ALTERIDAD
REVISTA DE EDUCACIÓN
p-ISSN:1390-325X / e-ISSN:1390-8642
http://alteridad.ups.edu.ec

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january-june 2022
Vol. 17, No. 1,49-61
https://doi.org/10.17163/alt.v17n1.2022.04

Perception of gamification strategies in Italian secondary school

Percepción de las estrategias de gamificación en las escuelas secundarias italianas

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Received on: 2021-10-20 / **Revised on:** 2021-11-26 / **Accepted on:** 2021-12-13 / **Published on:** 2022-01-01

Abstract

Gamification is projected as a challenge for innovation in educational contexts. In recent years, ga-mified didactic proposals have been developed to support the acquisition of the curricular contents of the subjects. This research aims to make a diagnosis of the level of application of gamification as a didactic strategy in the area of mathematics, based on the perception of teachers and students of se-condary schools in Italy. A multi-case study is chosen, which combines quantitative and qualitative techniques, with an exploratory-correlational scope. The data was collected through the questionnai-re, completed by 4,845 students, and in-depth interviews with 12 teachers. It was found that the stu-dents hardly perceived the use of games, analogue or digital, by the teaching staff. The teachers indi-cate that they have knowledge of games to facilitate the learning of mathematical concepts. Students do not perceive that gamification didactic strategies are applied consciously. The teaching team claims to use incentives, prizes, and rewards. At the same time, they claim to have little knowledge about gamification and its possibilities. Gamification is attractive as a didactic approach to teaching mathematics. In this sense, the need to offer solid training that establishes the foundations of the ga-me, gamification and the opportunities it offers for the design of learning experiences and game sce-narios is highlighted.

Keywords: Gamification, didactic strategies, teaching math, secondary education, learning processes, teaching methods.

Resumen

La gamificación se proyecta como un desafío para la innovación en los contextos educativos. En los últimos años se han desarrollado propuestas didácticas gamificadas para apoyar la adquisición de los contenidos curriculares de las asignaturas. Esta investigación pretende realizar un diagnóstico del nivel de aplicación de la gamificación como estrategia didáctica en el área de matemáticas, a partir de la per-cepción del profesorado y alumnado de las escuelas secundarias de Italia. Se opta por un estudio mul-ticaso, que combina técnicas cuantitativas y cualitativas, de alcance exploratorio-correlacional. Los datos se recogieron a través del cuestionario, cumplimentado por 4845 estudiantes, y de entrevistas en profundidad a 12 profesores. Se encontró que el alumnado apenas percibe el uso de juegos, analógi-cos o digitales, por parte del profesorado. El profesorado señala tener un conocimiento sobre juegos para facilitar el aprendizaje de los conceptos matemáticos. El alumnado no aprecia que se apliquen estrategias didácticas de gamificación conscientemente. El equipo docente afirma usar incentivos, pre-mios y recompensas. Al mismo tiempo, manifiestan tener un escaso conocimiento sobre la gamifica-ción y sus posibilidades. La gamificación resulta atractiva como planteamiento didáctico para la ense-ñanza de las matemáticas. En este sentido, es evidente la necesidad de ofrecer una formación sólida que siente las bases del juego, de la gamificación y las oportunidades que ofrece para el diseño de ex-periencias de aprendizaje y escenarios de juego.

Descriptores: Gamificación, estrategias didácticas, enseñanza de las matemáticas, educación secundaria, proceso de aprendizaje, método de enseñanza.

Suggested citation: Malvasi, V., & Recio-Moreno, D. (2022). Perception of gamification strategies in Italian secondary school. *Alteridad, 17*(1), 49-61. https://doi.org/10.17163/alt.v17n1.2022.04

1. Introduction and state-of-the-art

Over the last few years, gamification has projected in different contexts such as advertising and marketing (Huotari & Hamari, 2012; Landers et al., 2017; Zichermann & Linder, 2013), health (González et al., 2016; Hamari & Koivisto, 2015) or education (Domínguez et al., 2013; Qahri-Saremi & Turel, 2016; Villagra-Arnedo et al. 2016). This panorama generated by the growing production of scientific literature in these contexts (Contreras & Eguia, 2016; Chou, 2021; Johnson et al., 2016; Kocakoyun & Ozdamli, 2018; Koivisto & Hamari, 2019; Sardi et al., 2017), has caused general confusion about the definition of gamification (Torres-Toukoumidis et al., 2018).

