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Innovating in Nutrition Education: Application of Gamification and Digital Resources in High School Students

Innovando en educación nutricional: Aplicación de la gamificación y recursos digitales en estudiantes de secundaria

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Abstract. Teachers have to use technology and active methodologies as fundamental tools for teaching basic nutrition issues. The objective of this research was to analyze the potential of a training plan on nutritional education carried out using both educational technology and a gamified methodology. For this, a quasi-experimental design was used in a sample of 237 Spanish students of the third level of Secondary Education. After the training experience on teaching was carried out, data were collected with a questionnaire. The results showed that the teaching of nutritional education through gamification fosters motivation, the relationship among students, autonomy, time perception during classes, and the improvement of marks. It can be concluded that gamification is an effective teaching method for nutritional education for Compulsory Secondary Education students.
Keywords: education; digital resources; gamification; innovation; learning; methodology; nutrition; physical education; students.

Resumen. Los docentes deben utilizar la tecnología y las metodologías activas como herramientas fundamentales para la enseñanza de temas básicos de nutrición. El objetivo de esta investigación fue analizar el potencial de un plan de formación en educación nutricional realizado tanto con tecnología educativa como con una metodología gamificada. Para ello, se utilizó un diseño cuasi-experimental en una muestra de 237 alumnos españoles de tercer nivel de Educación Secundaria. Una vez realizada la experiencia formativa en docencia, se recogieron datos con un cuestionario. Los resultados mostraron que la enseñanza de la educación nutricional a través de la gamificación fomenta la motivación, la relación entre los estudiantes, la autonomía, la percepción del tiempo durante las clases y la mejora de las notas. Se puede concluir que la gamificación es un método de enseñanza eficaz para la educación nutricional de los estudiantes de Educación Secundaria Obligatoria.
Palabras claves: educación; recursos digitales; gamificación; innovación; aprendizaje; metodología; nutrición; educación física; estudiantes.

Introduction

Nowadays, educational technology provides an alternative for continuous or permanent learning and updating of critical knowledge within every field (López-Belmonte, Moreno-Guerrero, López-Núñez & Hinojo-Lucena, 2020). Nutritional education can make use of this technology as it is crucial for students to take nutritional education, and they can be motivated to increase skills and improve nutrition practices if they use technology to manage knowledge. Management of nutrition data aims at recording the acceptable high standards, processes, and technology that guarantees the quality provision of services. It is essential to know what we eat (de Moraes-Martins, Drumond-Tavares, de Araújo-Ribeiro, do Perpétuo-Socorro, & dos Santos, 2018).

Within this scenario, the number of new pedagogical methodologies has experienced exponential growth in recent years, partly thanks to the introduction of new technologies within the educational system (Parra-González, Segura-Robles, Vicente-Bújez & López-Belmonte, 2020). Technology-based education increases participation and collaboration in the classroom and out of it, as students can easily write comments online or chat with their classmates (Chis et al, 2018). The adoption of such education technology can increase the effectiveness of a training methodology and positively influence student motivation (Moreno-Guerrero, Soler-Costa, Marín-Marín & López-Belmonte, 2021).

Technology-based learning is defined as the use of the internet with a computer or technology-related devices to produce, disseminate, and supply learning materials and regulate course content. Therefore, many schools have implemented technologies to enhance the

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teaching and learning processes (Ortega, Hameleers, Trujillo-Torres & Moreno-Guerrero, 2020). Teachers can adopt technological strategies to disseminate curricula and guarantee students' access to materials from various disciplines through digital resources.

