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Fostering University Students' Engagement in Teamwork and Innovation Behaviors through Game-Based Learning (GBL)

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Abstract: Higher Education Instituions (HEIs) should be the driving force behind the training of college students in terms of both hard and soft skills (for example, innovation and teamwork competencies), and they should also do so without neglecting their health and well-being, perhaps more than ever in these complex times of the SARS-CoV2 pandemic. Game-based learning (GBL) could be a powerful and useful tool in this regard. There is, however, some controversy surrounding the use of games for learning purposes in higher education institutions, and most of the research done about this issue corresponds to GBL through digital games. Under this background, the main objective of this study was to test the effect of GBL on the intrinsic motivation (IM), teamwork engagement (TWE), team building (TB), teamwork competence (TWC), and innovation behaviors (IWB) of 142 college students of Health Sciences and Social Work. After rehearsing in small groups, the game was tested (T2). Our results obtained through the differential analyses confirmed that undergraduates were more intrinsically motivated, experienced more TWE, TB, and TWC, and developed more IWB than before playing the game (T1). Therefore, the development of core personal skills might be promoted effectively by games in an efficient, engaging, and motivating way.

Keywords: game-based learning; engagement; teamwork competence; team building; innovation behaviors; HEIs

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1. Introduction

Innovation is at the forefront of sustainable social and economic development. The intentional introduction of new ideas, new products, or new ways of doing to obtain an improvement that implies innovation [1] has been linked to a wide set of beneficial effects both at the organizational and social levels. Economic growth and financial development [2], rapid response to emerging challenges [3], and even overcoming crises [4,5] are some of these potential positive results of innovation. However, it is in the individual where organizational innovation capability largely resides. While it seems to be an imperative for workers to be innovative in their workplaces, this requirement may also constitute a demand that negatively influences their health at work [6], and the benefits of being innovative in terms of individual psychological well-being, such as work commitment [7] could outweigh its costs [8]. Not surprisingly, both innovation and well-being are two important sustainable development goals (SDG) included in the 2030 Agenda for Sustainable Development, which was defined, and adopted by 193 countries around the world in September 2015. This agenda, which involves individuals, companies, universities, nongovernmental organizations (NGOs), and governments, and constitutes an ambitious

and necessary plan of action for people, the planet, and prosperity, and for strengthening universal peace and broader freedom [9].

Sustainability has become a global challenge [10], for which Higher Educational Instituions (HEIs) play a key role [11]. On the one hand, HEIs exert an important influence on society, transferring knowledge and training today's students, future generations of professionals. On the other hand, HEIs are also organizations in which sustainability must be integrated into their strategy. Therefore, HEIs should pay attention not only to training in skills, behaviors, and values in terms of their contribution to sustainable and competitive organizations [12–14], but also promoting educational strategies and methodologies oriented to pursue their own sustainability as organizations [15].

Today's organizations must face important challenges to be sustainable and successful in high-risk and constant-changing environments where the COVID-19 pandemic has exerted a profound impact [16–18]. In this context, financial results, and organizational performance should not be considered as the only main objectives [18]. Organizations must also address a wide range of practices and procedures that allow them to approach and deal effectively with the demands of the environment in which they operate while ensuring the safety and well-being of their members [16–18]. Under this background, some key issues have been highlighted by the organizations [14,17,19–23] such as the promotion of innovative work behaviors, work commitment, and teamwork in a sustainable way [6]. Thus, for HEIs the challenge is even greater: they must be the driving force in the training of future professionals and members of organizations in terms of both hard and soft skills. However, they must also do so without neglecting the health and well-being of their students. Gamification, broadly defined as "the use of game design elements in non-game contexts" [24] (p. 10), could be a powerful and useful tool in this regard.

1.1. Gamification as a Learning Strategy: Some Conceptual Details

The use of games for purposes other than mere entertainment dates back to very ancient stages of humanity itself. In the context of education and learning, the interest of researchers for their uses and effects is a more recent character, around the 1970s when Clark Abt coined the term serious game [25]. He defined serious games as "those that have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining" [26] (p. 27). This means that "the 'seriousness' of these games refers to a content that may well be used as teaching material by teachers" [27] (p. 27). However, the interest in the educational use of games grew especially since the early 2000s when some game designers began looking for strategies to transfer the excitement and joy of playing to the real world [28]. In its origin, this process adopted different names as playful or gameful design, but in 2002 Nick Pelling coined [29] the term gamification to refer to the use of the game in contexts other than the game. Thus, a term that originated in the digital media industry was largely adopted in all potential application areas, including education.

