application and gamifies our progress with badges.

In the second category of applications, we find those that provide specific information to the user on how to organize and carry out a personal exercise plan.

Thus, we have a subset of applications on the Android system that are explicitly aimed at weight loss. This fact is already evident in the title itself, in addition to showing a specific orientation to one of the genders. This type of app is so characterized by marked gender and body image stereotypes that we cannot consider it acceptable in an educational context. They show physical exercise from a reductionist and instrumentalist point of view, only as a tool to improve body aesthetics, ignoring its importance in the health, quality of life and social relations of the practitioners. The information, both visual and written, conveys questionable stereotypes within a current educational environment, which we believe do not favor the development of the individual.

There is a second subgroup of applications that attempt to guide the user's physical exercise practice from different contexts and dimensions. Thus, we have applications focused on strength exercises, others on resistance exercises and still others on a combination of both. Here, we also find differences in terms of the quality of the applications and their contents, but all of them try to provide guidance for the user to exercise in a simple and safe way.

However, within this subgroup, there are a number of quality applications that offer an attractive, simple interface with updated information, good performance feedback and a clear commitment to minimizing stereotypes and biases related to physical exercise. These apps show the user how to exercise, how to correct it and how to organize it, and this information could be an educational complement inside and outside the classroom.

Thus, we can highlight "Nike Run Club", "Decathlon Coach—Fitness, Run", "Fitness Online—Home and Gym Exercises" and "Adidas Training". Although they have different designs and characteristics, all of these applications overlap in trying to provide quality information to the user about healthy physical exercise, correct execution and correct planning and dosage. They are not specifically educational apps, but, in them, a pedagogical spirit can be observed in their design base that tries to involve the user in a more comprehensive idea of physical exercise, fully compatible with the educational aspect that must be present in a formal classroom.

A network development is perceptible in the small group of applications aimed at the creation of trails in the natural environment. Two applications, "Kamoot" and "AllTrails", offer the possibility of sharing routes in a network of users, thus establishing guidelines for group creation and participation that favor constructive educational development. The basis for dissemination of content related to healthy physical exercise is not so marked, but this collaborative platform could be interesting in the educational context to promote healthy exercise (walking, running, biking, etc.) in the context of students.

3.4. Psychological Dimension

Within the psychological dimension, motivation and the use of stereotypes were measured. To measure motivation, it was observed whether progress is monitored, whether there is feedback on the activity and whether there are gamification and rewards activities.

As can be seen in Figure 6, the assessment of motivation is considered poor in most of the applications. However, the joint rating of good and excellent reaches 48%, similar to the joint rating of the poor and deficient categorizations (51%).

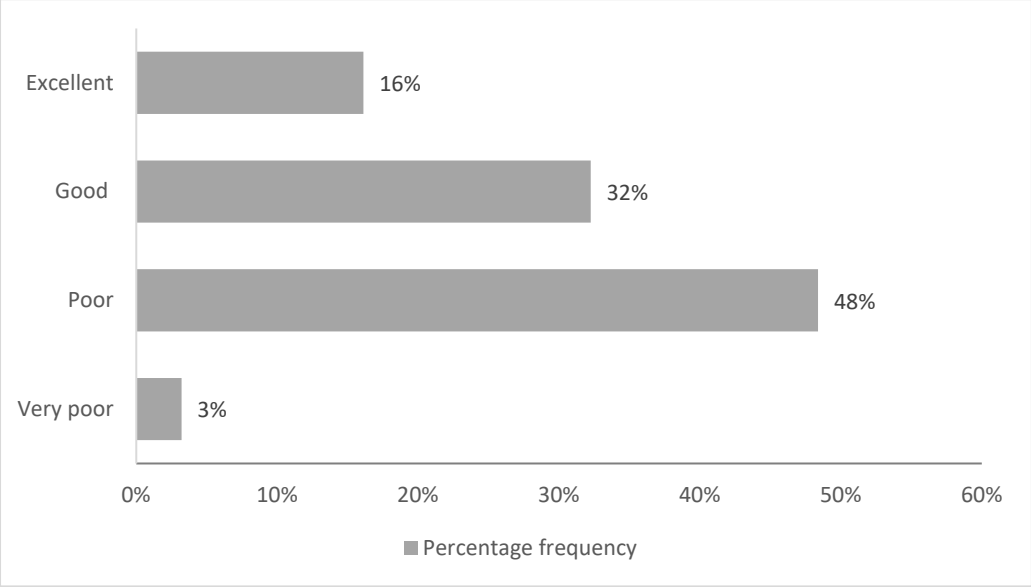

Figure 6. Percentage frequency of the motivation obtained in the applications.

To define stereotypes, it has been taken into account that they reflect prefixed patterns of behavior that define how women and men should be, act, think and feel in a society. Gender stereotypes were not found in 58% of the apps, a total of 18, although only three (10%) are considered to adequately address them, i.e., they do not propose gender roles for each exercise or activity. On the other side of the scale, 33% show slightly (10%; three apps), quite (10%; three apps) and very stereotyped content (13%; four apps).

Stereotypes are sometimes subtle using colors, images or less obvious messages, but from an educational point of view can be classified as biased.

4. Discussion and Conclusions

Focusing on possible technological applications for PE is particularly important given the specific characteristics of this discipline and its social demand [30,34], as well as possible educational problems related to the use of digital tools as learning resources [35].