Students respond positively to nutrition and dietetics programs that incorporate active learning methodologies that routinely cover course content, particularly in the study of nutrition and dietetics (Marín-Marín, Soler-Costa, Moreno-Guerrero & López-Belmonte, 2020). Gamification is one of the approaches that increases students' motivation, as they interact with the contents and contexts in a joyful manner (Lamoneda Prieto, González-Víllora & Fernández-Río, 2020). Gamification is the design of interactive games that integrate course content, instruction, and training materials that make learning more enjoyable (Van Roy et al., 2018). Gamification aims at increasing imagination, engagement, and interactive activities of students when interacting with course information (Fuentes-Cabrera, Parra-González, López Belmonte, & Segura-Robles, 2020; Parra-Gonzalez, Segura-Robles, & Gómez-Barajas, 2020).

This kind of methodology capitalizes on information seeking and the motivation to play a game to design incentive systems that add value to nutritional education (Gómez-García, Marín-Marín, Romero-Rodríguez, Ramos Navas-Parejo & Rodríguez Jiménez, 2020). Gamification can increase students' meaningful ways of creating positive connections during playtime and creative interactions. A study found that gamification encourages student participation in competitive activities and increases rates of engagement with instructional content (Andrade, Mizoguchi, & Isotani, 2016; Çeker & Özdaml, 2017).

Nutritional knowledge is a challenging task for teachers who must depend on traditional approaches to provide nutrition guidelines, as it is essential to teach and learn healthy routines and habits (Ponce Blandon, Molina, Martin, & Campos, 2017). Students can increase competence and other skills in dealing with nutritional education through an active motivational process.

Recent research reveals that educational technology has a positive impact on instructional processes. Thus, there has been a large volume of digital applications created to stimulate training action (Romero-Rodríguez, Aznar-Díaz, Marín-Marín, Soler-Costa & Rodríguez-Jiménez, 2020), as well as active and emerging methodologies such as gamification. All this leads to a substantial improvement in different academic factors, such as motivation, interaction among members of the educational community, and attitudinal aspects. Furthermore, all these potentialities are reflected in an improvement in student performance and, consequently, in an increase of student ratings (Van Roy et al., 2018; Fuentes-Cabrera et al., 2020; Hinojo, Aznar Díaz, Romero Rodríguez, & Marín, 2019; Hinojo-Lucena, López-Belmonte, Fuentes-Cabrera, Trujillo-Torres, & Pozo-Sánchez, 2020). Regarding the ratings, these refer to the results obtained by the students themselves in the subject, which were used to analyze the influence of the pedagogical method applied across different dimensions.

Materials and Methods

Study objective and research questions

The objective of this research was to analyze the potential of a training plan on nutritional education using digital resources compared to training based on gamification as a teaching and learning methodology. From this general objective, the following research questions (RQs) were specified:

- RQ1: How does the educational technology or training methodology used influence student motivation?
- RQ2: How does the educational technology or training methodology used influence the interaction between the students and the teacher?
- RQ3: How does the educational technology or training methodology used influence the interaction of the students with the didactic contents?
- RQ4: How does the educational technology or training methodology used influence the interaction between students?
- RQ5: How does the educational technology or training methodology used influence the autonomy of the students?
- RQ6: How does the educational technology or training methodology used influence the collaboration of the students?
- RQ7: How does the educational technology or training methodology used influence the level of deepening of the content?
- RQ8: How does the educational technology or training methodology used influence the degree of problem solving of the students?
- RQ9: How does the educational technology or training methodology used by the students influence class time?
- RQ10: How does the educational technology or

training methodology used influence the ratings obtained by the students?

Research design and data analysis

A quasi-experimental design was utilized to answer the research questions. For research efficiency, educational technology and gamified experience offered by experts in this type of analysis were followed (Hernández-Sampieri, Fernández-Collado, Baptista-Lucio, Méndez-Valencia, & Mendoza-Torres, 2014; Rodriguez, 2011). Many current studies have used the same research design (Hinojo-Lucena et al., 2020; López-Belmonte, Fuentes-Cabrera, López-Nuñez, & Pozo-Sanchez, 2019; Lopez-Núñez, López-Belmonte, Moreno-Guerrero, & Pozo-Sanchez, 2020; Moreno-Guerrero, Romero-Rodríguez, López-Belmonte, & Alonso-García, 2020; Moreno-Guerrero, Rondón-García, Martínez-Heredia, & Rodríguez-García, 2020), demonstrating that it is a research model which has been accepted and validated by the scientific community.