Gamification became increasingly popular in the context of learning, especially through the last decade, such that it is now called gamified learning [30]. As we noted, it could be broadly described as the application of playful thinking, and game mechanics, in non-game contexts to engage users in problem-solving or task completion [31]. As the application of game dynamics grew in the educational context, it also grew the heterogeneity of the approaches and therefore the terms and applications (e.g., serious games, game-based learning, gamified learning, gamification). Despite the fact that it is not unusual to identify gamified learning just with the use of digital games for teaching and learning purposes, the main objective of all these applications is to educate or to train, often combining the experienced enjoyment and the necessary concentration through challenging tasks when the maximum is reached using one's own skills [32]. As Sailer and Hommer noted [30], these applications share a common game design element toolkit [33], and a focus on adding value beyond entertainment [24], or, in other words, on building meaningful and useful learning based on entertainment and fun. In fact, the research literature on gamified

learning and game-based learning overlap, although they are different in nature [30]. The main difference between the both is that whereas gamified learning is fundamentally a learning design change process that adds game elements, game-based learning approaches are a product, in the sense that they involve the design of complete (serious) games [30] (p. 78). These serious games "are typically designed to fulfill the role of instructor by actually providing instructional content to learners" [34]. Thus, the true fundamental key has to do with the use of game mechanics and design elements to generate learning. In this regard, it comes out of a growing body of empirical research that supports that the use of game elements tends to positively impact several types of learning outcomes [30] as well as several valuable issues, such as motivation, and engagement: a specific type or work-related subjective well-being [35] that might be critical for healthy students [21].

1.2. Does Game-Based Learning Work in HIEs? Its Theoretical Foundation

The incorporation of gamification in the learning process is being considered as a significant factor in the success of teaching, learning, and research in HIEs [36]. As noted above, gamified learning and game-based learning (GBL) tend to exert positive effects on learning outcomes and the learners themselves. For example, it has been pointed out that the development of basic personal skills, including highly valuable soft skills for organizations such as those related to teamwork, as well as learning in a variety of subjects, can be effectively supported by games in an efficient, attractive and motivating way [30,37–40]. However, the use of games for learning purposes in HIEs is not without controversy, not only in terms of whether and to what extent their effects are always beneficial [41] but also with respect to their theoretical foundation [30,42].

From a theoretical point of view, the most widely used frameworks to explain the relationship between learning and the use of games have been the theory of gamified learning and the self-determination theory (SDT) [30,41–43]. Very succinctly (see a longer description [30,34,41–44]) the theory of gamified learning [34] postulated that GBL influences learning through four components—such as instructional content, behaviors and attitudes, game characteristics, and learning outcomes—being the critical issue to the success of any GBL effect that "the instructional content in place is already effective" [34] (p. 9). Self-determination theory (SDT) postulated that "an understanding of human motivation requires a consideration of innate psychological needs for competence, autonomy, and relatedness" [43] (p. 227). Its application in the context of GBL implies that the satisfaction of these needs in students will positively influence their intrinsic motivation, and, will subsequently lead to high-quality learning. In this process the environment in which the satisfaction of those needs takes place is essential. Thus, the incorporation of game mechanics to the instructional content in these environments allows their modification and enrichment, and therefore, they can positively affect learning outcomes. Students intrinsically motivated through the use of games for learning chose more difficult assignments and produced higher-quality artifacts [45], retained information better, were generally happier and more engaged [46].

Finally, a third theory has also been more recently identified as one of the most common theoretical frameworks [42] in the GBL arena: Csikszentmihalyi's flow theory [47,48]. The concept of flow can be broadly conceptualized as a state of deep absorption in an activity that is inherently pleasant [48,49]. Therefore, this theory postulates that challenging activities (e.g., playing a game for learning purposes) might lead people who are immersed in to experience a state of flow [42]. These flow experiences can be considered states of absolute absorption or intense concentration in an activity, and in educational contexts, deep absorption in activities could promote optimal learning experiences [49]. Based on this theory, it can be argued that gaming activities could potentially induce learners to a state of flow if the challenge is adjusted to their skill level, leading them to experience feelings of enjoyment, creative achievement, and satisfaction [42,49] while learning. The fundamental issue seems to be the balance between "the inherent challenge of the activity

and the player's ability to address and overcome it in order to maintain a player's flow experience" [49] (p. 1186).

Together, these three theories provide us with important arguments to consider that the incorporation of the game for learning purposes is effective and efficient. Firstly, GBL is not intended to replace instructional learning materials [30,34]. In fact, the quality of instructional content is essential: if this content does not help college students to learn, gamified learning itself cannot produce learning [50]. Second, the game characteristics should help support psychological needs such as competence, autonomy, and empathy [43–46,50]. In this sense, the combination of collaboration (e.g., playing the game in teams) and competition (for example, the winning team is getting an award) could positively affect learning-related behaviors and outcomes [30]. The application of missions in GBL could foster the creation of such kinds of social interactions. Missions provide explicit learning goals for players in a meaningfully engaging way [50], as well as to practice activities to support competency and autonomy [51]. Finally, this game-based learning experience will be intrinsically motivating. So, if the level of challenge is adjusted to the level of skill of the learners, the serious game might provide players an experience of flow and feelings of enjoyment, creative achievement, and satisfaction [42,49]. Indeed, some recent meta-analyses showed that if these considerations are taken into account, the use of the game will positively affect learning in university settings.