Since the term gamification emerged, there is no agreement among the scientific community to establish a common definition, as each author takes a particular approach and emphasizes certain aspects. Among the most popular definitions, gamification is understood as the use of game mechanics in a non-playful context (Deterding *et al*., 2011), as the use of game elements and game design techniques in non-playful environments (Werbach & Hunter, 2012), as a set of tools used in brand initiatives using game elements and mechanics (Zichermann & Linder, 2013) or finally, as the use of game design elements in non-playful contexts (Deterding et al., 2011).

Other definitions are focused on the user experience. In them, gamification is seen as a process to improve a service through gaming experiences in order to assist users in generating overall value (Huotari & Hamari, 2012) and as a use of game elements to get a gaming experience from activities in non-playful contexts (Seaborn & Fels, 2015). These approaches focus on the activities that people must perform to acquire a similar aspect to a game, i.e., to identify them as a game in a playful environment.

Finally, in relation to the different definitions that can be found on gamification, approaches focused on people's behavior and behavior are addressed. In these cases, gamification is understood as the application of strategies, thoughts and game mechanisms in non-playful contexts in order for people to adopt or maintain certain behaviors (Ramírez, 2014). In this sense, Kapp (2012) defines gamification as the use of gameplay mechanics, perceptions, and gambling thoughts to engage people, motivate them to action, support their learning, and solve problems. Zichermann and Cunningham (2011) are committed to understanding it as a process of thought and gameplay to connect with people and solve problems. Given the undeniable benefits of this didactic strategy, methods for its application are currently being developed. For example, Gasca-Hurtado et al. (2017) present a proposal for the evaluation of gamified environments in order to ensure gamified experiences with purposes, objectives, principles and elements that are defined as fundamental components of gamification, i.e., oriented to the definition of a design method for gamified activities.

The literature review shows a poor approach to gamification as a didactic strategy in the teaching of mathematics. Although there are different research or educational experiences that present the results obtained from the implementation of gamifcation in the primary and secondary education levels (Fernández-Gavira et al., 2018; Pisabarro & Vivaracho, 2018; Quintero et al., 2018), and in higher education (Corchuelo, 2018; Fernández- Antolín et al., 2021; Santos-Ferreira & Lacerda-Santos, 2018; Pérez-López et al., 2017). However, there are different studies that relate gamification to the teaching of mathematics. Tomislav et al. (2018) point out that ludified activities contribute to increasing student performance in learning mathematical concepts. Another study presents an educational project aimed at students to help improve their perception of failure in the area of mathematics by incorporating an interactive mystery game as a

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didactic strategy, in which different mathematical contents are applied (Carson, 2021). Widodo and Rahayu (2019) show the results of a study where the students, after using games to work on arithmetic concepts, show a better commitment and a greater emotional connection. In this sense, López et al. (2021) analyze the opinions of the teachers in the area of mathematics, especially in relation to STEM competitions, in Brazilian and Spanish educational centers. In this study, a high percentage of teachers believe that gamified activities have a positive impact in student learning, favoring a greater approach to mathematics and to skills related to this mathematical competence. Finally, Zaharin et al. (2021) explore student perceptions of acceptance, interest, and skills in implementing gamification in mathematic learning processes. The results show a high acceptance when considering gamification as a didactic strategy that benefits the learning of specific mathematical concepts. This connection between games and learning is presented as a line of action for working the curriculum contents in mathematics.

If all of these approaches are taken to the educational field, gamification can be understood as a didactic strategy that can enrich the methodological approaches of professors. An et al. (2021) analyze teacher perceptions of interest, effectiveness, perceived barriers and needs regarding gamified approaches within teaching methodology, particularly in Massive Online Open Courses (MOOC) models. In this case, professors show a high interest in gamification and the elements of the game, motivated by greater interaction and connection with the students. Among the main barriers are lack of time, knowledge of the topic, lack of funding and the poor relationship between specific content and the gamified approach to the didactic approach, requiring expert training.

