

Fostering financial literacy in high school education through a game: the experience of RANOKA

Fomentando la educación financiera en educación secundaria a través de un juego: la experiencia de RANOKA

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ABSTRACT: According to the official educational curricula, formal financial training in Spain has been and still is limited. Consequently, the level of financial competences of Spanish students in their last year of high school remains below the average level of OECD's countries.

This research aims to highlight the importance of complementing the formal high school education with non-formal activities. Such non-formal activities could help in the acquisition of economic-financial knowledge and skills at an early age.

Specifically, an activity based on a game denominated "Ranoka" was designed and implemented to contribute to enhancing the financial literacy levels of young people. Therefore, our challenge is to increase the level of financial competence in a fun way to capture the attention of these young students when faced with content that might be tedious or unattractive for them. The activity was carried out in 2021 in the Southwest of Andalusia. Five different educational institutions and a total of 224 students from the last course of mandatory high school in Spain participated in the activity. The participants valued positively the proposed activity with an average score of 8.4 points out of 10.

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The students who participated in the game also answered a questionnaire. Five questions from the PISA report were used to test their level of financial competence. Results have been analysed by gender, type of school, and enrolment in Finance or Economics subjects. Therefore, the insights of this research could be useful for education authorities when developing the educational curricula of high school students.

Key words: Gamification, High School Education, Financial Literacy.

Resumen: Según los currículos educativos oficiales, la formación financiera formal en España ha sido y sigue siendo limitada. En consecuencia, el nivel de competencias financieras de los estudiantes españoles de último curso de secundaria se mantiene por debajo del nivel medio de los países de la OCDE.

Este trabajo pretende resaltar la importancia de complementar la educación formal con actividades no formales que podrían ayudar en la adquisición de conocimientos y habilidades económico-financieros a edades tempranas.

En concreto, se diseñó e implementó una actividad basada en un juego denominado "Ranoka" para contribuir a mejorar los niveles de alfabetización financiera de los jóvenes. Por tanto, nuestro reto ha sido promover la educación financiera de forma divertida para captar la atención de jóvenes estudiantes ante contenidos que pueden resultarles tediosos o poco atractivos.

La actividad se llevó a cabo en 2021 y participaron cinco centros educativos diferentes y un total de 224 alumnos de último curso de secundaria en España. Los participantes valoraron positivamente la actividad propuesta con una puntuación media de 8,4 puntos sobre 10.

Los alumnos que participaron en el juego respondieron también a un cuestionario. Se utilizaron cinco preguntas del informe PISA para comprobar su nivel de competencia financiera. Los resultados se han analizado por sexo, por tipo de centro escolar y por matriculación en asignaturas de Finanzas o Economía.

Por lo tanto, las conclusiones de esta investigación podrían ser útiles para las autoridades educativas a la hora de elaborar los planes de estudios de los alumnos de secundaria.

Palabras clave: Gamificación, Educación Secundaria, Educación Financiera.

1. INTRODUCTION

Policymakers and academia have been interested in financial literacy since before the international financial crisis of 2007 (AECA, 2023). However, the financial environment is becoming increasingly dangerous and hostile to consumers (Fernandes et al., 2014) and is constantly changing (Lusardi, 2019), so that financial literacy is becoming more and more essential for empowering people to manage their finances (Amagir et al., 2020; Goyal & Kumar, 2021). Furthermore, the lack of financial literacy could negatively affect wellbeing due to the increasing financial decision-making (Becchetti et al., 2013). In order to make right decisions, individuals need the financial knowledge but also the skills to be able to apply the knowledge (Erner et al., 2016).

An important idea to consider is that financial literacy should not only be possessed by experts in the economic field. Everyone is obliged to be familiar with economic-financial terms and to acquire economic-financial knowledge to be able to cope with everyday life (Villacorta-Hernández, 2022).

Consequently, financial education programs have been developed in most OECD countries (Gallardo-Vázquez et al., 2023). In Spain, this responsibility was assumed by the National Securities Market Commission (CNMV) and the Bank of Spain (2008, 2013, 2018, 2022) through the development of several Financial Education Plans which promoted a national financial education strategy with the aim of improving the financial culture of citizens, so that they can better cope with the new financial context that is presenting increasingly complex challenges.

The level of financial competences in Spain is measured for general population by the Financial Competences Survey developed by the Bank of Spain. Last edition results pointed out that the current situation of financial literacy in Spain is not the desirable one (Hospido et al., 2023) since only 52.83% of the adult population is able to correctly answer three basic questions about inflation, compound interest, and risk diversification. Although the whole population needs to increase their financial competences, Kaiser and Menkhoff (2017) suggest that young people have a greater capacity to learn than adults, which supports the fact that it has been the priority target audience of the actions (Frisancho, 2020; Kaiser & Menkhoff, 2020). Among young people, Batty et al. (2020) and Villacorta-Hernández (2022) argued that the most suitable age group is high school students. This is consistent with the fact that PISA report has been assessing the financial competence of 15-year-old students since 2012.