1.3. Game-Based Learning in HIEs: Some of Its Effects on Learning and Related Outcomes

As noted above, research in this field has grown quickly recently. More specifically, Subhash and Cudney [38] considered that the turning point for the growth of this area in HIEs may be around the early years of the last decade. They systematically reviewed studies published from 2012 until 2017 and revealed some important key findings. Using games for learning purposes has benefits such as improving college students' confidence, practical skills, perceived learning, academic effort, and psychological satisfaction. The most significant results were the improvement of students' performance, motivation, enjoyment, and engagement: in approximately 50% of the reviewed studies, Subhash and Cudney [38] found GBL positively affected a key indicator such as subjective well-being. It is interesting to note that even some of these studies identified that the experienced engagement had a positive effect on learning [32], in line with what was stated in a previous point in relation to flow theory [47–50].

The review by Kalogiannakis et al. [52] yielded similar results. They analyzed 24 empirical research papers published from 2012 to 2020 and concluded that four outcomes stood out: motivation, engagement, learning achievements, and social interaction. The results revealed that all studies that measured both motivational and learning outcomes, reported increased learning outcomes and also showed improved motivation, as well as positive feelings and learning-related behaviors, such as engagement. Based on these findings, the authors stated that their results indicated a strong connection between motivational and engaging outcomes and significant learning outcomes, in line with that previous research supporting that the engaged and motivated students were also very likely to achieve significant learning results.

Zainudin et al. in 2020 [42] developed a systematic literature review of 46 empirical papers published between 2016 and 2019 related to the effects of gamified learning and GBL. From their review, the main areas of positive influence were engagement, motivation, academic performance, and interaction and socialization. The authors concluded that the introduction and use of game elements with learning purposes could increase student engagement and motivation, improve academic performance, encourage interaction and socialization, and offer opportunities to develop autonomous learning skills.

In summary, the intrinsic motivation and engagement of college students are some of the most frequent and reported outcomes derived from the use of GBL [53]. Student engagement, more recently called academic engagement, has been linked to self-esteem, satisfaction with studies, and academic performance [54] and characterizes healthy individ-

uals. However little research has examined this experience in HIEs from the point of view of the team, or in other words, the so-called teamwork engagement: "a shared, positive, fulfilling, motivational emergent state of work-related well-being" [55] (p. 35). Social interaction constitutes an essential part not only of game-based learning applications [52] but also of the university training and learning process itself. Interpersonal relations play a key role in students' outcomes, experiences, and emotions, as well as in the development and promotion of relevant soft skills, highly valuated in workplaces, without threatening college students' well-being, enhancing their feelings of teamwork engagement.

Regarding the effects of GBL, it is important to note that some studies have reported an improvement in several soft skills related to teamwork, such as students' confidence for teamwork and team building, creativity, and innovation behaviors [56–58]. Team building has been defined as "the formal and informal team-level interventions that focus on improving social relations and clarifying roles as well as solving task and interpersonal problems that affect team functioning" [59] (p. 9). Some studies showed that GBL improved communication, collaboration, problem-solving, and goal setting among group members, and influenced their perceptions of being and feeling as a team [60,61]. Innovation work behaviors (IWB) involve the intentional and successful introduction of a new idea, process, or product. The most recent conceptualizations of this IWB construct [62] consider it might encompass creativity, or "the production of novel and useful ideas" [20] (p. 3) and innovation "the successful implementation of creative ideas" [20] (p. 3).

Despite its value, most of the research conducted comes from the application of GBL through digital games that might not provide face-to-face interaction, while in a classroom situation, student–student interactions could have a profound impact on the improvement and acquisition of basic competencies as soft skills for teamwork. This could also be more crucial in those college students of Health Sciences and Social Work. In the exercise of their professional career, cooperation and teamwork usually involve face-to-face interaction and coordination with other professionals and even with the users of the service. Therefore, more research is needed regarding face-to-face game-based learning tools that could contribute to fostering teamwork among such undergraduates.

