

Article

Effects of a Gamification and Flipped-Classroom Program for Teachers in Training on Motivation and Learning Perception

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Abstract: We present the results of a training program with future Primary Education teachers on the impact on motivation and perception of learning achieved through strategies and techniques associated with gamification and flipped-classroom. The program was run in four classroom groups ($n = 210$) at the University of Murcia (Spain) and the aim was to analyze the effect that the gamification-based and flipped-classroom program has on motivation and learning. Information was collected through a perceptions questionnaire. Descriptive statistics are shown; mean tests (t of Student and ANOVA of a factor) and Pearson correlations between subscales. The data show a very positive impact on motivation, the learning achieved, and the strategies applied in the program. Some differences between group-class and gender are discussed, and some future improvements of the program are put forward.

Keywords: gamification; flipped-classroom; motivation; teacher education; social sciences teaching; student perceptions

1. Introduction

1.1. Gamification, Flipped-Classroom and Motivation

In recent years, new methodological horizons have been fixed in the field of teacher training [1]. International studies insist on the need to renew teacher training programs to improve teaching-learning processes in compulsory education [2–4], and place emphasis on the mastery of normal classroom tasks [5,6].

Thus, this methodological renewal incorporates new strategies that put the students at the centre of the teaching and learning process. Good examples of this are the flipped-classroom and gamification [7,8]. Hence, research that empirically analyzes the positive effects of greater motivation on the part of students with their role in class [9,10], is fundamental to lay the foundations for this new educational paradigm.

In these studies, technological resources and mobile connections are playing a notable role [11]. At the same time, the use of play is being focused on to increase commitment and motivation [12–14]. In this context, a phenomenon known as gamification arises [15,16]. Gamification is based on the argument that many traditional activities (including school activities and traditional learning) are not intrinsically interesting. The understanding is that the incorporation of game-like characteristics would make them more attractive [17]. Among other techniques, gamification uses rewards when a user reaches a specific goal [18]. There is a scoring system and a record of achievements, classifications (global or partial), and badges are awarded [12].

This system of ranking, scores and rewards is a strategy in itself, providing students with tools to improve their performance in activities and seeking to stimulate the necessary motivation to improve one's ranking in the game. In this sense, several research papers have analyzed the intrinsic and extrinsic results of the motivation of the students prior to gamification strategies [19,20], finding that gamification per se does not guarantee greater motivation, but must be focused on achieving learning results, so the type of game must be adapted to the contents to be worked on and to the characteristics of the students who participate in it [21,22].

Authors such as Urh et al. [23] believe that the use of play in Higher Education has positive effects on the teaching and learning process, and these effects have been supported by empirical studies [12,24] based on key elements such as points, prizes or rewards [15,25,26].

The motivational change sought with gamification is closely related to SAL (Student Approach to Learning). Although this approach has been promoted by the European Union for Higher Education Studies since the Bologna Plan, studies show that teacher training programs are still reminiscent of ineffective instructional strategies [27], so further research along these lines and empirical results on new educational paradigms focused on student work must be provided. In this sense, the flipped-classroom is a strategy that allows students to carry out activities and research work in class, while being guided and supported by the teacher [28]. Thanks to the support of educational technologies, the flipped-classroom has become a viable pedagogical approach that addresses the needs of today's students [29]. The flipped-classroom allows greater student activity based on practical work in the classroom, leaving the transmission of conceptual knowledge for home video viewing [30]. Like other technological strategies, its success depends on good educational planning that specifically complies with the three levels of the T-PACK framework [31–33].

It remains, however, a strategy with relatively little empirical research in academia [34]. Like other didactic actions focused on active student learning, the flipped-classroom improves traditional formulas [35], increases student participation [36] and, at the same time, allows for research and critical activity. Studies show that a direct consequence of this methodology is increased motivation and greater experiential learning [30,37].