Based on PISA 2018 report (Spanish Ministry of Education, 2020), the level of financial competences of Spanish students in their last year of high school has increased from previous editions, although it remains below the average level of the OECD's countries. In 2012, Spain was one of the countries with less formal training on Finance or Economics in schools both in cross-sectional subjects and in specific courses (Spanish Ministry of Education, 2014). However, those who were enrolled in Finance or Economics subjects are the ones who have the higher level of financial competences (Salas-Velasco et al., 2021).

Despite the importance of incorporating financial literacy training through specific subjects in the official educational curricula, it has not been considered a priority (Villacorta-Hernández, 2022). Formal specific training is limited (Cordero & Pedraja, 2019) although some improvements have been achieved in terms of educational policy on financial literacy. For example, the incorporation for the first time of the subject of Economics in the Humanities and Social Sciences Baccalaureate thanks to the LOGSE (Law 1/1990); and the introduction for the first time of subjects related to Economics at all levels of mandatory high school education mainly in Arts itinerary thanks to the LOMCE (Law 8/2013). Therefore, the number of Finance or Economics related subjects in high schools continues being scarce and in most cases optative (AECA, 2023), and students consider that they do not receive enough explanations of finance concepts in cross-sectional subjects (Villacorta-Hernández, 2022).

Moreover, this situation seems to have worsened with the LOMLOE (Law 3/2020), resulting in a loss of relative weight of economic and financial subjects and acquiring a voluntary nature both in mandatory high school education and in Spanish Baccalaureate (Villacorta-Hernández, 2022).

Considering this scenario, non-formal training in Finance and Economics through activities out of the educational curricula plays a key role in fostering financial competences in high school students. Based on Amagir et al. (2018), financial education activities proposed are changing from being more-knowledge based to have a more experimental learning approach focused on learning by doing. This not "chalk and talk" approach would also be more helpful to intrinsically motivate students through the consideration of "relatedness", "autonomy" and "competence" as Self-Determination Theory argued (Deci & Ryan, 1991).

Although even more formal training needs to incorporate some elements related to experiential learning, this approach perfectly fits with non-formal training. Consequently, an activity based on a game was designed and implemented to contribute to enhancing the financial literacy level of young people. After the implementation of the

activity, participants were invited to fill in a survey with the aim of assessing the initiative as well as having some evidence of their financial competence level.

Next section focuses on the theoretical background through the analysis of financial literacy and gamification. An explanation of the proposed activity as well as the questionnaire used follows (Section 3). Section 4 is dedicated to the presentation and discussion of the results. Finally, concluding remarks are presented in Section 5.

2. THEORETICAL BACKGROUND

The present work is based on two main concepts that are examined below: financial literacy and gamification. On the one hand, we aim to help in the acquisition of economic-financial knowledge at an early age. On the other hand, we aim to do it in a fun way to capture the attention of these young students when faced with content that might be tedious or unattractive for them.

2.1. Financial literacy

There is a lack of consensus about what financial literacy is (Amagir et al., 2018) since it is a broad concept. One of the most accepted definitions stated that financial literacy is "the knowledge and understanding of financial concepts and risks, and the skills, motivation, and confidence to apply such knowledge and understanding to make effective decisions in a range of financial contexts, improve the financial well-being of individuals and society, and enable participation in economic life" (OECD, 2014).

Amagir et al. (2018) argue that there are mainly three components of financial literacy: knowledge and understanding, skills and behaviour, and attitudes and confidence. While knowing the concepts is needed (i.e., knowledge and understanding), it has a limited effect on behaviours. If changing in behaviour is the target, skills are required to be able to apply the knowledge (i.e., skills and behaviours). Finally, it should be complemented by the application out of the learning context (i.e., attitudes and confidence).

Although enhancing financial literacy is needed for the whole population, most financial education activities are focused on young people due to their greater capacity to learn in comparison with adults (Kaiser & Menkhoff, 2020), the increasing complexity of financial markets they have to deal with in the future (Frisancho, 2020), and the more challenging financial choices they have to face (Lusardi, 2015). As Kaiser and Menkhoff (2020) highlights, motivation to learn and apply is higher when they think that they are going to take such financial decisions in the moment or in the short term. In this sense, 15-year-old students are dealing with several financial decisions (Lusardi, 2015; Erner et al., 2016) such as having a bank account in order to be able to carry out online payments or deciding about their mobile phones contract.