Two groups of analysis, one with «using digital material» (UDM) and the other with «gamification» (GAM), were set up to carry out the study. The UDM group used various digital applications for the work on the selected contents related to nutritional education. The GAM group employed a training action on such content using a gamified methodology. This research design had two types of variables. The independent variable is linked with the type of training methodology used and the dependent variable with the different dimensions studied in this study. In this instructional experimentation, a single measurement was carried out that took place at the end of the training process (Post-test). Carrying out this type of study is relevant to compare the findings between the established analysis groups, since each one carried out a different learning method. All this with the purpose of verifying which one has obtained the best results after the application.

The statistical treatment of the data was performed using the Statistical Package for the Social Sciences (SPSS) v25 (IBM Corp., Armonk, NY, USA). Statistics such as mean (M) and standard deviation (SD) were used. The distribution trend was determined by skewness (Skw) and kurtosis (Kme) tests. The comparison between the means of both groups was carried out with Student's *t* test ($t_{n1+n2-2}$). In addition, the size of the effect caused was verified with Cohen's d and biserial correlation (rxy). In all data analyses, $p < 0.05$ was selected to determine statistically significant differences.

Participants

By means of intentional sampling, a sample of 237 Spanish students of the third level of Secondary Education was recruited. This sample has been used due to the ease of access to the sample of subjects. It has been verified that the sample size for this type of training experiment does not bias the results of the research; therefore, the number of participants did not establish any limitation for the development of this study (Chou & Feng, 2019; Y1lmaz & Soyer, 2018).

Of these students, 43% were men and the rest were women, and they had an average age of 15 years (SD = 1.57). These students were assigned to two study groups (UDM and GAM). The treatment in question (educational technology and gamified methodology) was established in a probabilistic way in the configured groups. That is, in order not to cause bias, the study group was assigned to the type of treatment (training intervention) at random (Table 1).

Table 1.
Composition of the groups.

Group	n	Composition	Pretest	Treatment	Post-test
1- UDM	118	Natural	-	X	O_1
2- GAM	119	Natural	-	X	O_2

Study dimensions

The dimensions analyzed were chosen from recent studies reported in the impact literature in the field of education that have analyzed the influence of various factors on the teaching and learning process at different levels, contexts, and didactic contents (Hinojo-Lucena et al., 2020; López-Belmonte et al., 2019; López-Núñez et al., 2020; Moreno-Guerrero et al., 2020). The dimensions used in this study are presented and defined below for the purpose of facilitating the understanding and interpretation of the results.

- Social–educational: These are aspects related to sex, age, city, nationality, religion, students' course, as well as aspects related to the training methodology and technological resources used.
- Motivation: refers to the level of motivation of the students during the training process.
- Interactions: refers to the different interactions of the students (with the teacher, with the contents, and between the different students) derived from the teaching–learning process.
- Autonomy: refers to the level of self-government achieved by the students during the training activity carried out.
- Collaboration: refers to the collaboration and teamwork reflected by the students in the different

learning tasks designed by the teacher.

· Deepening: refers to the projection level reached by the content which was worked on during the learning process according to the type of training used.

· Problem resolution: refers to the ability of students to solve problems arising from the training process or raised by the teacher during the teaching and learning process of the content.

· Class time: refers to the temporary use of the different training sessions developed that made up the didactic unit prepared.

· Ratings: refers to the final mark that students obtained on the evaluation test carried out to check the degree of assimilation of the content taught.

Instrument

An ad hoc questionnaire was used to collect data regarding the different dimensions analyzed. This tool was made from other validated instruments chosen from the impact literature (Hinojo-Lucena et al., 2020; Pozo-Sanchez, López Belmonte, Moreno-Guerrero, & Lopez-Nuñez, 2019; Santiago & Bergmann, 2018; Sauro & Lewis, 2016; Testa & Simonson, 2017).