Under this background, the main objective of this research is to test the effect of GBL on Health Sciences and Social Work students' intrinsic motivation (IM), teamwork engagement (TWE), team building (TB), teamwork competence (TWC), and innovation behavior (IWB). Our set of hypotheses states:

Hypothesis 1 (H1). *GBL will positively affect undergraduates' IM, being higher after playing the game.*

Hypothesis 2 (H2). *GBL will positively affect undergraduates' feelings of TWE, being higher after playing the game.*

Hypothesis 3 (H3). *GBL will positively affect undergraduates' experience of TB, being stronger after playing the game.*

Hypothesis 4 (H4). *GBL will positively affect undergraduates' own sense of TWC, being higher after playing the game.*

Hypothesis 5 (H5). *GBL will positively affect undergraduates' IWB, being higher after playing the game.*

2. Materials and Methods

2.1. Participants

The convenience sample of this study consisted of a total of 142 Occupational Therapy, Physiotherapy, Psychology, and Social Work undergraduates of the University of Zaragoza (Spain) who voluntarily participated in the game (8.5%, 32.4%, 38%, and 21.1% respectively of the whole sample). At the time this research was conducted, all of them were enrolled in

subjects related to the psychology of groups as a part of their university training (this was the main inclusion criterion of the research sample). A total of 18.2% were in the first year of the degree, 44.1% in the second, and 37.8% in the third. The age of participants ranged from 18 to 25 years old (M = 20.58; SD = 1.61). A total of 72.5% were women.

2.2. Procedure

This study has a longitudinal design with two data collections (T1 and T2), from February until the first week of March 2020. Before (T1) and after (T2) playing the game named "the group to the rescue" [63], participants completed the anonymous pen-and-paper instrument used to measure the researched variables with a unique subject identifier (ID). First, they were informed of the objectives and anonymity of data collected, as well as that all participation was voluntary without any compensation as described in the informed consent that they all accepted. The study was approved by the Research Ethics Committee of the Autonomous Community of Aragon (C.I. PI19/446).

To play the game "the group to the rescue" [63,64], written in Spanish, groups of five members were composed in each undergraduate group (Occupational Therapy, Psychology, Physiotherapy, and Social Work). Participating students were able to choose with which other people they wanted to play the game as a group. This simulation game based on interaction face-to-face in the classroom is grounded on theoretical and empirical foundations of the psychology of groups around the so-called effects of the physical, social, and personal environment on group dynamics and performance [65–67]. On the one hand, it considers some potential characteristics of the special and exotic environments [65,68,69] where groups must sometimes work (for example, characteristics of the team's workspace, weather conditions, etc.). In this sense, we thought it could be a good context to travel in space in a small ship for a month round trip, together with an indeterminate stay on a newly discovered planet that is perhaps suitable for human's life (Thessaltion). On the other hand, it considers some sociodemographic, personality traits, attitudinal and intellectual characteristics of group members (for example, team members age has been linked to the quality of social interactions established), which configure an idiosyncratic composition, influencing group interaction, dynamics, and performance [66,67,70–75]. Twelve different characters were created that varied in age, gender, ethnicity, abilities, personality traits, intelligence, and attitudes. An example of one of such characters can be described as follows: "M. PITTON: 68 years old, retired military man with the spirit of a Renaissance man. The list of his skills and knowledge is long: biology, astrophysics, linguistics, paleontology, architecture, geology, telecommunications . . . He is nicknamed 'Know-it-all'. He inspires confidence and takes anxiolytics".

The game had to be completed by the groups made up of college students in a maximum of 45 min in each grade separately. Players must work effectively in their own group to form a team of individuals based on the aforementioned twelve possible characters. The formed team is the one that will travel to Thessaltion, to explore it, and to indicate based on the information they collect during their stay there if humanity could live in it, because the Earth, our Earth, is disappearing. The setting consisted of traveling through space in a small spaceship (the Chachigate I: a last-generation spaceship, astonishingly fast and barely 50 square meters) for two months' round trip at least, along with an indeterminate stay on a newly discovered planet (Thessaltion) with an atmosphere similar to the Earth's but with a very cold climate, large animals (including dinosaurs), and exotic vegetation. Every group of players had to provide a report signing all the elected members to conform the team that will explore Thessaltion in the order in which they were incorporated, explaining the main reasons for inclusion.

All players, if they successfully complete this task in their groups, as well as their families, loved ones, and friends will have a place in the big spaceship Chachigate II, when it is built. Additionally, the first group to properly complete the report will win the game and will have a V.I.P. place in the spaceship. All members of the winning group will receive a personal document recognizing the award.

2.3. Instruments

2.3.1. Intrinsic Motivation (IM)

Self-rated intrinsic motivation was measured by asking students about their reasons for studying at university by using a validated Spanish version [76] of the Academic Motivation Scale (AMS) [77]. This instrument contained 12 items related to intrinsic motivation. Answers are reported on a 6-point Likert scale: from 1 (completely disagree) to 6 (completely agree). The 12 items can be grouped into three subscales: intrinsic motivation towards stimulating experiences (for example, "For the intense moments that I live when I communicate my own ideas to others"); intrinsic motivation towards knowledge (for example, "Because I enjoy learning new things"), and intrinsic motivation towards the achievement (for example, "For the satisfaction that I feel when I improve myself in my studies"). Previous studies have shown significant correlations above 0.50 among these three IM components [76,77]. To obtain a total score of intrinsic motivation we combined the three subscales both for T1 (before the game) and T2 (after the game). We conducted two principal component analyses (PCA) to test the validity of the scales in our study. The obtained results showed the 12 items of the IM scale before (T1) and after playing the game (T2) loaded on one factor. The Kaiser–Meyer–Olkin test of sampling adequacy (KMO) values were respectively equal to 0.86 ($p < 0.01$) and 0.87, which are satisfactory [78]. Cronbach's alpha for this MI scale in T1 was 0.86, and for T2 was 0.89.

