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Impact and Learner Experience of a Technology Ecosystem as an Approach to Healthy Lifestyles: Erasmus+ SUGAPAS Project

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Abstract: The promotion of lifestyle habits in all ages is essential for the prevention of chronic non-communicable diseases. The aim of this study was to develop, validate, and disseminate an ecosystem that favors effective education on physical activity, a healthy lifestyle, and healthy nutritional habits. The sample consisted of 258 Spanish volunteer students. The evaluation of Ecosystem SUGAPAS was composed of two online surveys: MOOC and game surveys. The result of the MOOC survey reported a score above three points in all the sections (users' opinion of the organization: 3.89 ± 0.71, 4.06 ± 0.64, and 4.01 ± 0.64; impact of the course on their day-to-day life: 3.62 ± 0.94; content present values: 3.96 ± 0.63, 3.69 ± 0.75, and 3.62 ± 0.94; usability of the platform: 3.75 ± 0.77, 3.96 ± 0.68, 4.06 ± 0.77, and 3.75 ± 0.84; relevance for professional development: 3.96 ± 0.63; overall opinion: 3.77 ± 0.57 points). The responses to all sections of the game evaluation reported a score between three and four points. A SUGAPAS ecosystem that includes new technologies for the promotion of a healthy lifestyle was developed, validated, and disseminated among the population. The users' opinion, the impact of the ecosystem on their personal and professional development, and the usability of the platforms created make this ecosystem valid for its implementation for the proposed purposes.

Keywords: healthy lifestyle; physical activity; healthy nutrition; MOOC; game

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1. Introduction

Practicing physical activity, having healthy nutritional habits, and generally having adequate lifestyle habits (not smoking, not drinking, taking care of personal hygiene, avoiding exposure to toxic products, managing stress, achieving mental balance, and socializing, among others) are essential for the prevention of chronic non-communicable diseases, such as overweight and obesity, hypertension, diabetes, metabolic syndrome, and cardiovascular diseases, among others; and the promotion of physical, psychological, cognitive, and social health at all ages [1–4]. In this line, it has been found that young people who present healthier lifestyle habits report less overweight and obesity and have lower adiposity and higher lean mass [5–7]. Conversely, those subjects who report more time spent in sedentary activities have higher values of global adiposity [5,6]. Therefore, the acquisition of healthy habits and an increase in the number of physically active hours per day is a determining factor in reducing the risk of presenting pathologies at an early age [8,9]. In addition to posing a risk to health, all this entails a high cost for public health, with a higher number of hospitalizations and the use of emergency services among those with a lower level of physical activity [10].

Moreover, it is important that these habits are established from an early age, as they form the basis for habits in later life [8,11–14]. More specifically, youth is one of the crucial stages for the establishment of healthy lifestyle habits, and despite previous research showing the benefits of maintaining a healthy lifestyle [15], this stage is a critical and

vulnerable time for the loss of healthy habits [12,14]. Moreover, the effects of physical inactivity during youth have a negative impact on health later in life, increasing the likelihood of an inactive youth becoming an inactive adult [8,11–13]. More specifically, an increasing percentage of young people do not meet the minimum daily physical activity recommendations set by the World Health Organization, making this a public health problem [11–14]. In fact, studies conducted in the university population indicate that most university students fail to meet the recommendations set out by the various international organizations for being active [12–14], citing various reasons, such as lack of time or organization with respect to studies, or a preference for sedentary activities, such as the internet or television, among others [16].

In addition, this is a critical stage in the acquisition of unhealthy habits, the increase of habits such as the consumption of drugs, alcohol, smoking [14,17], or a sedentary lifestyle, and the worsening of their nutritional habits [14,16]. This leads to a significant increase in body mass during this stage, affecting a significant percentage of young university students [12]. In addition, it has been observed among university students who gain body mass that this increase also leads to an increase in the amount of adipose tissue, with negative consequences for health [18].

One of the aspects that has most affected the increase in physical inactivity, nutritional habits, and healthy habits among young people has been the COVID-19 pandemic and, more specifically, the confinement resulting from this pandemic. This confinement led to changes in their daily routines, characterized by a decrease in physical activity, poorer nutritional habits, and a less salubrious lifestyle [19], placing young people in a state of vulnerability and decreasing their quality of life [20]. Despite the time that has passed since the confinement, these unhealthy habits seem to have become established in the young population rather than reversed after their return to normality [14].