At the same time, other studies [38] also detect that, although flipped-classroom increases motivation, this decreases as students become accustomed to this way of working, so it is important to program activities correctly so that class work encompasses different methodological strategies. Akçayir and Akçayir's research [39] reviews the main advantages and disadvantages of the flipped-classroom through 71 research articles in the Social Sciences Citation Index of the Web of Knowledge, and concludes that this methodological strategy improves student learning, although its weak points are found in the daily classroom activities and also in the confusion it generates in students not knowing directly the learning objectives of the subject to be studied [40]. For Sergis et al. [41] this improvement in learning is due to the theory of self-determination that increases student motivation, especially those students with low grades who prefer a new methodological model, such as the flipped-classroom, although as Cai et al. [42] stress, the success of this strategy is always linked to good planning on the part of teachers in terms of content, ease of use and access to materials.

If we focus on the perceptions of future teachers towards the use of active and innovative methodologies in the classroom, we observe diverse and contradictory results when analyzed taking into account the gender variable. Students value new teaching methods very positively [43–45]. This is demonstrated, for example, by the works of Barba et al. [46] or Pegalajar and Colmenero [47] that have focused on investigating the impact of cooperative learning, those of Angelini and García-Carbonell [48] or Blasco-Serrano et al. (2018) [49] who have investigated simulation, gamification and flipped-classroom strategies; or that of Cózar et al. [50], who have investigated the assessment that future teachers make about the use of virtual reality in the teaching of history.

However, when gender differences, we observe that student perceptions vary in some research, with the tendency for male students to feel more comfortable with traditional learning styles, while women prefer more active learning styles, being willing to train in it [51,52].

With regard to the use of ICT. There are a big number of papers that have indicated how men seem to have more knowledge and skills regarding the use and management of these digital resources. In these papers, women show less confidence and interest in new technologies [53,54]. Although men seem to have greater technical skills, more experience and knowledge in these technologies, women would stand out for being more interested in using them for learning and their own training. According to Cózar and Roblizo [55], women would outperform men in greater social use of ICT [56].

However, at present, this trend seems to be reducing, as research begins to show the absence of a relationship between gender and the degree of acceptance of technologies [49,57].

1.2. Aims

The aim of this paper is to analyze the effect that a gamification and flipped-classroom based program has had on the motivation and learning of teachers in training.

SO1: To detail the opinion of future teachers about the effect that the training program based on flipped-classroom and gamification had on intrinsic and extrinsic motivation, and in particular:

- To examine the different perceptions of future teachers on the effects of the flipped-classroom and gamification based training program on intrinsic and extrinsic motivation.
- To examine the different perceptions of future teachers on the effects of the flipped-classroom and gamification based training program on intrinsic and extrinsic motivation according to the groups.
- To examine the different perceptions of future teachers on the effects of the flipped-classroom and gamification based training program on intrinsic and extrinsic motivation according to the sex of the participants.

SO2: To obtain details about the opinions of future teachers of the effects on motivation of the strategies and techniques used in the training program, and in particular:

- To analyze the perceptions of the future teachers on the effect on motivation of the strategies and techniques used in the training program based on flipped-classroom and.
- To examine the different perceptions of the future teachers on the effect on motivation of the strategies and techniques used in the program according to the groups.
- To examine the different perceptions of the future teachers on the effect on motivation of the strategies and techniques used in the program according to the sex of the participants.
- To examine the different perceptions on the effect on motivation of strategies and techniques associated with the flipped-classroom and those associated with gamification.

SO3: To analyze the perceptions of future teachers on the learning achieved using on the flipped-classroom and gamification based training program, and in particular;

- To analyze the perceptions of the future teachers of their own learning on the training program.
- To examine the different perceptions of the future teachers of the learning achieved on the training program according to the groups.
- To examine the different perceptions of the future teachers of the learning achieved on the training program according to sex.

SO4: To get a detailed opinion of future teachers on the strategies and techniques used in the training program, and in particular:

- To analyze their perceptions of the strategies and techniques used in the training program.
- To examine the different perception of the future teachers on the strategies and techniques used in the training program according to the groups.
- To examine the different perception of the future teachers on the strategies and techniques used in the training program according to the sex of the participants.

- To examine the different perceptions of the future teachers on the strategies and techniques associated with the flipped-classroom and those associated with gamification.
- To analyze the correlations between intrinsic and extrinsic motivation and the perceptions the future teachers had of their own learning during the training program.