The different dimensions presented above were captured in 35 items (Social–educational = 10 items; Motivation = 3 items; Interactions = 7 items; Autonomy = 3 items; Collaboration = 2 items; Deepening = 3 items; Problem resolution = 3 items; Class time = 2 items; Ratings = 2 items). These questions mostly followed a 4-point Likert scale, with 1 being the most negative value and 4 the most positive.

The questionnaire was qualitatively validated using the Delphi method. Eight judges, experts in this field of knowledge, were chosen to carry out a review of the instrument and offer feedback to help optimize the tool. The opinion of these specialists was positive (M = 4.13; SD = 0.21; min = 1; max = 6) and their comments focused on modifying the lexicon used in certain items so as not to cause comprehension problems for the students. Fleiss (K) and W by Kendall (W) complemented this qualitative method with Kappa tests in order to determine the level of agreement and relevance of the judgments provided by the experts. The results of such tests were satisfactory and adequate, revealing adequate feedback from the judges (K = 0.82; W = 0.84).

Quantitatively, the questionnaire was validated by means of an exploratory factor analysis following the principal components method. Statistics such as Bartlett's sphericity test of determined dependence between the study variables (2271.62; $p < 0.001$) and the Kaiser–Meyer–Olkin test revealed the satisfactory adequacy of the sample (KMO = 0.85).

To assess the internal reliability of the questionnaire, various statistics were used such as Cronbach's alpha (á) (0.84), compound reliability (0.83), and average variance extracted (0.81); the results of which demonstrated the adequate internal consistency of the different established constructs.

Procedure

Once the study subjects were selected, the analysis groups were set up. The students' group type membership was assigned randomly; that is, the students could not choose the type of analysis group to which to belong. This setup was done by the researchers. At all times, the assignment of the students to their class group was respected. The students did not change their group of belonging in the educational center so as not to affect relationships with classmates and to produce biases in the results. The intervention was carried out in the Physical Education subject. The UDM group carried out a learning program on nutritional education through digital applications. The contents were developed and worked on through educational technology. With this didactic approach, the students worked on the content using mobile applications installed on the tablets of the educational center. Students interacted with the digital resources provided to receive the instructional action. The GAM group developed the process of imparting and learning the dietary education content through the gamification of the sessions. To do this, the students carried out several actions and dynamics based on games, challenges, and team tests to work on the content.

Both groups followed the same didactic unit made up of six 1 h sessions. The only difference between the groups of students was the way in which the different formative instruction actions were carried out. A

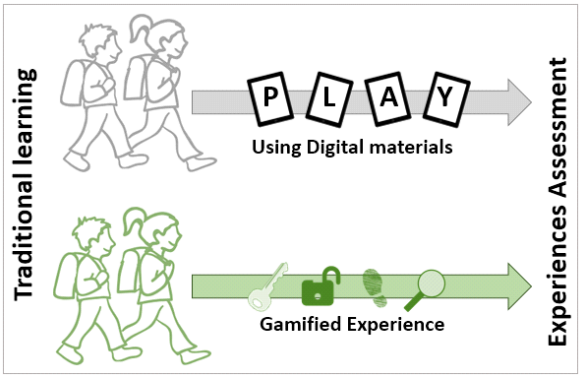

Figure 1. Two experiences used in class.

professional expert in nutrition and dietetics who had specific training in educational innovation taught the sessions in both study groups. The contents worked on in the different sessions were as follows: healthy lifestyles, balanced diet, healthy foods, and nutritional guidelines. The UDM group students received the training actions separately from the GAM group students. Each group was in a different learning space, to avoid any type of contamination (figure 1).

After the development of the didactic unit, the data collection process took place with the application of the questionnaire, which was completed by the students.