Research in this field suggested that financial education could be given through formal or non-formal training, although several researchers argue that the financial education should be mandatory in the educational curricula (Amagir et al., 2018; Villacorta-Hernández, 2022) through cross-sectional subjects or specific Finance or Economics related subjects. Empirical evidence supports that those students who have a formal training through specific subjects are the ones who present higher levels of financial competence (Salas-Velasco et al., 2021). Nevertheless, as stated previously, formal financial training in Spain has been and still is limited (Spanish Ministry of Education, 2014; Villacorta-Hernández, 2022). The evidence found after analysing the existing literature is not conclusive (Cordero & Pedraja, 2019). An update would be necessary to analyse if

changes in the educational curricula pushed by the LOMCE (Law 8/2013) has increased the level of financial competences of high school students.

Martínez-García et al. (2023) also suggested that the type of school in Spain did not show any significant impact on financial competences. It seems that in other countries (Salas-Velasco et al., 2021) such as Belgium, Colombia, and Latvia students from private school achieved a higher level of financial competence than Spain although it is necessary to point out that only in the case of Belgium the percentage of participants from private school is relevant (81% -Belgium- vs. 18% -Colombia- and 1% -Latvia-).

Finally, existing literature argued that financial training is also needed to reduce gender gaps (Amagir et al., 2018). In Spain, previous research suggest that men show higher level of financial competences than women not only in general population (Hospido et al., 2023) but also in high school students (Cordero & Pedraja, 2019; García-Lopera et al., 2021; Salas-Velasco et al., 2021; Martínez-García et al., 2023), although in most cases the differences are not statistically significant.

2.2. Gamification

Bearing in mind the need to promote financial literacy of high school students through non-formal training, we wondered what the best way to contribute would be. Non-formal training is defined by the UNESCO (2012, p. 11) such as the type of education which “is institutionalised, intentional and planned by an education provider”. In addition, non-formal training is complementary to formal training, and such training is usually given by short courses, workshops or seminars. School Financial Literacy Competition promoted by CNMV and Bank of Spain, or Economic Debate on Financial Literacy¹ promoted by the Spanish General Council of Economist are examples of it.

In general, there is a growing belief that it is necessary to innovate in educational methodologies due to the speed at which social and cultural changes are occurring, which are making the more traditional and lecture-based methods obsolete (Batlle, 2013). Consequently, teachers are increasingly interested in incorporating learning tools that allow them to improve the way they teach and involve students (Torres et al., 2017). In this context, among the different proposals for teaching innovation, those that allow capturing the student's attention and creating the ideal environment that favours learning stand out.

Financial education programs also rely on “learning by doing” methodologies since increasing financial competences is not limited to knowledge and concepts (Becchetti et al., 2013) but also skills and confidence (Amagir et al., 2018) which requires an active role of students. In this sense, Mandell and Klein (2009) argued that games would be a good way to train students' skills due to their active role. Furthermore, motivation plays a key role in the learning process (Fernández-Mesa et al., 2016) and gamification would allow to increase it (González-Rojo, 2019).

Gamification is considered an active methodology that improves learning by allowing students to be the protagonist of the process and to regulate themselves (Roa González et al., 2021). It is defined as “the use of game design elements in non-game contexts” (Deterding et al., 2011, p. 9). Thus, gamification “seeks to promote learning processes based on the use of games for the development of effective teaching-learning processes, which facilitate cohesion, integration, motivation for the content, and

¹ <https://economistas.es/educacion-financiera-torneo-2024-2025/>

enhance the creativity of individuals" (Marín-Díaz, 2015). This method provides the learner with the opportunity to perform an action, which implies a response from the individual on a psychological and behavioral level (Hamari et al., 2014). When gamification is applied to an educational context, different elements can be included through which the progress achieved in relation to oneself and in relation to peers can be observed.

Experimental learning is one of the key elements of financial education although relevance is also important (Amagir et al., 2018). Relevance could be achieved by contextualizing the learning with real experiences that young people are facing now or in the short future (Bruhn et al., 2013). Managing their pocket money through paying bills, facing unexpected expenses, using credit cards or asking for a loan would help them to be more active in the activity.

Therefore, considering previous literature, the design of the proposed non-formal financial training activity is based on a game. The game has been chosen as a method to focus not only on the concepts but also on the way they could be applied (skills and behaviours training). The context will be carefully considered so that students would increase their motivation to be involved.

3. METHODOLOGY

This section focuses on the description of the proposed activity. First, the process followed for the design and implementation of the game is explained. Next, the questionnaire used is presented.

3.1. The proposed activity: "Ranoka"

The "Game of the Goose" is the popular game which served the team as a starting point since it could be easily adapted to the content and has enough flexibility to incorporate the key elements for achieving the proposed goals. This is a race game in which participants need to dice throw to progress on a board consisting of a variety of numbered spaces. Landing on one of the numbered spaces allows participants to advance a certain amount of numbered spaces -such as a "Goose", "The Bridge" or "Dices" which allow to go directly to the next numbered space represented by the same illustration- or to remain on the space and miss one/two turns or trap until other participant landing on it such as "The Prison".