References should be numbered in order of appearance and indicated by a numeral or numerals in square brackets, e.g., [1] or [2,3], or [4–6]. See the end of the document for further details on references.

2. Materials and Methods

2.1. Participants

The research comprised 210 trainee teachers (53 males (25%) and 157 females (75%)) on the Primary Education degree at the University of Murcia, Spain. The age of the participants ranged from 19 to 44 years ($M = 20.94$ and $SD = 2.77$). Almost 90% of the participants were 19 to 22 years old. The training program was implemented in four classrooms, and the distribution was fairly homogeneous—21% (Group 1), 25.6% (Group 2), 28.6% (Group 3) and 24.8% (Group 4). The sample selection procedure was non-probabilistic, specifically of an accidental type, due to the previous assignment of the student groups to the teachers who developed the training program.

2.2. Focus of the Research

A methodological approach based on program evaluation was chosen for this research: design, implementation and evaluation of a training program [58]. A quantitative approach through a questionnaire with a Likert scale (1–5) was applied to ascertain the perceptions of the participants about their motivation and learning.

2.3. Design of the Training Program

The training program was implemented in four classroom groups in the subject Didactic Methodology for the Teaching of the Social Sciences in the Primary Education Degree course of the University of Murcia (Spain). The aim of the course is for students to acquire competences in the design of innovative didactic proposals for the teaching of social sciences in Primary Education. The strategies used in the training program were based on flipped-classroom as a teaching approach, and gamification as a technique to encourage motivation. The subject was taught in the first semester of the academic year 2018/2019 (September–December). There were two sessions of two hours each week. The teaching team produced a weekly video with the theoretical contents of the subject. For the flipped-classroom, the students had to watch the video at home. The activities inside the classroom were based on case studies, simulations, analysis of materials, cooperative work, etc. This was combined with gamification techniques. At the beginning of each of the sessions the students answered questions about the theoretical videos through team competitions made with the Socrative platform, following the recommendations authors like [59]. At the end of the sessions, team competitions were held again on the contents dealt with throughout the session. The work groups could obtain badges during the development of the proposal, and prizes at the end of the course for those who obtained more badges.

2.4. Data Collection Tools

The information on the effects of this training program was collected through the ad hoc questionnaire “Evaluation of the training program based on gamification and flipped-classroom”, with a closed Likert type (1–5) assessment scale consisting of three thematic blocks. The first was devoted to the perceptions of teachers in training on how the training program implemented had affected their motivation. The second block was based on perceptions of how the training program had satisfied them. The third block focused on the perception of the learning received in the program. A series of

statements related to each of the teaching objectives of the program was prepared. Participants were also asked to assess the role they thought each of the strategies and techniques used in each block played.

For the design of this questionnaire, works investigating the effects of gamification programs on motivation, satisfaction and effectiveness of learning were taken into account [12,19,60,61]. Peer judges validated the content in terms of the relevance and clarity of the items in the tool.

2.5. Procedure and Data Analysis

The data were coded and analyzed in Statistical Package for the Social Sciences (SPSS) v.22.0 for MAC. The degree of reliability and validity of the construct was estimated prior to data analysis. The reliability of the questionnaire was tested using Cronbach's Alpha to estimate the reliability of a measuring instrument composed of a set of items, of Likert scale type, which we expect to measure the same theoretical dimension (the same construct). This validation procedure has also been used in other historical education works [62]. The well-established criterion is that a Cronbach alpha value, between 0.70 and 0.90, indicates a good internal consistency for a one-dimensional scale [63,64]. In the case of the questionnaire, satisfactory results were obtained both on a global scale and on each of the subscales used in this study. The appropriate degree of reliability of the global scale with the index was also verified using the Guttman split-half technique (See Table 1). In addition, an action protocol was designed to standardize the implementation of the training program by all teachers involved, thus strengthening the reliability in the development of the program.

Table 1. Coefficients of Cronbach's Alpha internal consistency and Guttman's split-half.