Results

The results obtained in the development of the statistical techniques applied in this research are presented below. Beginning with the descriptive analysis (Table 2), it was observed that the averages reached by both the UDM and GAM groups were in the range of 2.5, which shows that both groups offered good evaluations in relation to the educational experiences developed. Even so, the averages reached by the GAM group were slightly higher than those of the UDM group were.

Table 2.
Results obtained for the study dimensions in the UDM and GAM groups.

		Likert Scale *n* (%)				Parameters			
	Dimensions	None	Few	Enough	Completely	M	SD	S_{me}	K_{me}
UDM group	Motivation	17(14.4)	29(24.6)	56(47.5)	16(13.6)	2.60	.898	-.347	-.609
	Teacher–student	19(16.1)	29(24.6)	58(49.2)	12(10.2)	2.53	.884	-.369	-.634
	Student–content	20(16.9)	31(26.3)	57(48.3)	10(8.5)	2.48	.874	-.337	-.686
	Student–student	21(17.8)	27(22.9)	58(49.2)	12(10.2)	2.52	.903	-.370	-.723
	Autonomy	19(16.1)	32(27.1)	58(49.2)	9(7.6)	2.48	.855	-.364	-.626
	Collaboration	22(18.6)	25(21.2)	63(53.4)	8(6.8)	2.48	.874	-.493	-.699
	Deepening	21(17.8)	28(23.7)	57(48.3)	12(10.2)	2.51	.903	-.344	-.738
	Resolution	20(16.9)	26(22)	61(51.7)	11(9.3)	2.53	.884	-.445	-.622
	Class time	22(18.6)	26(22)	60(50.8)	10(8.5)	2.49	.894	-.412	-.737
	Ratings[a]	21(17.8)	24(20.3)	56(47.5)	17(14.4)	2.58	.946	-.372	-.772
GAM group	Motivation	5(4.2)	37(31.1)	37(31.1)	40(33.6)	2.94	.905	-.232	-1.07
	Teacher–student	15(12.6)	34(28.6)	41(34.5)	29(24.4)	2.71	.977	-.208	-.956
	Student–content	14(11.8)	37(31.1)	42(35.3)	26(21.8)	2.67	.949	-.145	-.895
	Student–student	7(5.9)	37(31.1)	36(30.3)	39(32.8)	2.90	.933	-.242	-1.05
	Autonomy	8(6.7)	31(26.1)	46(38.7)	34(28.6)	2.89	.900	-.349	-.723
	Collaboration	6(5)	33(27.7)	44(37)	36(30.3)	2.92	.885	-.299	-.826
	Deepening	17(14.3)	32(26.9)	43(36.1)	27(22.7)	2.67	.984	-.222	-.947
	Resolution	18(15.1)	29(24.4)	44(37)	28(23.5)	2.69	.998	-.276	-.954
	Class time	7(5.9)	29(24.4)	49(41.2)	34(28.6)	2.92	.875	-.392	-.602
	Ratings[a]	6(5)	33(27.7)	41(34.5)	39(32.8)	2.95	.901	-.325	-.895

Note: M (Media); SD (Standard Deviation); S_{kw} (Skewness); K_{me} (Kurtosis). [a] Established grade group (None: 1-4.9; Few: 5-5.9; Enough: 6-8.9; Completely: 9-10). Scale made from [20,24-26].

Taking into account the data from the asymmetry and curt tests, the values presented a normal distribution, if we consider what Jöreskog (2001) established, given that the values were between -1.96 and +1.96. The standard deviation showed a trend of equal response, which was observed in all the dimensions analyzed. Kurtosis was platykurtic in all dimensions analyzed. In this case, the data provided by skewness, kurtosis and standard deviation confirm that parametric tests can be applied in this study.

The comparison of means showed higher means in all dimensions of the GAM group in relation to the UDM group. The great difference in means between the dimensions of motivation, student–student, autonomy, collaboration, class time, and rating stood out, being the dimensions with more valuation by the GAM group. In the UDM group, all the dimensions showed trends of even responses (Figure 2).