Far from simplistic approaches of gamification, a global approach is needed that would take into account the essence of the game, as well as the cohesion between the dynamics, elements and mechanics that integrate it. For this purpose, training is needed to avoid the feeling of insecurity and the need for specific training to face methodological approaches based on gamification (López et al., 2021). In this line, there are different elements to consider when facing the design of a playful learning experience. Following Werbach and Hunter (2012), a sense could be found when incorporating a set of dynamics (narrative, emotional aspects, rules, boundaries, progression or interactions), mechanics (earning rewards and prizes, retrofeeding, challenges, competition, cooperation or collaboration) and components (characters or avatars, badges, ratings, levels, teams, competitions), all this with a series of objectives that the faculty needs to define at the beginning, which will guide the design phase and the final evaluation of the gamified experience that they decide to develop in a specific area and stage. In conclusion, on a more general level, Hossein-Mohand et al. (2021) argue that pedagogical models such as flipped learning and active methodologies such as project-based learning and gamification facilitate the teaching and learning processes of mathematics through the support of technologies that promote the exchange of information and contents, participation and collaboration among students.

Hence, the aim of the research is to discover the perception of students and teachers on gamification as a didactic strategy in the teaching of the curricular contents of mathematics in elementary schools of Italy.

2. Method

The methodological proposal followed by this multicase study (Stake, 2005) aims to explore more than one unit of analysis to provide the basis for its generalization (Rule & Mitchell, 2015). This option provides criteria for internal validity, external validity and reliability of the collected data. In this multicase study, the combination of quantitative and qualitative techniques is presented by a mixed design of

exploratory-correlational scope. Regarding the quantitative design, the instrument used to collect the data is the questionnaire, completed by a total of 4845 students living in 75 of the 80 provinces that make up the territorial organization of Italy. The questionnaire is prepared with specific questions and answers with open and multiple-choice questions. Qualitative methodology (Stake, 2007; Barton et al., 2009; Igartua & Humanes, 2009; Gibbs, 2012) focuses on discourse analysis (Valles, 2000; Iñiguez, 2006; Van Dijk, 2005) with 12 in-depth interviews with teachers in the area of mathematics who teach in high schools.

In order to define the purpose of the study, the following questions are raised for students: do teachers propose digital games in math classes?, does the teacher propose serious (analogue) games?, what games helped to better understand the math content?, do you know games (analogue or digitals) that could be used in math classes? do teachers use awards, or rewards in math to properly perform homework outside the classroom? do math teachers use awards, or rewards for doing correctly the proposed activities in the classroom?

The following questions are raised in relation to the actions performed by teachers: what do they understand by gamification?, how do they rate gamification in terms of its incorporation into their teaching methodology?, have they been trained in terms of this didactic strategy?, do they know or do they suggest any games (analogue or digital) to their students to help or facilitate the learning of mathematics? do they use rewards for their student's work? do they use any digital application to award such rewards? Using the game in educational practice is valued as a way of getting students accustomed to receiving rewards for what they do without striving, what do you think about this statement?

2.1. Objectives and Hypothesis

The above questions allow reflecting of the objective of this study. Formally, the research aims to diagnose the application level of gamification as a didactic strategy in mathematics, based on the perception of teachers and students in secondary schools in Italy. The formulation of this objective responds to a study that is planned to approach observable phenomena. Several hypotheses that have been tested and formulated by a hypothetical-deductive method are presented:

- Hypothesis 1. Gamification as a didactic strategy in the area of mathematics is perceived by the students in the secondary education of the schools in Italy.
- Hypothesis 2. Gamification as a didactic strategy in the area of mathematics is known by teachers in the secondary education of the schools in Italy.
- Hypothesis 3. Gamification as a didactic strategy in the area of mathematics is applied by teachers in the secondary education of schools in Italy.

2.2. Population and sample

The sample participants correspond to 4845 students in secondary schools who live in Italy; the students are from13 to 22, and average of 16.43 years. 52% of the people surveyed identify with the female gender and 48% with the male gender. The provinces of residence reached are 75 out of a total of 80, distributed in different geographical areas of Italy: north (60 %), center (7 %), south and islands (33 %). All these people live in more than 800 different localities, 66.6% in a rural area and 33.4% in an urban area. The reduced sample from the central zone was not intentional, but it responds to a request for participation by leaders from the three areas of the country; although, for the most part, they do not provide the questionnaire because of the situation of students during COVID-19.