Scales and Sub-Scales	Number of Elements	Cronbach's Alpha	Guttman's Split-Half
Overall Scale "Evaluation of the gamification and flipped-classroom based training program"	37	0.940	0.903
Sub-scale "perception of learning"	8	0.876	
Sub-scale "perception of motivation"	13	0.821	

The validity of the construct and the viability of a subsequent factorial analysis were also checked. For this purpose, the correlation matrix was analyzed and Bartlett's test of sphericity and a Principal Component Analysis (PCA) were run for each block of the questionnaire. The exploratory PCA explains the maximum percentage of variance observed in each item from a smaller number of components summarizing that information [65].

With the analysis of the correlation matrix, we looked for variables that did not correlate well with any other, that is, with correlation coefficients of less than 3, and for variables that correlated too well with others, that is, variables that have some correlation coefficient greater than 9. No variable with these characteristics was found.

In the three blocks a critical level (Sig.) of 0.000 was obtained in Bartlett's test of sphericity. If we apply the PCA to each of the blocks, we obtain a distribution in the first block of 3 dimensions, explaining 48.9% of the total variance, with a KMO of 0.848. In the second block we obtain 2 dimensions, explaining 46.3% of the variance, with a KMO of 0.828. In the third block we obtain 3 dimensions, explaining 55.01% of the variance, with a KMO of 0.884.

The results showed that the questionnaire has an adequate degree of reliability and validity. Descriptive statistical analyses were carried out (minimum, maximum, mean and standard deviation of each of the variables). In addition, mean tests (Student t and single factor ANOVA) were applied for sex and group variables; and Pearson correlations between subscales.

3. Results

3.1. Opinions of Future Teachers on the Effect that the Training Program Based on the Flipped-Classroom and Gamification on Intrinsic and Extrinsic Motivation

Table 2 shows the means and standard deviations, as well as the minimum and maximum numbers of participants according to the group they belonged to for each of the variables referring to the perception of intrinsic and extrinsic motivation contemplated in the study.

Table 2. Descriptive statistics about to the perception of the different types of intrinsic motivation.

Type of Intrinsic Motivation	Group 1 (n = 44)			Group 2 (n = 54)			Group 3 (n = 60)			Group 4 (n = 52)		
	M (DT)	Min	Max									
Motivation related to methodologies used	4.75 (0.44)	4	5	4.28 (0.81)	1	5	4.55 (0.53)	3	5	4.52 (0.64)	3	5
Motivation related effort	4.64 (0.57)	3	5	4.33 (0.64)	3	5	4.50 (0.65)	2	5	4.37 (0.66)	3	5
Motivation related to teaching practice	4.73 (0.62)	2	5	4.39 (0.68)	3	5	4.47 (0.72)	2	5	4.15 (0.75)	3	5
Motivation to improve grades	4.66 (0.68)	2	5	4.31 (0.72)	3	5	4.40 (0.82)	1	5	4.06 (0.78)	2	5
Overall/Total intrinsic motivation	4.69 (0.46)			4.32 (0.58)			4.47 (0.55)			4.27 (0.53)		
Type of extrinsic motivation	M (DT)	Min	Max									
Classification/Score related	4.64 (0.49)	4	5	4.20 (0.93)	1	5	4.42 (0.70)	3	5	4.08 (0.73)	3	5
Prize related	4.52 (0.70)	3	5	4.15 (1.11)	1	5	4.22 (0.72)	3	5	4.19 (0.84)	2	5
Pass related	3.16 (1.31)	1	5	3.44 (1.27)	1	5	3.53 (1.15)	1	5	3.31 (1.16)	1	5
Overall/Total extrinsic motivation	4.10 (0.51)			3.93 (0.9)			4.05 (0.60)			3.86 (0.76)		

For intrinsic motivation, the scores obtained are very similar, from 4.15 to 4.75. As Table 2 shows, Group 1 has a greater perception than the others in all the types of intrinsic motivation studied. Within group, perception is greater in three of the four groups (1, 3 and 4) in the item “Motivation related to the methodologies used”, except for Group 2, which is greater in the item “Motivation related to teaching practice”.