2.3.2. Teamwork Engagement (TWE)

The Spanish version [79] of the Utrecht Work Engagement Scale (UWES) [53] adapted to teams was used to measure students' feelings of teamwork engagement. This instrument includes 18 items that can be grouped into three subscales: absorption (e.g., "Time flies when we are working"), dedication (e.g., "During the task we feel full of energy"), and vigor (e.g., "We are enthusiastic about the task"). Responses were rated on a 7-point Likert scale: from 1 (never) to 7 (always). The three subscales were combined obtaining a total teamwork engagement score as in previous studies in which TWE has demonstrated good factorial validity, internal consistency, and discriminant validity [55,80,81]. The subscales were combined to create a total engagement score, both for T1 and T2. Two principal component analyses (PCA) were run to test the validity of these scales in the sample of the present study. The results confirmed the 18 items of the TWE scale before playing the game (T1) loaded on one factor, with the Kaiser–Meyer–Olkin test of sampling adequacy (KMO) equal to 0.88 ($p < 0.01$) which is satisfactory [78]. Cronbach's alpha for this scale in T1 was 0.91. For T2, similar results were obtained from the PCA (KMO = 0.94; $p < 0.01$). The Cronbach's alpha was 0.95 for this measure in T2.

2.3.3. Team Building (TB)

A 12-item instrument was used to measure the students' experience of team building. Based on previous studies [59,82–84] we developed a measure to capture individuals' perceptions regarding their own sense of being a team inside his or her workgroup. Responses were rated on a 6-point Likert scale from 1 (completely disagree) to 6 (completely agree). A sample item reads as follows, "Team members have a clear shared vision for each task". The results obtained from the PCA confirmed these 12 items were loading highly on one factor both for T1 and for T2. In terms of goodness of fit KMO was also quite high [78]: KMO = 0.93, $p < 0.01$ and KMO = 0.92, $p < 0.01$, respectively. Furthermore, Cronbach's alphas were both 0.93 before and after playing the game (T1 and T2).

2.3.4. Teamwork Competence (TWC)

An adapted version of the instrument effectiveness in teams [85,86] was used to capture students' perceptions regard to their own sense of competence for teamwork. This instrument contained 21 items asking students for their own teamwork behaviors associated with team member effectiveness, such as cooperation, conceptual and practical contribution to the teamwork, and work ethically within the team. The 21 items were rated

on a 6-point Likert scale: from 1 (completely disagree) to 6 (completely agree). A sample item was "I actively communicate within the group". To test the validity of this scale a PCA was carried out with returned good results [78]. The twenty-one items were loading in one factor in T1 (KMO = 0.90; $p < 0.01$) as well as in T2 (KMO = 0.90; $p < 0.01$). All item scores were summed and averaged for global scale punctuation. High scores indicated high levels of confidence in their own teamwork competence. Cronbach's alpha before (T1) and after (T2) playing the game were respectively 0.91 and 0.92.

2.3.5. Innovative Work Behaviors (IWB)

Self-rated innovative performance by own student was assessed using Janssen's nine-item measure [87,88]. Of these nine items, three referred to idea generation (for example, creating new ideas for difficult issues), three to the idea promotion (for example, mobilizing support for innovative ideas), and the remaining three to the idea realization (for example, transforming innovative ideas into useful applications). Responses were rated on a 7-point scale: from 1 (never) to 7 (always). Correlations among these three IWB components were found to be above 0.79 in previous studies [89]. The results obtained from the PCA confirmed that the nine items loaded highly on one first factor, with the Kaiser–Meyer–Olkin test of sampling adequacy (KMO) equal to 0.91 ($p < 0.01$) in T1 and 0.94 ($p < 0.01$) in T2 which are quite high [78]. Therefore, nine item scores were combined to obtain a global IWB score. High scores indicated high levels of innovative work behavior. The Cronbach's alpha was 0.92 for T1 and 0.95 for T2.