Once the game to be used was chosen, successive meetings were held to configure our activity. As a result, the functioning of the game was defined, and the rules of the game were customized. The numbered spaces were also designed (both the content and the representative illustration). In addition to the traditional spaces such as "Goose" (called in our activity "Ranoka"), "Dices" or "The Prison", several blocks of spaces related to financial literacy were established: traditional games, tolls, extraordinary incomes, solidarity bonus, savings, good/back luck, unforeseen expenses, and whims. The board was designed (Figure 1) by a technician and it was registered obtaining the legal deposit.

Since this activity was implemented just after COVID-19, the proposed board game had to be transformed into an outdoor game, so that the board had to be printed in a cloth of 6 square meters, dices had to be replaced by a big inflatable dice, and tokens were replaced by traffic cones of different colours.

Students were divided into teams for participation. As in the reference game, teams throw dices. However, in our case, before moving the token students should answer correctly a question about financial literacy. In case the answer was wrong, the team

could not advance on the board and miss the turn. When the token was moved, it landed on a numbered space with different effects. The teacher who guides the game lets the group know what to do in each situation since some of the spaces require making decisions, moving the token, to pay, to collect money, or to play.

Figure 1: Board of RANOKA



Source: Authors' own work (DL: SE 478-2021).

The initial questions were prepared by the team based on their experience as part of the local committee of the Olympics in Economy at the University of Seville, and on material available on the websites from the main financial entities in Spain which was created specifically for the development of financial literacy such as "Finance for all"², "Clear Accounts"³, Bank of Spain⁴, CNMV⁵ and Mapfre Foundation⁶.

² <https://www.finanzasparatodos.es/>

³ <https://www.rtve.es/play/audios/las-cuentas-claras/>

⁴ <https://clientebancario.bde.es/pcb/es/menu-horizontal/actualidadeducac/educacion-financiera/>

⁵ <https://www.cnmv.es/Portal/inversor/Videos-Educacion-Financiera.aspx>

⁶ <https://segurosypensioneparatodos.fundacionmapfre.org/recursos-didacticos/?query=ALL>

Once the initial version of the questions was agreed, they were refined and validated by some volunteers devoted to financial literacy of one of the Foundations that financed the activity. Finally, there were 124 questions grouped into three blocks: Basic Concepts (such as financial security concept, savings, investments, differences between Payment and Expenses -also Proceeds and Incomes-, or characteristics of financial targets), Banks and Banking products (such as credit/debit/pre-payment card characteristics, back account details, mortgage, bank deposits, or personal loans), and Cash Budget (such as cash budget definition and purpose, or the identification and differences among fixed/variable/discretionary expenses).

The same material was used to identify important financial concepts and definitions to develop several traditional games associated to another type of spaces in the game. Three main traditional games were used: Hangman, Word search puzzles, and Crosswords. Available online tools were used to elaborate Word search puzzles⁷ and Crosswords⁸. This other type of spaces had a different working since the other teams could also participate.

In addition to the usual rules of this game and considering that the aim is to foster financial skills, each team had a bank account in "Nenufar" bank with an opening balance of 50€ in which all the payments and collections as a consequence of the game would be included. Furthermore, each 15 days they got paid their pocket money, and by the end of each month they had to pay their fixed expenses. Then, when they landed on this space or pass through it (considering that each 7 spaces are equivalent to 15 days), the teacher who guide the game reminds them of the corresponding collection or payment, and the team should control the movements in the bank account through a document proportionated by the organizers. To control it, one of the teachers also noted the collections and payments from all the groups.

Furthermore, each team could use a credit card and request a loan to "Nenufar" bank. Regarding to the credit card, it has a limit per month. By the end of the month, in case that the team did not have enough money to pay in the bank account, they could divide and postpone the payment. Consequently, they would have to pay an interest rate for the deferred part. Another option for teams was to request a loan which conditions depends on the amount needed, although a maximum amount was fixed. The maximum return period was two months, and the payment would take place by the end of each month (that is, together with the payment of the fixed expenses). The different possibilities are presented to the teams in a flyer in which it is explicitly written the amount as well as the loan fee (i.e., principal and interests).

All students actively participated in the game as a part of a team but, additionally, each one had different own responsibilities in the team. Then, one student was in charge of throwing the dices and moving the tokens through the board. Other student was the team representative for answering the questions, and finally, other needed to update the movement of money in the bank account.

The winner team would be the one that first land exactly on the last space having at least 50€ in its bank account. If a participant team oversteps the last space, is necessary to move backward by the rest amount shown by the dices, which increases the possibility of landing on a hazard space and lose the game. In case the time is over, and no team reached the last space, a ranking was performed considering the position on the board

⁷ <https://www.educima.com/wordsearch.php>

⁸ <https://worksheets.theteacherscorner.net/make-your-own/crossword/lang-es/> or <https://www.educima.com/crosswordgenerator.php>

as well as the amount of money in the bank account to decide the winner and the position of each group.