In terms of extrinsic motivation, the perception of the participants is greatest in Group 1, except in the “Motivation to pass”, where the students of Group 3 present a superior perception. At the intra-group level, Groups 1, 2 and 3 have a higher perception in relation to classifications/scores, and Group 4 in relation to prizes. Finally, it should be noted that the lower perception in all groups is related to passing.

A single factor ANOVA was run to analyze whether the future teachers’ perceptions of their overall intrinsic motivation in relation to the Flipped-Classroom-based training program and Scoring differed statistically. The results showed statistically significant differences for Group 1 with respect to Groups 2 and 4. In the light of these results students in Group 1 have a higher perception of their intrinsic motivation.

Table 3 below shows the descriptive statistics for the perceptions of intrinsic motivation of the training course according to the sex of the participants, with females scoring higher than males.

Table 3. Descriptive statistics of the variable Intrinsic Motivation (overall score) by sex.

	Sex	n	Mean	SD
Perception Learning Overall	Male	53	16.96	0.29
	Female	157	18.00	0.18

We applied the Student t test for independent to see whether the overall perception of the intrinsic motivation of the participants differs according to sex. This test showed statistically significant differences between men and women in the overall score of perception of their intrinsic motivation, with females scoring higher [$t(208) = -2.976, p = 0.003$].

However, there are no statistically significant differences in their extrinsic perception according to the group or sex of the participants.

3.2. Perception of the Future Teachers on the Effect of Motivation of the Strategies and Technique Used in the Training Program Based on the Flipped-Classroom and Gamification

Table 4 shows the averages and standard deviations, and the minimums and maximums of the participants according to the group they belong to for each of the variables referring to the perception of the role of the strategies used in the program in their motivation. Between group, Group 1 values all the strategies used more positively for their motivation, except for “Whole group practical activities”, in which the students of Group 3 obtain a higher mean. Within group, the highest scores were obtained by Groups 1, 3 and 4 for the “Socratic Test” strategy and by Group 2 for the “Simulation of the Teaching Unit” strategy.

Table 4. Descriptive statistics on the perception of the role of the strategies used for motivation.

Strategy Used	Group 1			Group 2			Group 3			Group 4		
	(n = 43)			(n = 53)			(n = 60)			(n = 52)		
	M (SD)	Min	Max									
Flipped-classroom videos	4.32 (0.74)	3	5	3.98 (0.83)	1	5	4.23 (0.83)	2	5	4.29 (0.75)	2	5
Whole group practical activities	4.02 (0.79)	2	5	4.06 (0.90)	2	5	4.58 (0.72)	2	5	4.48 (0.80)	2	5
Socratic test	4.86 (0.35)	4	5	4.40 (0.60)	3	5	4.68 (0.60)	3	5	4.58 (0.82)	2	5
Points and badges (prizes)	4.50 (0.73)	2	5	4.07 (1.17)	1	5	4.17 (0.83)	2	5	4.17 (0.62)	3	5
Work in small groups	4.66 (0.57)	3	5	4.26 (0.91)	2	5	4.32 (0.79)	2	5	4.37 (0.97)	1	5
Simulation of the Teaching Unit	4.73 (0.50)	3	5	4.54 (0.71)	2	5	4.58 (0.56)	3	5	4.42 (1.01)	1	5
Total score	4.51 (0.42)			4.22 (0.49)			4.42 (0.47)			4.38 (0.47)		

A single factor ANOVA was run to test for the existence of statistically significant differences in the evaluation of the motivational strategies and techniques used by the teachers in the training program according to the groups formed. The results showed statistically significant differences for Group 1 with respect to Group 2.

Table 5, below, shows the descriptive statistics for the perceptions of the role of the various motivation strategies according to participants’ sex, with females scoring higher.

Table 5. Descriptive statistics of the role of the strategies used in motivation (overall score), by sex.

	Sex	n	Mean	SD
Perception Learning Overall	Male	52	25.23	2.73
	Female	157	26.65	2.84

The Student t test for independent samples were applied to analyze whether the overall perceptions of the role of different strategies motivation of participants differed statistically by gender. There were statistically significant differences between men and women [$t(207) = -3.170, p = 0.002$], indicating that females’ perceptions about the role that the different strategies have played in their motivation are higher than those of males.