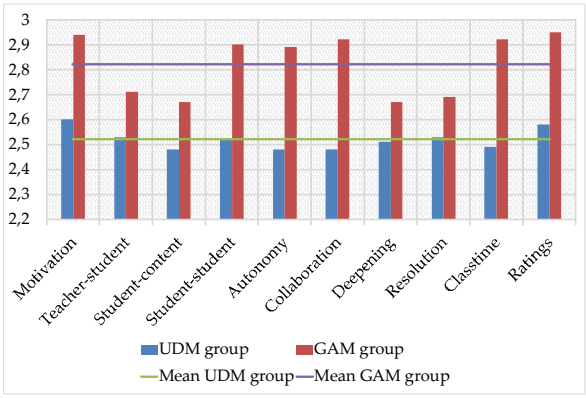

Figure 2. Comparison between UDM and GAM groups.

To determine the value of the independence of data collected between a didactic approach based on the use of educational technology and a didactic approach based on the use of a gamified methodology, Student's *t* test ($t_{n1+n2-2}$) for independent samples was applied. The results showed that there were very significant differences ($p < 0.05$) in the dimensions of motivation, student–student, autonomy, collaboration, class time, and rating between the groups analyzed.

In the rest of the dimensions (teacher–student, student–content, deepening, and resolution), there was no relationship of significance. In the cases where there was a relationship, the force of association, according to the statistics of the biserial correlation test, was average in the dimensions of student–student, autonomy, and collaboration. On the other hand, in the dimensions of motivation and ratings, it was low. The size of the effect, as indicated by Cohen's d, was small in all cases (Table 3). In this case,

Table 3.
Study of the value of independence between the UDM and GAM groups.

Dimensions	$\mu(M_c\text{-}M_c)$	$t_{n1+n2-2}$	df	*d*	r_{xy}
Motivation	-.339(2.60-2.94)	-2.900**	235	.051	.186
Teacher–student	-.172(2.53-2.71)	n.s.	235	.024	.092
Student–content	-.189(2.48-2.67)	n.s.	235	.032	.104
Student–student	-.382(2.52-2.90)	-3.203**	235	.062	.205
Autonomy	-.408(2.48-2.89)	-3.575**	235	.026	.227
Collaboration	-.441(2.48-2.92)	-3.862**	235	.062	.244
Deepening	-.164(2.51-2.67)	n.s.	235	.021	.087
Resolution	-.155(2.53-2.69)	n.s.	235	.013	.082
Class time	-.433(2.49-2.92)	-3.767**	235	.046	.239
Ratings[a]	-.365(2.58-2.95)	-3.041**	235	.061	.195

**. The correlation is significant at the 0.01 level. *. Correlation is significant at level 0.05. n.s.: Not significant. [a]. Established grade group (None: 1-4.9; Few: 5-5.9; Enough: 6-8.9; Completely: 9-10).

it can be indicated that there are significant differences when applying one pedagogical method or another according to the dimensions analyzed in this study.

Discussion

Among the dimensions that showed a positive effect on students, motivation stands out. This result is consistent with the literature, in which motivation is one of the aspects that increases most significantly when a classroom is involved in a gamified experience (Buckley & Doyle, 2016). In addition, we also found research that shows the power of simple digital resources to increase student motivation (Dehghani, 2018; Churchill, 2017; Trust, 2017).

In other way, as determined by previous studies, an advantage of gamification over digital resources is the ability it has to increase the marks obtained by students. Gamification seems to produce significant effects on the results obtained in a subject. Different studies show the ability of these methodologies to produce mental or attitudinal changes that are reflected in student performance (Mekler, Brühlmann, Tuch, & Opwis, 2017). However, these effects usually occur only in the early stages and not when the experience is repeated or lengthened over time (Attali & Arieli-Attali, 2015).