3.2. The questionnaire used

Once the activity with the students was completed, an anonymous and individual questionnaire was distributed. In addition to collecting demographic data such as age, gender, type of school in which the student studied, and the enrolment in a Finance or Economics subject, this questionnaire was divided into two main sections. The first one focused on gathering their assessments of the activity (from 1 to 10) while the other addressed their level of financial skills (Appendix A).

To assess the level of financial skills among the students who participated in the activity, we based our approach on the methodology used by the PISA report for evaluating such competences. PISA is a triennial international survey that, since the year 2000, has assessed the skills and knowledge of 15-year-old students in three key areas: mathematics, reading, and science. In 2012, for the first time, a financial literacy assessment was introduced, becoming the first large-scale international study to evaluate financial literacy.

Therefore, financial literacy was assessed considering three key elements: concepts, process, and context. Then, students' ability to demonstrate and apply concepts (money and transactions, financial planning and management, risk and return, and the broader financial landscape) in the financial domain was measured.

A series of questions were established, and their level of performance was evaluated. Five levels of performance were defined with the implications pointed out in Figure 2.

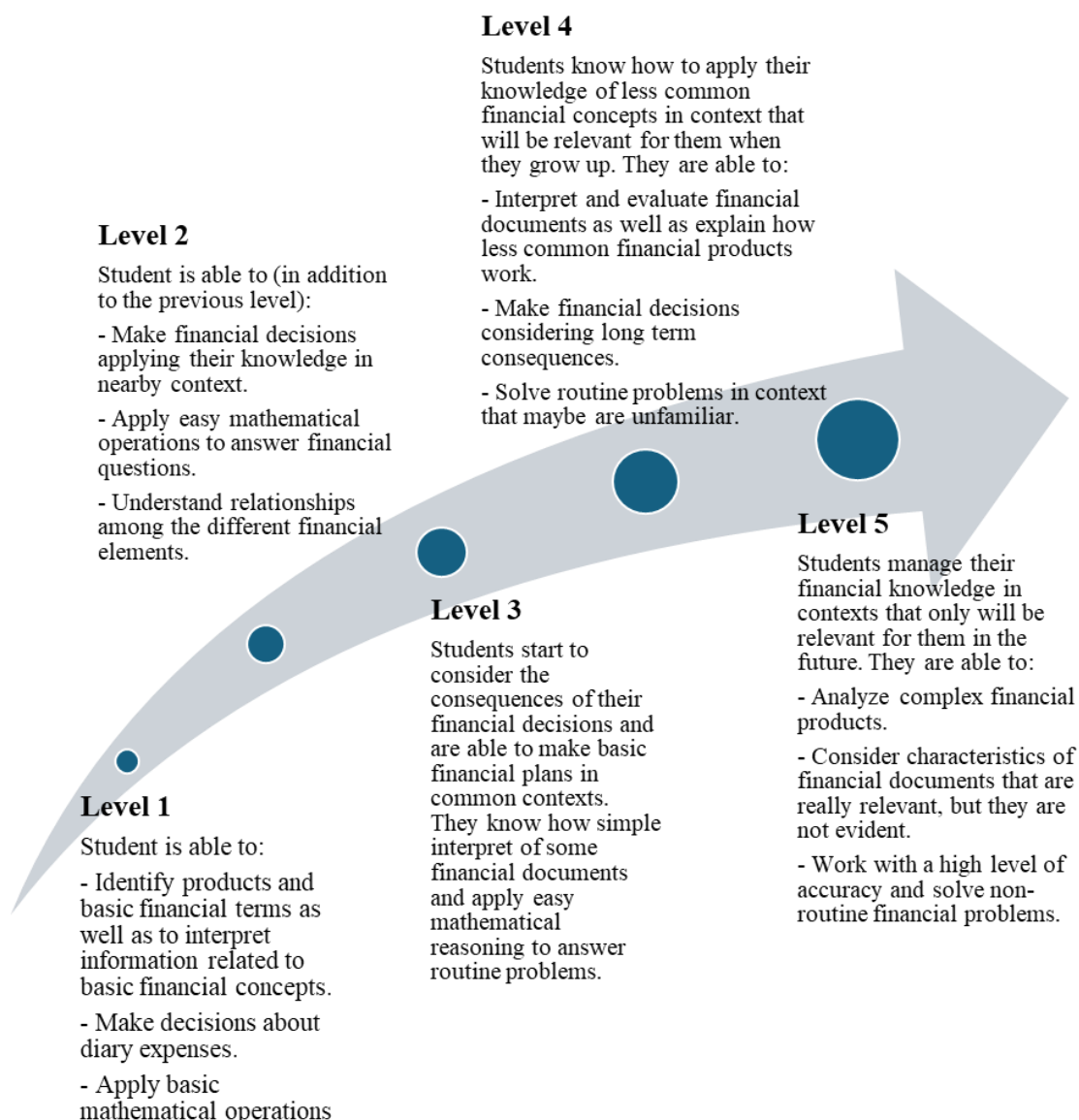
Therefore, achieving a higher level of competence implies that competences of previous level of performance were also reached. PISA report considered that not passing Level 2 of performance implies that student did not have acquired the minimum basic level of financial literacy necessary to manage their adult lives.