3.3. Perceptions of the Future Teachers on the Learning Acquired in the Training Program Based in the Flipped-Classroom and Gamification

Table 6 shows the means and standard deviations, and the minimum and maximum of the participants according to the group to which they belong for each of the variables referring to the perception of learning in the training program and with the grouped items.

Table 6. Descriptive statistics of the perceptions of the learning acquired in the training program.

Item	Group 1			Group 2			Group 3			Group 4		
	(n = 44)			(n = 54)			(n = 60)			(n = 52)		
	M (SD)	Min	Max	M (SD)	Min	Max	M (SD)	Min	Max	M (ST)	Min	Max
Structure of the Teaching Unit	4.86 (0.35)	4	5	4.59 (0.66)	2	5	4.63 (0.55)	3	5	4.58 (0.60)	3	5
Activities and stages	4.91 (0.29)	4	5	4.57 (0.69)	2	5	4.67 (0.51)	3	5	4.63 (0.69)	2	5
Evaluation	4.75 (0.49)	3	5	4.48 (0.72)	2	5	4.52 (0.62)	2	5	4.48 (0.70)	2	5
Methodology	4.82 (0.49)	3	5	4.56 (0.60)	3	5	4.72 (0.49)	3	5	4.62 (0.56)	3	5
Total Score	4.83 (0.34)	3	5	4.55 (0.56)	2	5	4.63 (0.42)	2	5	4.57 (0.57)	2	5

The scores show a very positive evaluation of the learning received in the training program. All the items obtained a score of more than 4 out of 5, and all but one exceeded 4.5 (Group 4 valued its learning with 4.48). Overall, Group 1 valued its learning in the training program most positively while Group 2 rated it the lowest. Within group, Group 1 valued its learning more positively in all the variables. Between group, the perception is more positive in Groups 1 and 4 in “Activities and phases”; Group 2 students perceived better learning in “Structure of the Teaching Unit” and Group 3 in “Methodology”.

A single-factor ANOVA test was run to analyze whether the perceptions that future teachers had of the learning achieved in the training program based on flipped-classroom and gamification showed statistical differences. The results showed statistically significant differences for Group 1 with respect to the other ones.

Table 7 shows the descriptive statistics for the perceptions of the learning acquired in the training program according to the participants’ sex. The mean of the females was higher than that of the males.

Table 7. Descriptive statistics for the variable Learning (overall score) by sex.

	Sex	n	Mean	SD
Perception	male	52	4.43	0.49
Overall Learning	female	152	4.7	0.48

The Student t test for independent samples were applied to analyze whether the differences are significant. The results showed statistically significant differences between men and women in the overall perception score of their learning, with women scoring higher (Student t = 0.000) indicating that females perceived that they had learned more.

3.4. Opinions of the Future Teachers on the Strategies and Techniques Used in the Training Program Based on the Flipped-Classroom and Gamification

Table 8 shows the means and standard deviations and the minimum and maximum of the participants according to the group they belong to for each of the variables referring to the perception of the strategies used in the study and with the grouped variables. The scores show a very positive evaluation of the strategies used. All items were rated higher than 4 out of 5, and a large part higher than 4.5. At an overall level, Group 1 rated the strategies used in the training program most positively

and Group 2 the least. Between group, and differentiating each of the strategies and techniques, Group 1 values all the items more positively, except that of “Whole group practical activities”, where Group 3 obtains the highest mean, and “Videos for the flipped-classroom”, where the students in Group 4 obtained a slightly higher average. Within group, the highest scores were obtained by Groups 1 and 2 for the “Simulation” strategies, and by Groups 3 and 4 for the “Socratic Test” strategy.

Table 8. Descriptive statistics about in the variables referring to the evaluation of the strategies used.