The teaching team of scientific disciplines involved in the interviews is made up of 12 people. 17% of the people interviewed identify with the male gender, while 83% identify with

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the female gender. The ages range from 32 to 59 years. They have from 2 to 33 of teaching experience. At the training level, the sample has enormous potential for study, and it is important to mention that 42% of the people interviewed graduated in Mathematics, 25% in Statistical Sciences, 17% in Physics and 8% in Economics and Computer Engineering respectively, thus, covering all the fields of STEM competences. Geographically, 58% live and work in the north of Italy, 8% live in the center and, finally, 34% in the south and islands.

It should be noted that the school itinerary is divided into three stages: primary school (which is composed of a total of five courses aimed at students between the ages of 6 and 11), first-grade secondary school (consisting of three courses and students from 11 to 14 years old) and second-grade secondary school (which is organized into five courses and the students are from14 to19 years old). This education process is structured by a total of 13 academic courses, of which the first ten are compulsory. This research focuses on second-grade high school. The main motivation for directing this research to this stage is based on the low results obtained by students in the area of mathematics, according to established national tests (Invalsi, 2019).

2.3. Instruments

The quantitative part of the study designs a questionnaire structured into closed, open and multiple questions. The independent variables are: gender, age, macro-area, type of school, course and academic performance. As dependent variables, different perspectives are considered that allow answering the questions, objectives and hypothesis of the research.

In order to face the qualitative approach, the idea is to design a semi-structured interview aimed at the privileged observers, collecting personal information such as gender, age, the city in which he/she teaches, the type of the educational center, the years of experience and, finally, the training degree. The most common teaching methods by teachers and the main difficulties found in their implementation are also analyzed. The Google Forms tool prepares informed consent for the interviewed people to have their approval for recording and subsequent analysis. During the interview, people are encouraged to provide their answers freely, avoiding interrupting their interventions, although at certain times they choose to influence some aspects in order to make the teaching team a clearer answer. To make simple references to the interview and to differentiate the contributions of each of the people interviewed, the "E-Tnº: p." was codified. In this coding system, reference is made to the interview (E), to the teacher (T), to the specific interview number (nº) and to the page on which the aforementioned event is located (pg.). Therefore, if during the analysis it is required to report information that appears in the first page of the interview to participant 1, it would be coded as follows: E-T1:1.

2.4. Procedure

The quantitative methodological design, corresponding to the questionnaires applied to second-level Italian students in secondary school, and the qualitative methodological design, focused on semi-structured interviews with secondary teachers, facilitate analysis from both perspectives that enrich the process; they were both developed from march 2020 to May 2020. Mixed social science methodologies are therefore applied by combining research techniques, methods, approaches, concepts or quantitative or qualitative language into a single study (Johnson & Onwuegbuzie, 2004). This makes it possible to acquire a greater understanding of what we are studying, encompassing the strengths of both methodologies and analyzing different approaches, combining the data to obtain convergent results (Callejo & Viedma, 2006).

Regarding the preparation of the questionnaires, a form sent to the Italian educational

institutions asking for their collaboration for this research is generated. Once the necessary data is obtained, it is analyzed following the corresponding procedure. First, for quantitative analysis, the .csv data was exported to an Excel file for later interpretation with the IBM SPSS v. 25. Data is entered into the program, assigning numerical values to the responses obtained in the questionnaires, filtering and debugging, selecting the appropriate procedure for calculating the statistics and executing the procedure for obtaining the research reports. The interviews are conducted using Skype and then the transcription, collection and analysis of data related to the objectives and hypotheses are carried out. Finally, a methodological triangulation and comparison of the survey data with the results of the discourse analysis presented in this study is established, respecting all the participants.

2.5. Reliability and Validity

This criterion determines whether the measurement scales of our tool are reliable, understanding reliability as the accuracy of the instrument, taking into account possible errors found in the factor analysis. If errors presented are minor, the measurement and therefore the study accuracy is higher. To study the reliability of the instrument we have followed the Cronbach α procedure. After analyzing the reliability statistics, Cronbach's α offers a value of 0.65 referring to the gamification items, confirming sufficient reliability.