From the total released questions⁹ from the Spanish version of PISA 2018 Financial Competence Report (Spanish Ministry of Education, 2020), five questions were chosen (one by each performance level). Each of these five questions addressed the different concept and process mentioned earlier, being focused on a context which is familiar for them in order to enhance the relevance (Bruhn et al., 2013; Kaiser & Menkhoff, 2017), and the answer would be as closed as possible. In addition, all the questions which answer could mean reaching different level of competences were not considered.

A short description of the five questions as well as the competences and abilities that are tested in them is presented. The first question aims to assess whether the student, after comparing the price of the product, can consider that buying a larger quantity of the product may mean wasting part of it if it is not needed and/or that there may be difficulties in facing the higher payment that the purchase of the box of tomatoes entails.

⁹ Released questions are those questions that have been used in previous editions but will no longer be used. These questions come from financial literacy tests from 2015 and 2018.

Figure 2: PISA Financial Competence Performance level



Source: Spanish Ministry of Education (2020).

According to the PISA report, Level 2 is considered the basic level of financial literacy that a student must possess to manage adult life in the financial domain and fully participate in society as an independent and responsible citizen. Question 2 tests if students understand what a contract is and the responsibilities and consequences that it entails.

Question 3 requires evaluating the factors that affect cost associated with owning a vehicle, which also implies to distinguishing between fixed and variable costs as well as to understand that the cost of a product depends partly on its use. Question 4 requires using mathematical operations in a situation in which the students should understand all the implications of his/her decision, that is not only immediate consequences but also long-term ones. Two main lessons could be drawn: planning a budget and the importance of reading all the information in any transaction including fine prints. Lastly,

Question 5 requires that they could identify a link among the different elements presented and decide considering the uncertainty.

To evaluate each question, the correction guidelines from the PISA report were used, which outlined the possible valid responses for each question—since there was not a single correct answer—and those that were considered incorrect. In this regard, each response was classified as either correct or incorrect, meaning that the student had either acquired the competence level or had not. The results would be presented in the next section.

4. RESULTS

The activity was carried out 10 times across three towns in the Southwest of Andalusia (Sevilla, Dos Hermanas, and El Puerto de Santa María) and implies to five different educational institutions. A total of 224 students from the last course of mandatory high school education in Spain participate in the activity. Considering the type of school, a 13% came from a public school, 16% are from a private school, and most of the participants (71%) are studying in a government-subsidized school.

As descriptive statistics, the participants' age ranged from 15 to 19 years, with an average age of 15.7 years. By gender, women were 54% of the participants, which implies no significant differences in the number of participants. Finally, a 51% reported that they were currently enrolled in, or had previously taken, a course on Finance, Economy or similar.

The participants valued positively the activity with an average score of 8.4 points. Table 1 presents the level of assessment of the activity categorized by type of school, gender, and enrolment in a Finance or Economy subject. In addition, mean difference statistical tests were carried out (t-student when the variables have two categories and ANOVA when there are more than two categories).

Table 1: Mean assessment of RANOKA by gender, type of school and enrolment

		Mean assessment	Mean difference statistics (p-value)
Gender	Woman	8.8	13.10 (p<0.0004)
	Man	8.1	
Type of School	Public	8.6	5.98 (p<0.003)
	Government-subsidized	8.2	
	Private	9.1	
Enrolment in a Finance or Economics related subject	Yes	8.7	9.18 (p<0.0028)
	No	8.1	

As shown in Table 1, mean difference statistical tests reveals significant differences in the three categories. Specifically, students from private schools are those who valued more the activity. Regarding gender, female are the participants which gave a higher rating to the activity. Finally, the assessment of the activity was higher for those participants who are involved or had previously taken a business-related course.

Next, as it was previously explained, the level of financial competence of the participants is going to be analysed based on the questions included in the survey (Appendix A)

according to the PISA 2018 Financial Competence Report (Spanish Ministry of Education, 2020).

Results are presented in Tables 2 to 5. Firstly, Table 2 shows the percentage of students who answered correctly each question.