Strategy Used	Group 1			Group 2			Group 3			Group 4		
	(n = 43)			(n = 53)			(n = 60)			(n = 52)		
	M (DT)	Min	Max									
Flipped-classroom videos	4.51 (0.77)	3	5	4.23 (0.70)	2	5	4.42 (0.72)	2	5	4.52 (0.65)	3	5
Whole-group practical activities	4.26 (0.79)	2	5	4.28 (0.72)	2	5	4.50 (0.65)	2	5	4.37 (1.01)	1	5
Socratic Test	4.72 (0.50)	3	5	4.38 (0.71)	3	5	4.57 (0.59)	3	5	4.54 (0.61)	3	5
Points and badges (prizes)	4.49 (0.67)	3	5	4.04 (1.24)	1	5	4.23 (0.81)	2	5	4.21 (0.80)	3	5
Work in small groups	4.56 (0.67)	3	5	4.21 (0.99)	1	5	4.45 (0.59)	3	5	4.40 (1.03)	1	5
Simulation of Teaching Unit	4.73 (0.59)	3	5	4.45 (0.69)	2	5	4.53 (0.62)	2	5	4.46 (0.98)	1	5
Strategy used Total	4.52 (0.46)	2	5	4.26 (0.56)	1	5	4.45 (0.46)	2	5	4.47 (0.54)	1	5

A single factor ANOVA was run to study the existence of statistically significant differences. The mean differences found between the four groups were not statistically significant.

The table below (Table 9) presents the differentiated descriptions of the two strategies/techniques associated with the flipped-classroom (videos and activities in the large group class) and gamification (Socratic test and scores/badges). It can be seen that Group 1 values the gamification strategies (Socratic test and scores and badges) substantially more positively than the other groups. However, Group 1 does not value the techniques associated with flipped-classroom as positively as Groups 3 and 4.

Table 9. Descriptive statistics for the variables referring to the evaluation of the two techniques used.

Strategy Used	Group 1			Group 2			Group 3			Group 4		
	(n = 43)			(n = 53)			(n = 60)			(n = 52)		
	M (SD)	Min	Max									
Flipped-classroom videos / Whole-group practical activities	4.38 (0.72)	2	5	4.25 (0.60)	2	5	4.45 (0.64)	3	5	4.51 (0.60)	2	5
Socratic Test/ score and badges	4.6 (0.51)	3	5	4.21 (0.36)	2	5	4.40 (0.62)	3	5	4.38 (0.60)	3	5

A single factor ANOVA was run to study the existence of statistically significant differences in the evaluation of the strategies and techniques associated with the flipped-classroom or gamification. The results showed statistically significant differences for both the flipped-classroom variable (between Groups 3 and 4 with respect to Group 2) and for the Gamification variable (between Group 1 with respect to Groups 2 and 4) (See Table 10).

Table 11, below, shows the descriptive statistics for the evaluation of the strategies and techniques associated to the flipped-classroom and gamification according to the participants’ sex. Females scored higher than males in both types of strategy.

The student t test for independent samples was applied to analyze whether the sex differences were statistically significant. The results showed statistically significant differences in the perception of the Flipped-Classroom in favor of women [t (207) = -2.172, p = 0.031], and also in their perception of Gamification [t (76.04) = -3.070, p = 0.003].

Table 10. ANOVA and post hoc tests: comparisons for the perceptions of the flipped-classroom and gamification strategies.

ANOVA FLIPPED-CLASSROOM					POST HOC (Dunnett's T3)
	Suma de Cuadrados	gl	F	Sig.	
Between groups	22.469	3	4.591	0.004	3 > 2 4 > 2
Within groups	336.026	206			
Total	358.495	209			
ANOVA GAMIFICATION					POST HOC (Dunnett's T3)
	Sum of squares	gl	F	Sig.	
Between groups	20.425	3	4.704	0.003	1 > 2 1 > 4
Within groups	296.714	205			
Total	317.139	208			

Table 11. Descriptive statistics for the variable Strategies and techniques (overall score) by sex.

	Sex	n	Mean	SD
Flipped Global	male	53	8.17	1.31
	female	157	8.61	1.29
Gamification Global	male	52	8.34	1.37
	female	157	8.99	1.15

As is seen in Table 12, there are significant moderate and positive correlations between the assessment that future teachers made of the strategies and techniques with the assessment they made of the intrinsic and extrinsic motivation in the training program, i.e., there was a positive effect of these strategies on the students' motivation.

Table 12. Correlations between the variables of the sub-scales with respect to motivation (strategies, intrinsic and extrinsic).