2.4. Data Analyses

SPSS 26.0 (IBM®, Armonk, NY, USA) was the software tool used for the data analyses. We included descriptive and internal consistency (Cronbach's alpha) analyses for all variables in the results section. Differential analyses between T1 and T2 were conducted after checking assumptions, for example, normality $p > 0.05$ (Kolmogorov test), and homoscedasticity $p > 0.05$ (Levene's test) to ensure their application. Two of the measured variables in T1, IM, and TB were non-normally distributed. To estimate the effect of playing the game on the reported levels of intrinsic motivation and team building, a nonparametric test (Wilcoxon signed-rank sum) was performed [89–91]. Two of the measured variables in T1, TB, and TCE did not present homogeneous variances among the four undergraduates' groups (i.e., Occupational Therapy, Psychology, Physiotherapy, and Social Work). Therefore, the Kruskal–Wallis H test was performed (using if need the post hoc Dunn test with Bonferroni adjustment) to test for potential differences [92] among the four undergraduates' groups before playing the game.

3. Results

This study analyzed the effect of GBL on IM, TWE, the experience of TB, confidence in their own skills to work in teams efficiently (TWC) and IWB of college students. First, the descriptive, and internal consistency analyses are presented, followed by the preliminary differential analyses among the four groups of college students. Finally, the differential analyses between T1 and T2 are shown.

3.1. Descriptive and Internal Consistency Analyses

Table 1 shows the sample distribution by gender of each degree group.

Table 1. Degree/gender distribution of participants.

Degree	Gender (Female)	Gender (Male)
Occupational Therapy	10	2
Physiotherapy	32	14
Psychology	47	7
Social Work	14	16
	103 (72.5%)	39 (27.5%)

Table 2 displays the results of descriptive and internal consistency analyses (Cronbach's alpha) of IM, TWE, the experience of TB, confidence in their own skills to work in teams efficiently TWC and IWB, for both T1 and T2.

Table 2. Descriptive and internal consistency analyses (Cronbach's alpha).

Variable	M (SD)	Cronbach's Alpha (α)
Intrinsic Motivation (IM) (T1)	4.63 (0.67)	0.86
Teamwork engagement (TWE) (T1)	4.55 (0.71)	0.92
Team Building (TB) (T1)	4.50 (0.73)	0.93
Teamwork Competence (TWC) (T1)	4.68 (0.55)	0.92
Innovation Work Behaviors IWB (T1)	4.52 (0.87)	0.92
Intrinsic Motivation (IM) (T2)	4.80 (0.66)	0.89
Teamwork engagement (TWE) (T2)	5.25 (0.85)	0.95
Team Building (TB) (T2)	4.93 (0.74)	0.93
Teamwork Competence (TWC) (T2)	4.94 (0.59)	0.92
Innovation Work Behaviors IWB (T2)	5.00 (1.02)	0.95

Note. N = 142. M and SD are used to represent mean and standard deviation, respectively.

3.2. Preliminary Differential Analyses

Preliminary differential analyses were conducted to check if the self-perceived levels of IM, TWE, TB, TWC, and IWB before playing the game (T1) were, or not, similar among the four groups of participants.

A one-way ANOVA was conducted to test potential differences in means of TWE and IWB before playing the game "the group to the rescue" (T1).

As shown in Table 3, no significant differences emerged ($F = 1.26$, $p > 0.05$ and $F = 0.69$, $p > 0.05$, respectively).

Table 3. One-way ANOVA by group degree.

	Occupational Therapy (1)		Physiotherapy (2)		Psychology (3)		Social Work (4)			
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	F	*p*
Teamwork Engagement (TWE) (T1)	12	4.54 (0.46)	46	4.64 (0.64)	54	4.40 (0.78)	30	4.64 (0.74)	1.80	0.168
Innovation Work Behavior (IWB) (T1)	12	4.31 (0.96)	46	4.41 (0.68)	54	4.62 (0.90)	30	4.53 (0.99)	0.72	0.493

A Kruskal–Wallis rank-sum test was performed to compare the degree groups (Occupational Therapy, Physiotherapy, Psychology, and Social Work) in terms of the means of undergraduates' IM, TB, and TWE before playing the game "the group to the rescue" (T1). Table 4 displays the results obtained. As shown in Table 4, the Kruskal–Wallis rank-sum test showed no significant differences emerged before playing the game (T1) in IM, TB, and in students' confidence in their own TWC.

Table 4. Kruskal–Wallis rank -um test by group degree.

	Occupational Therapy (1)		Physiotherapy (2)		Psychology (3)		Social Work (4)			
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	χ^2	*p*
Intrinsic Motivation (IM) (T1)	12	4.40 (0.58)	46	4.59 (0.58)	54	4.68 (0.65)	30	4.65 (0.85)	3.79	0.285
Team Building (TB) (T1)	12	4.53 (0.73)	46	4.67 (0.53)	54	4.41 (0.77)	30	4.39 (0.94)	2.56	0.317
Team Working Competence (TWC) (T1)	12	4.66 (0.22)	46	4.72 (0.47)	54	4.75 (0.47)	30	0.48 (0.80)	3.03	0.387

As the four groups did not differ significantly in their levels of these variables, the Dunn–Bonferroni post hoc test was not conducted.