Table 2: *Percentage of participants who answered correctly each question of financial competences*

	Percentage
Question 1	60.7%
Question 2	64.3%
Question 3	55.8%
Question 4	24.1%
Question 5	16.5%

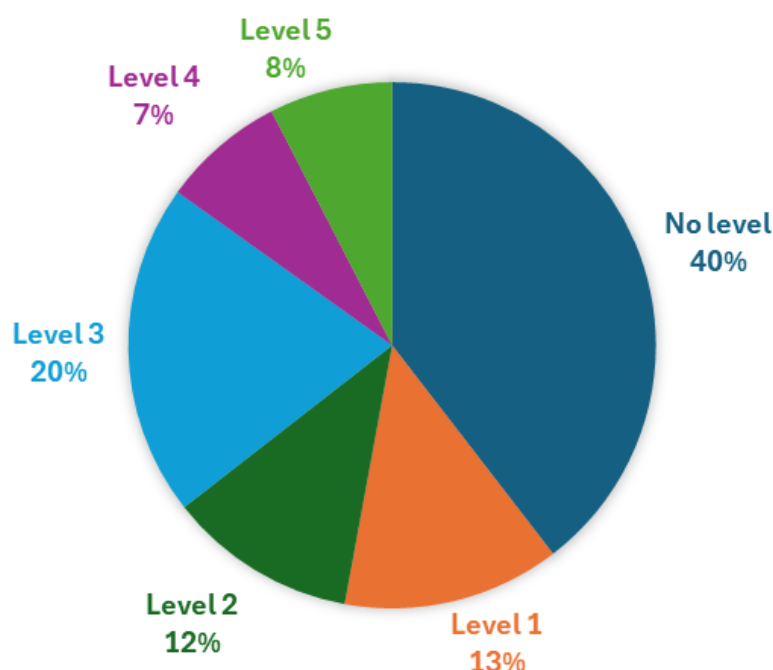
As can be seen, the percentage of participants answering each question correctly decreases as the complexity of the concept and skills increases except for question 2. This is surprising as it is assumed that students who pass question 2 have achieved the competences of the previous level. At this point, it would be relevant to point out that the familiarity of the context (Kaiser & Menkhoff, 2017) may explain the inconsistency of this results since currently most young people aged from 15 to 16 have a mobile telephone and they could not sign the contract (question 2). Furthermore, this also may reflect a lower commitment of young people to housework (question 1) since their parents are in charge of them.

Also, a higher difference in the percentage is shown between questions 3 and 4 which implies that participants identified a qualitative leap in the content as well as the skills required.

These results should be complemented by showing the level of financial competence reached by participants, since PISA 2018 employed a cumulative approach. That means that the level of financial competence is determined when participants do not pass a question, then the achieved one would be the one determined by the previous question. Although it seems logical to assume that answering correctly to the question concerning the fourth level of competence implies having achieved the previous ones, PISA approach considers that it only occurs when the student has passed all previous questions.

Figure 3 shows the level of competence reached by participants considering PISA approach. The first insight is that a 40% of the participants in the activity did not reach any level of financial competence, which is a higher percentage than the Spanish data based on PISA 2018 report (Spanish Ministry of Education, 2020) - 4%-. Since the percentage of those students who achieved a level 2 of performance is similar, it implies that the percentage of the participants who got at least the minimum basic level of financial literacy necessary to manage their adult lives is lower in the sample analysed than in PISA 2018 report. In addition, it is surprising that the percentage of participants who achieved the maximum level of competence is slightly higher in our sample than in PISA 2018 report.

Figure 3: *Distribution of participants by financial competence level*



When the results are broken-down by gender (Table 3), no significant differences are reported for any question. Men show higher percentage of correct answers than women -except in question 3- which is consistent with previous research in secondary students (Martínez-García et al., 2023; García-Lopera et al., 2021; Cordero & Pedraja, 2019) and in general population (Hospido et al., 2023).

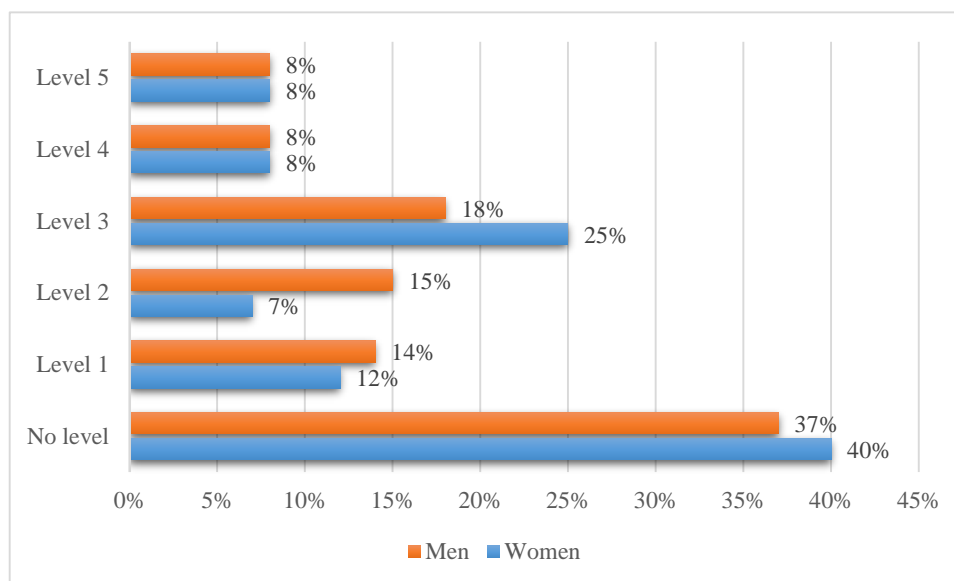
Table 3: *Correct answers for individual questions. Percentage by gender*