After analyzing the results, we found that there is currently not a wide range of apps related to physical exercise that could be used as educational tools, given that their content is very general and focused on aerobic or cardiovascular exercises that use large muscles and can be performed over a long period of time and on a basic physical capacity such as strength. Therefore, the applications evaluated lack the educational potential necessary for use in the PE classroom and primarily have two purposes: exercise accounting or the creation of training plans for the user. A small percentage are focused on the realization of routes in the natural environment.

The difference between the first category of apps, most of which are called "pedometers", is the type of interface and the subsequent processing and visualization of the quantified data. We can also observe that they are a typology more frequent on the Android operating system (nine apps) than on iOS (four apps). At the educational level, they have limited potential as they barely provide information on healthy habits and correct exercise practices, but they could be a tool that complements the content that teachers use in the PE classroom. They are a good way of counting students' walking trips, so they could be an effective tool to highlight our current sedentary lifestyle and the excessive use of transport on short, daily routes.

The first category also includes those related to running or walking where gamification is incorporated. This effort to use the game in the teaching–learning process makes the user a participant in the process and, therefore, improves their involvement and motivation [36–39]. In addition, this type of app is consistent in its basic objectives with those recommended by the WHO [40] as heart health goals for the general population: 150 min of brisk walking or 75 min of running per week.

These applications provide the user with quality information on healthy physical exercise. In addition, they also enhance the collective experience of network users as a motivational tool, something that is in line with authors such as Osuna et al. [41], who claim that interactivity and the sharing of knowledge in the digital space create collective knowledge, even if there is no such intention.

In the second category are applications that facilitate the design of a personal exercise plan, especially related to weight loss by guiding the user towards physical exercise. For educational use, this subgroup of apps has the most obvious potential, as it could help teachers to create healthy habits based on physical exercise in the PE classroom, but we have found very diverse proposals in terms of objectives and quality. We should bear in mind that there are applications that, although in a less marked way than the previous ones, show the user gender and body image biases that are not beneficial in the classroom.

Most of the apps analyzed were developed or updated in the year 2021, but they do not present a totally free option. This fact shows the monetizing potential of the developments linked to the practice of physical exercise but almost always from an objective oriented to the aesthetic dimension of the exercise.

Likewise, it has been verified that the users' evaluation of their satisfaction with an appand its use does not serve as a didactic or pedagogical indicator; this is a very biased indicator due to the experience of use of very heterogeneous age segments. Age classifications of the apps have also not been proven to be a reliable indicator because they show no clear criteria to identify the appropriate age orientation [32].

There is no didactic design when developing applications for the dissemination of physical exercise. This supports the opinion of numerous authors who state that developers do not usually take care of the pedagogical aspects and neglect the didactic aspects [20,32]. In fact, Gibbone et al. [10] or Bodsworth and Goodyear [11] point to teachers' unfamiliarity with technology and poor cooperation in classroom work groups as barriers to the use of technology. Furthermore, the so-called iGeneration of today's society is not as competent or capable of using digital technologies for learning in formal educational contexts as would be expected.

In terms of the platforms, there are significant differences in the availability of free applications. On the iOS platform, it is more complicated to find free options that do not involve a usage charge and a registration with mandatory payment method entry.

Therefore, in conclusion, we have been able to observe that there is an empty niche in the market for mobile applications within the educational dimension of physical exercise. There are no specifically educational apps on the market for the development of this type of objective or content in the classroom, and the generalist ones have a highly improvable quality.

After carrying out the analysis, the authors believe that they can recommend some basic guidelines for selecting a useful application in the educational field of PE:

- Free of charge: the imposition of a fee will make it difficult to universalize their use in the classroom.
- Simple: in their interface and use.
- Customizable: basic personal anthropometric parameters, personal avatar. These aspects contribute to the user's identification with its use.
- Informative: about healthy habits in general and physical activity in particular.
- Formative: providing correct information on the practice of exercise in terms of its use, execution and main mistakes to avoid.
- Safe: promoting a safe and healthy practice.

- Quantifying: recording and counting practice parameters that favor self-evaluation (km traveled, steps, series, repetitions, etc.)
- Motivating: encouraging practice through gamification and network participation of users.
- Inclusive and adapted: avoiding gender, image, race or physical condition biases and favoring the inclusion of any type of user.

However, following this line of research, it would be important to conduct research to guide developers in the development of digital training/exercise content with an educational component that can serve as a complement for adolescents in the field of PE and beyond [9].

5. Practical Applications

Educational applications, also called educational software, are a didactic medium that facilitates teaching and learning processes. Their design must take into account the user's need to experience mastery, growth and learning; to feel successful and effective in decision making; to feel in control of their choice; to be attended at all times and to be interconnected.

Based on the content analysis performed and suggestions made by Educational AppStore [25], we add the following criteria that allow teachers and teenagers themselves to select physical exercise apps:

- Designed to be age appropriate and suited to the physical needs of the recipient by offering rewards for effort and achievement of goals.
- Must take into account the special needs of the population [16].
- Simple interface without use of stereotypes (e.g., body image, physical attitude, etc.)
- Provide security in the handling of data.
- Be compatible with different operating systems.
- Immediate accessibility so that they do not need to be downloaded and installed and can be used online.
- Offer balance between cost, ease and benefits of use.
- Be suitable for use both in and out of the classroom.
- Adapt to the contents of the PE subject by offering proposals with quality exercises to achieve a more active life, error corrections and feedback during execution and possible medium-term planning control.
- Encourage interaction among users.
- Capture the student's attention and curiosity.
- Possibility of network training.

In addition, as Bianchi and De Lorenzi point out [24], it seems necessary to introduce content on the use of information and communication technologies in the initial and in-service training of secondary education teachers.

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