Among young people's leisure alternatives are new technologies, which have been considered as one of the main factors that interfere with the healthy habits of this population [21,22]. Among these predisposing factors to a sedentary lifestyle, it is worth highlighting the drastic increase in the use of smartphones and tablets, which are used by 80% of the young population [23], with a daily time spent using mobile applications of more than four hours [24].

However, this provides an opportunity for the use of new technologies as a tool to promote sports and healthy lifestyle habits in sedentary university students [25], modulate the prevalence of overweight and obesity, and influence the health and quality of life of young people [26]. In this line, a systematic review with meta-analysis conducted by Schoeppe et al. [23] concluded that mobile apps could help to improve the level of physical activity in the adult and children population. Other research has demonstrated the effectiveness of mobile apps on the market in establishing healthy habits among adolescents [27–30]; improving their physical activity level and daily activity time [27,28]; decreasing body mass [30]; or improving their aerobic fitness [28,29]. Other studies have used new technologies to create a mobile ecosystem for the promotion of healthy habits and physical activity in adolescents. These studies have found that such ecosystems improve physical activity levels and body composition, decreasing the number of sedentary behaviors and the rates of sedentary behavior and inactivity among adolescents [31]. However, despite the acceptance that these programs have had among adolescents and the interest generated by the use of mobile applications, the effects they achieve are reduced, and adherence to the use of the application is lost when the novelty effect disappears [32]. In addition, those studies have a small sample size, small effect size, lack of methodological rigor, or reduced intervention times, resulting in reduced and biased scientific knowledge. In addition, none of these settings have been tested in young people, let alone created with a holistic approach to promote healthy lifestyles.

The main objective of this study was to develop, validate, and disseminate an ecosystem with a holistic approach, based on theory and evidence, that favors an effective education on physical activity, a healthy lifestyle, and healthy nutritional habits. As spe-

cific objectives, we aimed to know (a) users' opinion on the Massive Open Online Course (MOOC) organization, (b) the MOOC impact on their daily life, (c) users' opinion on the MOOC learning content, (d) the platform's usability, (e) the relevance of the MOOC to users' professional development career, (f) users' overall opinion on the platform, and (g) users' flow when playing the game.

2. Materials and Methods

2.1. Design

Our descriptive research study was part of the European Erasmus+ Project SUGAPAS (Supporting Gamified Physical Activities in & out of Schools), funded by the European Erasmus+ Fund [Project Code: 613270-EPP-1-2019-1-LT-SPO-SCP]. The Supporting Gamified Physical Activities in & out of Schools (SUGAPAS) project aims to change students' behavior towards physical activity by being aware of their body and nutrition aspects. The project consortium consists of 7 European countries (Greece, Cyprus, Denmark, Austria, Lithuania, Switzerland, and Spain), involving the following 8 universities, associations, organizations, and foundations: Aristotle University of Thessaloniki, European University Cyrus, European Physical Education Association, Lithuanian Sports University, Games for Health Europe, Schools for Health in Europe Network Foundation, Catholic University of Murcia, and Allgemeiner Sportverband Osterreichs.

This descriptive research study was carried out following the STROBE guidelines. Approval was obtained from the institutional ethics committee of the Universidad Católica de Murcia (CEO72001). In addition, all participants in the study signed an informed consent form prior to data collection, where they were informed about the objectives of the study, as well as the treatment of the data obtained and their confidentiality.

2.2. Participants

The sample consisted of 258 voluntaries students from the Physical Activity and Sport Sciences Degree program and the Master's Degree in Teacher Training program at the Universidad Católica de Murcia (Spain) (25.13 $\pm$ 4.71 years old). We performed non-probability sampling for selection of the participants. Although the evaluation was carried out by students from all participating countries, only the Spanish sample was included in this study.

The inclusion criteria were the following: (1) enrolled in the Physical Activity and Sport Sciences Degree program or the Master's Degree in Teacher Training program of the Universidad Católica de Murcia; (2) attending the first theoretical session in person, in which the project was explained; and (3) not having participated in the project in previous phases.