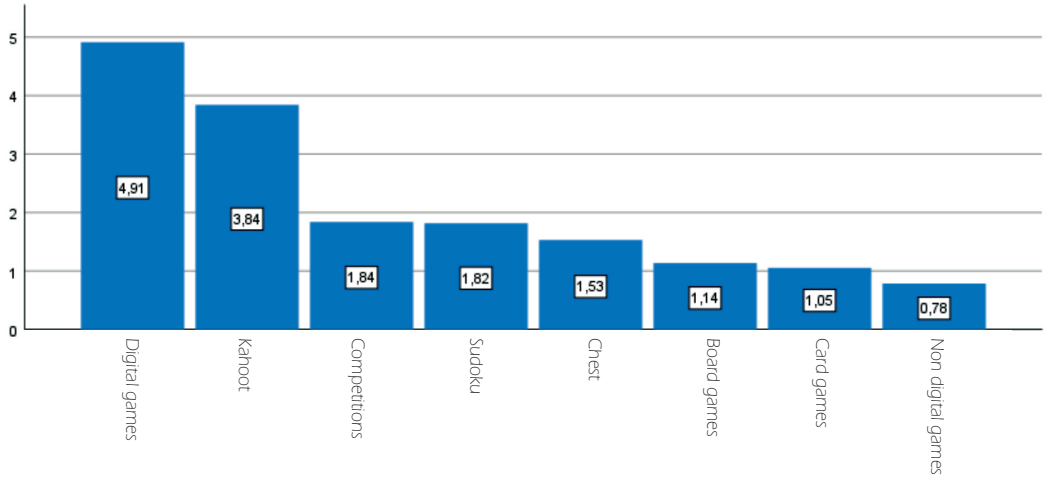
3. Results

The results of the study are presented below in three categories:

Category 1. Math classes: Proposed games versus known games

Regarding the proposal of analogue or digital games in math sessions, students answer negatively with 94% and 95.5% respectively. As for questions about the knowledge of games that favor the understanding of the math content according to the students, the answers show a negative position of 83%, while 6% indicates that they are analogue games (card games, board games, sudokus and chess). 5% say they are digital games, but they do not give examples, 4% point to Kahoot and 2% say competitions (Figure 1).

Figure 1. Games that favor the understanding of math knowledge according to the students



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Despite the student's negative response to the question of whether teachers propose analogue or digital grade during math sessions, when asking teachers about whether they know or propose any analogue or digital game to their students that facilitate the learning of mathematics, 75% answer positively by referring to games of brainteasers, competitions between teams, contests or prizes.

> We use games like riddles or sudokus. (E-T1: 6)
>
> I organize prize contests or speed competitions in the calculation. (E-T2: 10)
>
> We use Scratch. And then I propose sudokus when there are few students in the class. (E-T3: 15)
>
> I do not use digital, just the Sudoku because we lack of tools. (E-T4: 20)
>
> Logic games. (E-T5: 24)
>
> Math Olympics Games. (E-T7: 32)
>
> During suspension periods of teaching activities and at this DAD stage (E-T8: 35)
>
> Fun problems and puzzles. (E-T9: 39)
>
> I do not use digital, I usually do small contests trying to stimulate them, competitions but without prizes. In fourth grade I wanted to make a competition with derivatives similar to a competition I made that was called 'Don't drink and derive' and they seemed happy. (E-T10: 44)

The difference in the answers between students and teachers may be due to the meaning of the game by students.

Category 2. Perception of the application of didactic gamification strategies according to the students

In order to discover the level of application of the didactic gamification strategies in the area of thematic programs, the responses of the students are combined with the answers of teachers. Advancing in the incorporation of gamification in the classrooms, understanding it not only as the integration of games but as a methodological change toward a game scenario and experience, it is clear that 81% of students answer negatively and 77% mention that teachers should use rewards for performing homework properly outside the school setting or for doing good exercises and problems in the classroom. The data collected reveal that the perception level of the application of didactic gamification strategies in second-grade secondary schools is low on the part of students.

Category 3. Applying gamification as a didactic strategy by teachers

In relation to the question about the concept of gamification, 67% say they do not know what it is and therefore cannot give an opinion, also because with the length of ministerial programs and the reduction of teaching hours, there is little time to address innovative approaches.