3.3. Differential Analysis between T1 (before Playing the Game) and T2 (after Playing the Game)

A paired sample t-test was carried out to analyze students' IM, TWE, TWC, and IWB before (T1) and after (T2) playing the game "the group to the rescue". Table 5 shows significant differences between T1 and T2. Undergraduates' IM was lower before playing the game in T1 than after playing it in T2 ($t = -5.414$, $p = 0.000 < 0.001$). To estimate the effect size Cohen's *d* indicator was used (small effect 0.2, medium effect 0.5, and large effect 0.8 [93]). The obtained result of Cohen's *d* was −0.50, that is, $0.50 \geq 0.5$. Thus, it is a medium effect size that confirms that playing the game had a medium impact on students' IM.

Table 5. The paired sample t-test: IM, TWE, TWC, and IWB before (T1) and after (T2) playing the game.

Variable	N	M	SD	*t*	*p*
Intrinsic Motivation (IM) (T1)	142	4.63	0.67	−5.414 **	0.000
Intrinsic Motivation (IM) (T2)	142	4.80	0.66		
Teamwork Engagement (TWE) (T1)	142	4.55	0.71	−9.393 **	0.000
Teamwork Engagement (TWE) (T2)	142	5.25	0.85		
Team Working Competence (TWC) (T1)	142	4.68	0.55	−5.054 **	0.000
Team Working Competence (TWC) (T2)	142	4.94	0.59		
Innovation Work Behavior (IWB) (T1)	142	4.52	0.87	−7.181 **	0.000
Innovation Work Behavior (IWB) (T2)	142	5.00	1.02		

** Indicates $p < 0.01$.

The levels of teamwork engagement experienced by undergraduates were higher after playing the game ($t = -9.393$, $p = 0.000 < 0.001$). The Cohen's *d* result was −0.80, that is, $0.80 \geq 0.8$. Therefore, it is a large effect size implying that playing the game had a great impact on undergraduates' feelings of teamwork engagement. Students' confidence in their own TWC was also higher after the game was played (T2) ($t = -5.054$, $p = 0.000 < 0.001$). Cohen's *d* was −0.40, that is, $0.40 \geq 0.2$. This indicated a small effect on undergraduates' perceptions of their own competence to team effectiveness. The levels of students' IWB were also higher after playing the game ($t = -7.181$, $p = 0.000 < 0.001$). Cohen's *d* was −0.60, that is, $0.60 \geq 0.5$. Thus, it is a medium effect size that indicates a medium impact of the game played on students' innovation behaviors.

As team building in T1 was non-normally distributed (Kolmogorov–Smirnov value = 0.083, $p = 0.019 < 0.05$) nonparametric test was used to estimate the effect of playing the game. Table 6 shows the results obtained from the Wilcoxon signed-rank test for two related samples to compare TB measures in T1 and in T2 [89–92]. The Wilcoxon signed-rank test showed that the observed difference between both measurements was significant ($Z = -6.352$, $p = 0.000 < 0.01$). Thus, we could assume that playing the game exerted a significant increase in students' experience of TB, with a medium effect size (r = −0.38) according to Cohen [93,94] (0.1–0.29 = small effect; 0.3–0.49 = medium effect; ≥0.5 = large effect).

Table 6. The Wilcoxon signed-rank test: TB before (T1) and after (T2) playing the game.

Variable	N	M	SD	Z [1]	p	r
Team Building (TB) (T1)	142	4.50	0.73	−6.352 **	0.000	−0.38
Team Building (TB) (T2)	142	4.94	0.73			

[1] Z (Wilcoxon sign ranges test) ** Indicates $p < 0.01$.

4. Discussion

The present study evaluated the effect of GBL on college students' IM, TWE, TWC, TB, and IWB. To achieve this goal, a total of 142 Occupational Therapy, Physiotherapy, Psychology, and Social Work undergraduates of the University of Zaragoza (Spain) voluntarily played in small work teams the serious game called "the group to the rescue" [63]. HEIs have a great role [11] in contributing to the sustainable economic and growing vitality of the regions, societies, and countries by connecting students with the real world through educational experiences [95]. The use of game elements for learning purposes could be helpful. Moreover, games could facilitate the intentional and innovative embedding of sustainability principles in HEIs [96]. Our findings showed that GBL constitutes a powerful tool for HEIs in the training of valuable soft skills, such as teamwork competence and innovation. Innovation and well-being have been identified as two important sustainable development goals (SDG) included in the 2030 Agenda for Sustainable Development [9]. In other words, such an educational strategy might contribute to the sustainability of HEIs themselves.