2.3. Ecosystem SUGAPAS

The SUGAPAS ecosystem hosts a platform with free MOOCs and two mobile applications. The basis of both is gamification, being connected, and being able to add points according to their progress in the course and scores in the two applications. The user can see the score ranking and check his own position. This ranking includes users from all member countries. In addition, by scoring points you can get prizes for your avatar in the game. In the "Our MOOC" section of the SUGAPAS Project website (https://sugapas.csd.auth.gr/) (accessed on 23 November 2022) are the guidelines for following the courses, using the mobile applications, and obtaining the final course completion certificates.

The MOOC has three different modules, and each module is composed of four topics. Module 1: "Physical Activity & Fitness" includes the following topics: (1) "Physical Activity & Exercise—Tips to be healthy and with high physical performance!"; (2) "Physical Activity and Exercise: How to Improve Your Fitness—Improving endurance"; (3) "Physical Activity & Exercise: How to Improve Your Physical Fitness—Improving physical strength", and (4) "Physical Activity and Exercise: How to Improve Your Fitness—Improving mobility". Module 2: "Healthy Diet" includes the following topics: (1) "My Plate", (2) "Balanced

Diet", (3) "Limit fat, salt and sugar intake", and (4) "Healthy Body Weight and Body Image". Module 3: "Healthy Lifestyle" includes the following topics: (1) "Hygiene and Physical Activity", (2) "The Use of Substances in Adolescents and Physical Activity", (3) "Sleep in adolescence and physical activity", and (4) "Emotional Health and Physical Activity".

Each topic contains a description, objectives, and an explanation of how to proceed through it. The courses are composed of theoretical material, recommendation guides, videos, games, and evaluations for each topic; they also include a bibliography for further information. The MOOC ran from 31 July 2022 through 1 October 2022. Each learning module lasted one week, although the module remained open until the participant completed it.

Upon completion of all courses, the user received a certificate of participation. This content was integrated and accessed as a free Massive Open Online Course (MOOC). The MOOC was conceived as a collaborative community of practice for students and teachers of physical education.

The SUGAPAS mobile game (4Battle Health) and the mobile app (SUGAPAS Steps Tracker) were connected. The game contained three sections: Quiz Healthy Plate, and Steps Tracker. The Quiz section presented questions linked to and worked on in the MOOC previously explained. The Healthy Plate section allowed the user to prepare a healthy plate every day. Finally, the Steps Tracker section counted the number of steps taken per day. This last section obtained the values from the SUGAPAS Steps Tracker mobile application, as both were connected. The participant received points by participating in the three sections and was able to see the points obtained by the rest of the participants, as well as check their position in the global ranking.

2.4. Procedures and Instruments

In order to respond to the objective of our research (to develop and validate an ecosystem with a holistic approach, based on theory and evidence, that promotes effective education on physical activity, healthy lifestyle, and healthy nutritional habits), the SUGAPAS Project developed three phases of evaluation. Phase A focused on experts' technical validation, Phase B involved experts' evaluation of the SUGAPAS course, and Phase C focused on the user's evaluation. Our study aimed to show the results of Phase C of the Spanish participants' project. All phases were developed in all countries. The SUGAPAS ecosystem was developed to be applied in all countries participating in the project.

Once the students had completed the courses and obtained their diploma, they carried out the evaluation of the SUGAPAS ecosystem. This evaluation was composed of two online surveys: the MOOC survey and the game survey.

The MOOC survey consisted of nine sections. Objective (a): Users' opinion on the organization of MOOCs was evaluated by means of three sections: (1) Segmentation, sequencing, and navigation of the platform, (2) Design of graphic texts and videos (8 items), and (3) Organization of the course platform (6 items). Objective (b): Impact of the MOOC solution on their daily life was assessed by means of a section composed of 3 items. Objective (c): Users' opinion of the MOOC learning content was assessed by means of 2 sections: (1) Learning content (12 items) and (2) Quality of the content compared to previous experience (3 items). Objective (d): Usability of the SUGAPAS platform was assessed by a section consisting of 4 domains and a total of 30 items. Objective (e): Relevance of the MOOC for the professional development of users was evaluated by means of 6 items. Objective (f): The general opinion of users about the platform was assessed by means of 17 items.