> There is little time to try new educational solutions, also considering the numerous educational outings in the area. (E-T3: 15)
>
> I don't know, but I intend to study it. (E-T9: 39)
>
> I don't know…. (E-T2: 10; E-T6: 28; E-T7: 31; E-T10: 44; E-T11: 47; E-T12: 50)

All the people interviewed answer negatively in terms of having received specific training about gamification and its use as a didactic strategy for teaching mathematics, although the research team considers it to be an unconscious or invisible gamification, i.e., the teachers apply it without being aware of it. In fact, to the question addressed to teachers about whether they use rewards or prizes for the work done by their students, 75% of the group answer affirmatively.

> I congratulate them or provide them a positive comment, give them a slap in the back to

congratulate them, but I do not reward them (E-T1: 6)

I do it in a playful way. Sometimes I use prizes. For example, I let them decide who to question (joke) or offer immunity for that day to questions as a prize. This lightens the environment in the classroom, strengthens the group within the classroom. (E-T2: 10)

I divided the class into three groups and played the classic question game. The person who answered first was rewarded (and I brought sweets as a reward!). Then, when I explain and assign the exercises, I sometimes propose a very difficult exercise and the first one that does it well has 8 as an oral grade (of course I warn them before). (E-T3: 15)

I use rewards as votes or fewer exercises. Both positive and negative: If you end up being the last you are penalized. (E-T4: 20)

Yes, I usually use rewards. This year I participated in an interdisciplinary project with a second class. The students, divided into Harry Potter film houses, had to present the assigned works each week, receiving points for their homes. Prizes were planned for the end of the year. I do not use digital applications to earn rewards or prizes, but I still find it stimulating to motivate students with rewards, which are later used as an oral vote or an increase in the grade of the written test. (E-T5: 24)

I do not use material rewards, however, sometimes I encourage achievement of goals with grades (to which I realize students are much more attached than I am as a teacher). I often organize challenges in small groups or individual in class with "culinary" awards offered to the winner by the other peers. (E-T8: 36)

Yes, I take this into account in the evaluation in a systematic way. I think this methodology is useful especially when you have an audience of small students, I am thinking about the first two years. With older and more mature students is no longer necessary. (E-T9: 39)

I have not yet implemented it, but I like this method. Even at the school level with competitions between classes. I appreciate the fact that it gives more participation. Frankly, I do not see negative aspects if you apply it in the correct way. (E-T10: 44)

No, but if they do something extremely wrong, I put two, is that valid? (E-T11: 48)

Data collected aimed at teachers at the qualitative stage of the study indicate that each one uses different rewards or awards, not material, which students may not perceive as such. In addition, no digital application is shared to facilitate the use of these elements during the process.

In order to deepen on the concept of the teaching team about gamification, a reflection is proposed on the assessment of the use of the game as a means to direct and instruct the students in the continuous reception for those actions that they perform and reduce with their efforts. 67% of the people interviewed claim not to agree with these postulates, stating that, with the introduction of the game in the teaching processes, striving is funnier.

The game stimulates competitiveness, character formation, respect for rules and roles, knowledge of oneself and others. The Scout method, a well-known pedagogical method, is based on playing. Those who say that the game usually does not strive, perhaps, have never played in their life. (E-T2: 10)

I do not see students learning by learn, they are already studying for voting. That is already the case 'do ut des'. (E-T3: 15)

You don't always get a reward, or the reward can also be just verbal congratulation. (E-T4: 20)

However, I think the boys or girls in second-grade high school should be mature enough as to understand that the effort made is for their future and not to receive a reward. The use of games in educational practices should be a plus, but not the foundation. (E-T5: 25)

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> It might be useful when combined with the traditional method; it does not work like that in the regular basis, you have to get used to trying hard to get to something. (E-T6: 28)
>
> The use of games in the teaching process could be beneficial, but we must be careful. I think it is not ideal to turn it into the only approach, but to alternate the game with moments of work without it. (E-T7: 32)
>
> I do not agree with this statement, as I assume that the reward should be awarded only when the goal is fully achieved. (E-T8: 36)
>
> I do not agree with these studies because you have to know to participate in the competition and play, you have to make an effort. (E-T10: 44)

As can be seen, half of the teaching team positively evaluates the use of games (or its mechanics) in the teaching process, as long as it is not the only educational approach or model.

4. Discussion and conclusions

The results found in this research allow having an approximation to the level of application of gamification as a didactic strategy in mathematics in secondary schools in Italy. At the same time, they allow some conclusions to be highlighted and future lines of research to be established.