First, it is interesting to note that in the previous analyzes we carried out, no significant differences were found in the variables of interest among the four groups of college students of Health Sciences and Social Work participating in the study. It may be that all of them have similar levels in the variables under study due to the training received in their degrees in Health Sciences and Social Work, as well as in previous phases, such as the training necessary to access university (Bachelor of Health Sciences and Social Sciences respectively). In this sense, it would be interesting for future research to compare the results obtained in this group with college students from other degrees, thus amplifying the empirical evidence at this level, which is particularly scarce in some areas of education [52].

Our results supported all the formulated hypotheses (H1, H2, H3, H4, and H5). In line with previous evidence [30,37,38,40,42,49,52,56–58,60,61], GBL works. We offered in the introduction some key elements to consider regarding the theoretical foundations for using games for learning purposes efficiently, that are contained in the game-based learning experience that we tested. The serious game "the group to the rescue" did not replace instructional learning materials [30,34]. In fact, it was grounded on theoretical and empirical foundations of the psychology of groups around the so-called effects of the physical, social, and personal environment on group dynamics and performance [65–67,70–74]. The game characteristics (for example, applying a mission, combining collaboration and competition, and providing explicit learning goals and a large amount of control for players in a meaningful way) favor the satisfaction of psychological needs such as competence, autonomy, and relatedness [43–46,50]. Moreover, the level of challenge is adjusted to the student's level of skills, providing them an experience of flow and feelings of enjoyment, creative achievement, and satisfaction [42,49], being an intrinsically motivating game-based learning experience.

After playing the game (T2), the levels of IM, feelings of TWE, the experience of TB, sense of TWC, and IWB of undergraduates were significantly higher than before playing the game. The effect sizes obtained, estimated through Cohen's d, allow us to affirm that this serious game experience had the largest influence over an important indicator of well-being and health [21–35] such as teamwork engagement. After playing the game, college students of Health Sciences as Social Work experienced a higher "shared, positive, fulfilling, motivational emergent state of work-related well-being" [55] (p. 35). Student engagement has been linked to several key related learning outcomes such as self-esteem, satisfaction with studies, and academic performance [54]. In this context, the positive meaning that

this game had on the intrinsic motivation and innovative behaviors of students is also noteworthy. There is some empirical evidence [45,46] to support that intrinsically motivated students using games for learning chose more difficult assignments and produced higher-quality artifacts, retained information better, were generally happier and more engaged. IWB is considered a valuable soft skill, where organizational capability is highly dependent, linked to individuals' optimal development and well-being. Moreover, some recent studies highlighted the importance of investing in resources to promote innovative behavior at work, especially during pandemic and post-pandemic times.

In addition to the fact that we believe that such findings could represent a promising avenue for future developments, this study is not free of limitations. First, the results obtained are based on a single data source—college students—and with a single collection method that consists of a self-reported survey. However, in this sense, authors such Rahmadani et al. [54] appeal to Spector [97] to point out that the so-called problem of common variance might be exaggerated, without this meaning that it is not necessary to develop new investigations that analyze the results obtained here using multisource and multimethod data (for example, observation, peer rating, etc.). Second, the number of female students is higher than the number of male students frequently in Health Sciences and Social Work degrees, at least in the University of Zaragoza. In this sense, one of the limitations of our work is the relatively higher number of participating women (72.5%) compared to men (18.5%). Although previous research has not shown consistent significant differences regarding the relationship between gender and game-based learning (GBL), it would be desirable to develop future studies that include a larger number of male participants. In this way, new insights could be shed on the conditions in which variables, such as gender composition, may or may not influence the results obtained from here. This procedure could also be useful in contributing to the achievement of another important SDG: gender equity. Third and last, given the nature of this study, we have not offered data that allow us to identify the possible significant relationships among the variables studied in this context of the game for learning purposes. For example, in organizational contexts, innovation behaviors and work engagement are often related [98]. However, little is known about this relationship in HEIs. Future research could close that gap.

5. Conclusions

Overall, and from a practical point of view, our results suggest that the serious game we tested can be used at HIEs to improve, in an engaging and healthy way, some important learning-related variables of college students as intrinsic motivation, as well as key soft skills for teamwork and innovation behaviors. One of the main limitations of our study is that it focuses only on the educational field of Health Sciences and Social Work. Future research could prove its usefulness among college students in other educational content areas, as well as practicing health and social work professionals. As we have already pointed out in these professions, teamwork, and face-to-face interaction is essential, and the game "the group to the rescue" is based on such face-to-face interaction in small work teams. This is how the findings are added to all this evidence, which comes to a greater extent from the use of digital games, which allows supporting the use of game elements for learning purposes in the macro of HEIs. Future lines of innovation actions in HIEs may also encompass an in-depth analysis of the possible significant relationships amongst the variables studied in this context of games for learning purposes, such as for example, the link between teamwork engagement and innovation behaviors.

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