The game survey included 12 sections: (1) Usefulness, (2) Ease of use, (3) Ease of learning, (4) Satisfaction, (5) Concentration, (6) Clarity of objectives, (7) Feedback, (8) Challenge, (9) Autonomy, (10) Immersion, (11) Social interaction, and (12) Knowledge enhancement.

All of these sections are based on Schoor & Körndle's [33] "Checklist for a didactic design of eLearning content", Douka's [34] survey, and the well-known usability questionnaire created by Lund [35].

Each section is composed of several lick-type items (1–5) in which the participant must give an answer according to his or her degree of agreement: 1 = Strongly disagree, 2 = Disagree, 3 = Neither disagree nor agree, 4 = Agree, and 5 = Strongly agree.

2.5. Statistical Analysis

The Kolmogorov–Smirnov test and Mauchly's W-test were used to evaluate the normality and the sphericity of the data. The mean and standard deviation were calculated from the quantitative variables.

Unpaired *t*-tests (continuous variables) evaluated the differences between the two groups (MS/FS). The statistical analysis was performed using the statistical package SPSS 24.0 for Windows (IBM Corp., Armonk, New York, NY, USA). An error of $p \leq 0.05$ was established.

3. Results

3.1. Results of the MOOC Evaluation

Table 1 shows the data related to the evaluation of the MOOC. It shows how in all cases the responses were very close to 4, which corresponds to agree.

Table 1. Descriptive data about the SUGAPAS MOOC evaluation and the differences between genders.

Section	Total Sample (*n* = 187) M ± SD	Men (*n* = 149) M ± SD	Women (*n* = 38) M ± SD	F	*p*	95% CI
Users' opinion about organization						
Segmenting, sequencing, and navigation of the platform	3.89 ± 0.71	3.86 ± 0.71	3.99 ± 0.72	0.080	0.326	−0.39; 0.13
Design of graphic texts and videos	4.06 ± 0.64	4.03 ± 0.62	4.15 ± 0.71	2.445	0.366	−0.37; 0.14
Course platform organization	4.01 ± 0.64	4.00 ± 0.63	4.03 ± 0.71	0.599	0.816	−0.28; 0.22
Impact of the course to their every day	3.62 ± 0.94	3.65 ± 0.92	3.50 ± 0.99	0.997	0.411	−0.21; 0.50
Users' opinion about learning content						
Learning content	3.96 ± 0.63	3.93 ± 0.61	4.09 ± 0.71	3.778	0.193	−0.42; 0.09
Quality of content vs. previous experience	3.69 ± 0.75	3.73 ± 0.73	3.53 ± 0.84	1.654	0.172	−0.09; 0.50
Usability of the platform						
Usefulness	3.75 ± 0.77	3.78 ± 0.75	3.64 ± 0.84	1.091	0.373	−0.17; 0.43
Ease of use	3.96 ± 0.68	3.93 ± 0.66	4.05 ± 0.78	4.524	0.340	0.36; 0.13
Ease of learning	4.06 ± 0.77	4.05 ± 0.75	4.11 ± 0.87	1.406	0.697	−0.37; 0.25
Satisfaction	3.75 ± 0.84	3.76 ± 0.81	3.68 ± 0.98	4.318	0.569	−0.22; 0.39
Relevance for the professional development	3.96 ± 0.63	3.93 ± 0.61	4.09 ± 0.71	3.778	0.193	−0.42; 0.09
Overall opinion about platform	3.77 ± 0.57	3.75 ± 0.56	3.85 ± 0.59	0.142	0.341	−0.31; 0.11

The sections referring to Users' opinion about organization (Segmentation, sequencing, and navigation of the platform, Design of graphic texts and videos, and Course platform organization) reported values of 3.89 ± 0.71, 4.06 ± 0.64, and 4.01 ± 0.64, respectively. These values are around 4 on the scale of 1–5 points, which means that they agree with the quality of the items.

In connection with Impact of the course to their everyday data next to agree are reported.

The sections referring to content (Learning content and Quality of content versus previous experience) presented values of 3.96 ± 0.63 and 3.69 ± 0.75, respectively. These values are close to 4, which means a high score on the 1–5 scale.