		Motivation Strategies	Intrinsic Motivation	Extrinsic Motivation
Motivation Strategies	Pearson's Correlation <i>p</i> -value N	1		
Intrinsic Motivation	Pearson's Correlation <i>p</i> -value N	0.587 ** 0.000 209	1	
Extrinsic Motivation	Pearson's Correlation <i>p</i> -value N	0.475 ** 0.000 208	0.425 ** 0.000 209	1

** Correlation significant at 0.01 (bilateral).

4. Discussion and Conclusions

This article addresses the data obtained from the questionnaire "Evaluation of the training program based on gamification and flipped-classroom". Descriptive statistics has showed a very positive evaluation of the program, both in motivation and perception of learning. Regarding the data on the reliability of the instrument used in this study, it should be noted that they are adequate and similar to those obtained in other studies [66]. The dispersion of the responses to the items is

acceptable. Stressing that in all the items there are subjects who have scored between level 3 and 5 of the Likert scale. In addition, in terms of means of the items, the values are located at the top of the scale around the value 4.

According to the data, and as in other studies [20,67,68], the students had a very positive overall opinion on the effects on the motivation, both extrinsic and intrinsic, of the training program. Noteworthy is the higher score given to intrinsic motivation, especially that related to the various teaching strategies used by the teachers, over the extrinsic one, where the mere fact of passing was scored lower, a noteworthy matter in itself.

As other research shows [38,69–71], the opinion expressed by students on the impact of different strategies and techniques on motivation offers very good and similar results in all the groups, with the Socratic test being the best valued technique and the flipped-classroom videos the least, although there are differences between the different groups when evaluating the different strategies.

With regard to the perception of learning, the results are also very positive, and the perceptions expressed by the students are in line with other research on the use of gamification and flipped-classroom [68,72].

Finally, the students expressed a very positive opinion of the strategies and techniques used in the training program. Increased participation, greater autonomy and the ability to tackle different learning styles [35–37,73], as well as better commitment towards the learning [20,74,75] are some of the factors explaining this favorable assessment.

The statistically significant differences found in all areas of the study with regard to sex and Group 1 should be highlighted. In the first case, girls perceived a greater effect of the program on motivation than boys, just as they thought they had learned more and that they valued the strategies employed more positively than their male peers. There is a wealth of literature on differences in the perception of the use of technology and digital literacy according to gender [76,77]. In this training program, in which ICTs played an important role, the girls showed a better perception of learning and a greater appreciation of the program, as we have just mentioned. Our results differ from a large part of the studies, which indicate notable differences in the use and usefulness of ICT [78]. We interpret the women's more positive opinion of the program and the techniques more in relation to their innovative potential than to the use of ICT as instruments. Therefore, the supposed gender digital divide [79] must be taken with extreme caution, and the results from different conceptions of what innovation means should be analyzed [80].

The differences of Group 1 have an explanation in the greater evaluation of the techniques and strategies linked to gamification. These techniques are related to the increase in student motivation [12]. The data seem to indicate that this motivation generally reflected a greater self-perception of learning.

We are, in general, in a position to affirm that the implementation of the training program based on gamification and flipped-classroom had a positive effect on the motivation and perceptions of learning of the students. All the psychometric data of the questionnaire obtained through this exploratory study show that the results are based on a valid and reliable scale to study these assessments of teachers in training. But not all published experiences of this type reflect these good results [19,37]. Indeed, from the conclusions of these experiences, we interpret that the satisfactory data obtained in our research are due to the fact that the students were informed from the very first day of the working method [36] and its acceptance could be counted on once the educational objectives associated with the program had been established. The learners were involved in the learning process by watching the videos in order to come prepared to the classroom. At the same time as the dynamics of the flipped-classroom and gamification, we also were able to draw on the cooperative work to establish learning and internal motivation [12].

Nevertheless, we need to continue to go more deeply into the elements with lower values within the program in order to improve them and achieve greater acceptance and motivation in the students, although the most important thing in new experiences will be to contrast the opinions of the students

with real learning results to ascertain true scope of the training program based on the flipped-classroom and gamification.

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