Regarding the use of games in math sessions, students do not appreciate that teachers use games, both analogue and digital, in the classroom. Nor do they know about games that favor the acquisition of the math contents. They mention applications such as Kahoot, which are used at some point in the training process. On the other hand, teachers claim to know different types of games as a means to facilitate learning the concepts of the area. They point out games like riddles, competition between teams, contests, and more. This type of gamified activity, as Tomislav et al. (2018), increase performance in relation to the learning of specific math concepts.

Addressing the perception on the use of gamification as a didactic strategy, students point out that they do not appreciate the use of gamified strategies in the math sessions. They do not perceive the use of prizes and rewards in exchange for properly performing homework, both inside and outside the classroom, as well as the exercises and problems presented in the classroom. On the contrary, Zaharin et al. (2021), when studying students´ perception, showed a high acceptance and interest in the skills developed through the incorporation of gamification as a strategy for learning mathematical concepts.

Regarding the application of didactic gamification strategies by teachers, the teaching team shows little knowledge about gamification and the opportunities it offers to their professional practice. They claim not to address gamification in their approaches because of lack of time, teaching hours and the situation caused by COVID-19, among other reasons. It is similar to the conclusions of López et al. (2021), when reference is made to further training in methodological approaches based on gamification to increase the safety of teachers and connect the curricular contents of the area through gamification strategies. They also mention not having received specific training on gamification and its implementation in the teaching of mathematics. Although many teachers are not aware of this, they comment on using awards or rewards in their teaching process. In other words, they are not aware of using these elements in their approaches. Students are not aware of the use of these elements either. In this sense, as stated by An et al. (2021), training by gamification experts is necessary to support rigorous teaching approaches in the area of mathematics, as well as to provide more time and flexibility to their proposals, funding, exemplification and resources that support the incorporation of elements of the game in teaching practices.

A limited use of some elements of gamification is perceived, which is closely related to maintaining or acquiring certain behaviors in

students. This idea agrees with Ramirez's contributions (2014), especially when the use of these strategies is aimed at people adopting or maintaining certain behaviors. Most teachers do not agree to grant value to the game as a means of instructing students in receiving rewards only, thus not favoring their effort. In this sense, the application of the didactic strategies of gamification implies an integration of the game and a methodological change toward the design of experiences and play scenarios. They argue that it is a resource, but it is not an educational model.

At the present time in which we observe several gamified didactic experiences developed by professionals in the field of education, the need to avoid the confusion that can be generated about the concept of gamification arises to obtain a clear consensus on its definition, as mentioned by Torres-Toukoumidis et al. (2018). This issue is related to the challenge of providing solid training to teachers that facilitate a consistent design of playful learning experiences to be carried out in different areas and educational stages, all along the lines maintained by Werbach and Hunter (2012), when referring to the coherent incorporation of a set of dynamics, mechanics and components of the game in the design of the different educational proposals in the area of mathematics.

To conclude and with the aim of establishing lines of action and research, gamification is defined as the use of elements, mechanics and dynamics typical of games in a non-playful environment, as defined by different authors in their works, such as (Deterding et al. 2011; Zichermann & Linder, 2013). There are educational experiences based on a gamified system that uses only points, medals and classifications. These approaches place gamification in a reductionist and limited approach, contrary to Kapp's postulate (2012), when it comes to involving, motivating students to action, supporting their learning and solving different problems. When designing recreational learning experiences in school contexts, it should be considered that this approach should not be unique but that the proposal can be enriched by incorporating other elements such as an initial situation or problem that contextualize the experience, a narrative that serves as a cohesive element and setting (characters, scenarios, facts, events, etc.), an approach to diverse challenges that favor student action, collaboration, and participation to solve problems (Zichermann & Cunningham, 2011). Hossein-Mohand et al. (2021) say that pedagogical models as the flipped classroom, active methodologies and gamification favor the teaching and learning processes of mathematics, along with the support that technological resources can offer in educational practices.

This innovative approach becomes a real challenge for teachers who try to project the game in educational contexts and relates it with learning the curriculum contents of a subject (Domínguez et al., 2013; Qahri-Saremi & Turel, 2016; Villagra-Arnedo et al. 2016), and also for university training institutions to try to achieve a solid training that helps to design and develop recreational proposals that try to relate learning with fun.

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