In relation to the usability of the platform (Usefulness, Ease of use, Ease of learning, and Satisfaction), the scores were 3.75 ± 0.77, 3.96 ± 0.68, 4.06 ± 0.77, and 3.75 ± 0.84, respectively. Again, these scores are around a value of 4 points out of 5, which means an interpretation of agreement on the section.

With respect to Relevance for the professional development, a value close to 4 was reported.

Finally, in relation to the Overall opinion, the value provided was 3.77 ± 0.57 points, placing it in a position close to agree.

There were no significant differences in the responses to the questionnaire according to gender.

3.2. Result of the Game Evaluation

Considering the responses to the evaluation of the game, the scores show the same dynamics (Table 2). In all the evaluated sections, the score ranged between 3.28 and 3.78 points, which placed all the sections between 3 and 4 points on a scale of 1–5, the value being between neutral and agree. The highest values, which showed scores closer to 4 (agree) than to 3 (neutral), were for Concentration, Goal, Feedback, Challenge, Autonomy, Knowledge, Usefulness, Ease of learning, and Satisfaction.

Table 2. Descriptive data about the SUGAPAS game evaluation and the differences between genders.

Section	Total Sample (n = 256) M ± SD	Men (n = 205) M ± SD	Women (n = 51) M ± SD	F	p	95% CI
Concentration	3.65 ± 0.69	3.60 ± 0.64	3.81 ± 0.85	5.172	0.055	−0.42; 0.05
Goal	3.78 ± 0.79	3.74 ± 0.73	3.98 ± 0.96	3.985	0.051	−0.48; 0.00
Feedback	3.69 ± 0.76	3.67 ± 0.74	3.80 ± 0.83	3.087	0.315	−0.38; 0.12
Challenge	3.60 ± 0.71	3.59 ± 0.67	3.68 ± 0.87	3.003	0.491	−0.35; 0.17
Autonomy	3.52 ± 0.82	3.52 ± 0.77	3.50 ± 1.03	7.538	0.885	−0.24; 0.27
Immersion	3.28 ± 0.88	3.29 ± 0.86	3.22 ± 0.98	2.158	0.646	−0.23; 0.37
Social interaction	3.48 ± 0.88	3.44 ± 0.87	3.62 ± 0.92	0.457	0.230	−0.46; 0.11
Knowledge	3.76 ± 0.83	3.69 ± 0.82	4.04 ± 0.80	0.021	0.007	−0.60; −0.10
Usefulness	3.54 ± 0.84	3.50 ± 0.81	3.67 ± 0.94	3.047	0.236	−0.45; 0.11
Ease of use	3.34 ± 0.75	3.32 ± 0.73	3.41 ± 0.85	1.088	0.498	−0.35; 0.17
Ease of learning	3.77 ± 0.92	3.73 ± 0.86	3.91 ± 1.10	3.113	0.279	−0.51; 0.15
Satisfaction	3.52 ± 0.94	3.51 ± 0.88	3.55 ± 1.13	8.803	0.756	−0.34; 0.24

Significant differences between genders were shown in relation to the game for the Knowledge section. To a greater extent, women considered that the game provided an improvement in their knowledge and that the game motivated them to want to learn more about this content.

4. Discussion

The objective of this study was to know users' opinion about a MOOC with a holistic approach, based on theory and evidence, that favors an effective education on physical activity, healthy lifestyle, and healthy nutritional habits. In recent years, the incorporation of digital technology into the field of education through the creation of MOOCs has allowed massive, open, pre-recorded online classes and large-scale participation online courses [36,37] supported by educational materials, text, sound, and video, as well as social networks or blogs as an element of connection and exchange of opinions, favoring the comprehensive education of students and a more participatory and interactive experience [36,38]. This has been especially important in higher education, which has been greatly influenced by the rapid development of information and communication technologies in the pursuit of meaningful learning for students and the general public, making learning accessible to all who want to learn without restriction [36]. Not surprisingly, MOOCs have been proposed as the tool that will achieve a qualitative leap in higher education teaching–learning processes [36]. The COVID-19 pandemic has been nothing more than an impetus for the incorporation of new technologies in higher education centers as the confinement caused by COVID-19 led to the closure of all educational centers in the world, making new technologies a fundamental tool for offering online learning environments [39].