Interaction and social learning are other processes in which gamification plays a fundamental role (Leite, Cetin-Berber, Huggins-Manley, Collier, & Beal, 2019) with respect to other types of methodologies or tools. In our case, it was in gamification where this interaction stood out when it occurred between students; it can even be considered as intrinsic to the definition. Not being relevant, in this the effects produced between teacher–students or between students–contents are involved. Despite this, we cannot ignore the importance of teachers in the use of different game mechanics and how their guidance is essential to provoke real commitment from the students (Papadakis, 2018).

When talking about interaction, we cannot forget collaboration and how new technologies can favor any educational process (Erkens & Bodemer, 2019). In this case, the positive results of interaction in the gamified process stands out. This type of design has demonstrated its usefulness in obtaining collaborative networks and social networks of work among students (Meske, Brockmann, Wilms, & Stieglitz, 2017; Wiethof, Tavanapour, & Bittner, 2021).

Similarly, it seems logical that gamification is directly associated with increased autonomy. These types of designs encourage creation and autonomous learning through the creation of their avatars, the design and elaboration of their tasks, and the products obtained (Xi & Hamari, 2019; Llorens-Largo et al., 2016). Although the use of digital resources can also cause this effect compared with traditional models, this difference may be due to the limited contextualization that these materials possess.

In traditional teaching processes, bad class time organization is a problem for most students, triggering boredom or distractions (Neiterman & Zaza, 2019; Lo & Hew, 2018). This does not happen when the learning experience is fully gamified (Azmi, Iahad, & Ahmad, 2016), as can been seen from our results. Finally, regarding the deepening and resolution of the students, no significant differences were found between the two educational tools. The improvement of problem solving does not appear to be a unique feature of this type of strategy (Zainuddin, Chu, Shujahat, & Perera, 2020). It seems that it has a greater capacity to satisfy psychological needs (Buil, Catalán, & Martínez, 2020) rather than to cause an increase in content acquisition.

Conclusions

This research helps to highlight several benefits of training actions in the teaching and learning processes.

Within this research, it has been shown that this educational approach - and more precisely, gamification - has positive effects on student motivation. Gamification seems to have significant effects on the results or academic performance of students, who obtain higher academic performance with this educational approach compared to the other pedagogical approach.

With this methodology, interaction and social learning also presents high values, but not significantly when compared to the other group. Therefore, it is important that teachers, when using gamification in the teaching process, keep in mind that their guidance is essential to foster real student engagement and participation.

Apart from interaction, collaboration is also important, and technologies can support it during the learning process. The design of this methodology has proven to be very useful in provoking collaborative networks and social work among students.

In addition, gamification promotes creativity and autonomous learning through the creation of avatars, as well as the design, development and implementation of their activities and products.

For all these reasons, gamification seems to be an active methodology that improves teaching and learning processes because of the benefits it brings. As such, this research can help to encourage the use of gamification to improve the education of both teachers and students.

The main limitation of this study was the digital competence of a few teachers. It is difficult to test new methodologies or resources when teachers are not sufficiently trained. Specific context can be a limitation too. On the other hand, the digital resources used did not always work as expected, as they had operational problems at certain times. As a proposal for future research, it would be interesting to expand the number of resources to be compared. Some proposals are educational escape rooms, blended learning, and augmented reality tools which can be applied in other contexts.

Practical and theorical implications

This research provides relevant information to the scientific literature related to nutrition education and more precisely on the application of Gamification through digital resources for students at high school. First of all, this study shows many relevant theoretical contributions by gamification application.

Then, with regards to the practical implications, this research shows the benefits of applying gamification with nutritional education. This can be very useful to teachers and proffesors when teaching nutrition, and even for scientists worldwide, as it is a quite recent way of applying active methodologies in this area of education and the benefits have been widely proved.

As future lines of research, authors think it would be interesting to apply other active methodologies on nutrition education as for example flipped learning or problem-based learning to analyze the impacts they may have on this area.

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