A relevant result of our study was that it was found that users showed adequate satisfaction (scores around 4 out of 5) with the developed MOOC in the sections for the impact of the course to their every day, users' opinion about learning content, relevance for the professional development, and overall opinion about platform. Furthermore, based on

the results of this study, these results could be independent of the gender of the students. These results could be because the designed MOOC fulfilled some of the requirements that could lead to a positive evaluation by the students' understanding that the learning was efficient and effective and also to an increase in the motivation of the students towards this type of resource [39]. These requirements are that users can relate new information to the information they already have [40]; that they are able to integrate and optimize learning resources [37]; that learning is flexible in the sense that users can adapt study times and space to their needs [37,41]; and also that they can obtain extra certificates in addition to the degree they are studying [42].

Another important finding is that users showed high scores in the sections for both users' opinion about organization and usability of the platform, without differences between genders. This is relevant because previous studies have shown that lack of user attention to logistical issues and platform failures make the user's experience of using the MOOC negative [36]. Therefore, monitoring users and system failures as was done in this study could be a good solution to the difficulties experienced by users and fundamental for the overall assessment of the experience to be positive, as was the case in this study.

However, our study not only developed a MOOC for the promotion of education on physical activity, healthy lifestyle, and healthy nutritional habits but also developed a game. Previous studies showed that the combination of MOOCs with other learning tools in ecosystems is more effective than when MOOCs are applied as the sole teaching resource [43]. More specifically, mobile technologies were shown to generate great interest as a learning resource [43,44] for children and adults [45], with these groups showing greater time dedication, involvement, enjoyment, and learning, along with having a more pleasant, interesting, and involving experience; therefore, mobile technologies as a learning resource showed greater effectiveness than did the same content taught to individuals by traditional teaching [44,46]. Not surprisingly, they are beginning to be a widely used resource for the transmission of knowledge related to health and physical activity [44,47,48].

When evaluating the game, the users of our study indicated a score between 3.28 and 3.78 points, which placed all the sections between 3 and 4 points on a scale of 1–5, the value being between neutral and agree. The highest values, which showed scores closer to 4 (agree) than to 3 (neutral), were for Concentration, Goal, Feedback, Challenge, Autonomy, Knowledge, Usefulness, Ease of learning, and Satisfaction. Previous studies have already indicated that users of mobile games designed for the delivery of health-related content generally show good satisfaction with them [44], as well as finding that this type of video game can be a good and attractive tool for the acquisition of new learning related to the practice of physical activity, eating habits, or a healthy lifestyle [49].

One surprising result was that women, to a greater extent than men, considered that the video game provided an improvement in their knowledge and that the game motivated them to want to learn more about this content. Although the use of video games according to gender has become more equal in recent years, their use is still more common among men [47], especially when it comes to video games related to sports, combat, or martial arts; driving or flying games; adventure games; massively multiplayer online role-playing games (MMORPG); strategy, platform, or riddle-solving games; and role-playing games. Conversely, no differences between genders were found in music simulators or karaoke games, life management games, and thinking or Facebook games [50]. Therefore, the differences found in the educational possibilities of video games according to gender could be due to the different interests found between women and men.

This study is not without limitations. The main one lies in the fact that this study was carried out from the positivist paradigm, collecting quantitative data on the opinion of the users of the ecosystem created by the European project Erasmus+ SUGAPAS to improve the knowledge of university students about healthy habits, physical activity, and healthy eating habits. However, the information collected through this paradigm does not allow us to know the improvements that users would propose to improve the evaluation of both the MOOC and the game. Therefore, in the future it is necessary to complete the information

obtained in this research with qualitative data collected through focus groups or workshops in order to improve the limitations of the ecosystem generated.

5. Conclusions

A SUGAPAS ecosystem that includes new technologies for the promotion of a healthy lifestyle was developed, validated, and disseminated among the population. The users' opinion, the impact of the ecosystem on their personal and professional development, and the usability of the platforms created make this ecosystem valid for its implementation for the proposed purposes.

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