	Women	Men
Question 1	60.5%	62.8%
Question 2	63.2%	69.1%
Question 3	58.7%	56.7%
Question 4	21.9%	25.7%
Question 5	16.6%	17.5%

When the level of financial competence is analyzed by gender (Figure 4), several interesting insights could be highlighted. Although more women present no level of financial competence, the average level of performance reached by women is slightly higher. The percentage of participants who reached at least the minimum level of financial competence is practically identical for both genders. It is also remarkable that more men than women who answered correctly question 3 failed in one of the previous questions (i.e., questions 1 or 2).

Table 4 shows the percentage of participants who passed each question by type of school. Significant differences are observed in all questions in this case. A pattern could be identified. The higher percentages are shown by participants from private schools followed by those who studied in government-subsidized schools. The lowest percentages are always reported by those students from public schools.

Figure 4: Financial competence level reached by gender



Even though PISA 2018 results revealed that the type of school did not affect to the financial competences (Martínez-García et al., 2023), our results suggest that participants who studied in a private or government-subsidized school, answered correctly more questions than those who studied in public schools. It is also remarkable that no participants from public schools passed questions 4 and 5, and the fact that the increase in the percentage of students who overcame question 2 in comparison to question 1, which has been pointed out previously, is due to the behaviour of students from public schools.

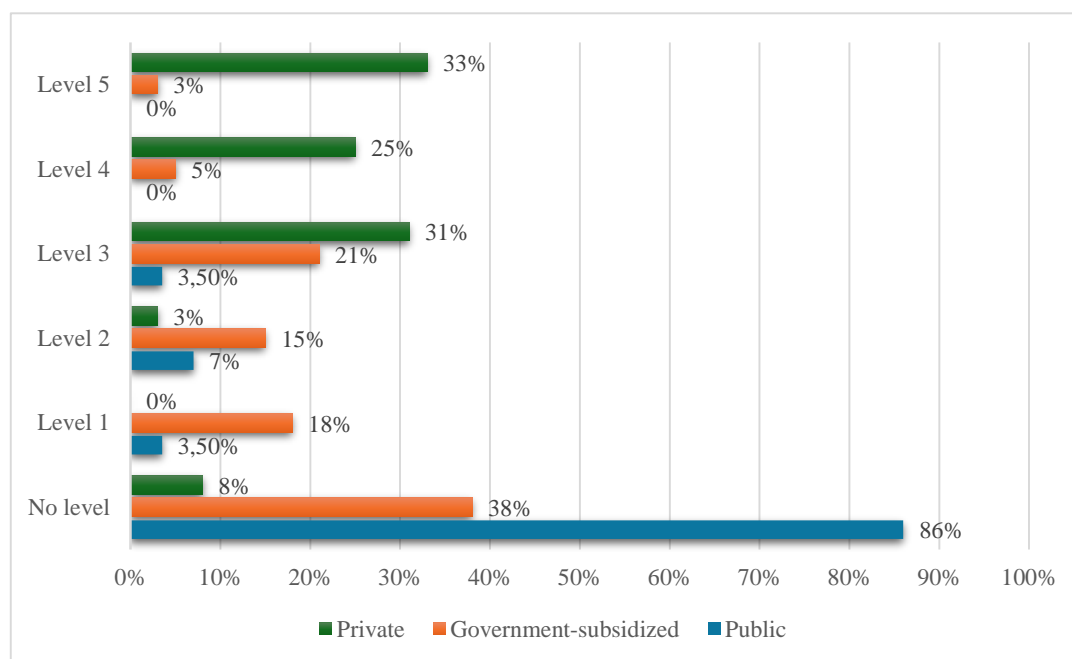
Table 4: Correct answers for individual questions. Percentage by type of school

	Type of School	Percentage	Mean difference statistics (significance)
Question 1	Public	13.8%	26.55 (p<0.000)
	Government-subsidized	61.8%	
	Private	94.3%	
Question 2	Public	24.1%	23.89 (p<0.000)
	Government-subsidized	63.7%	
	Private	100%	
Question 3	Public	10.3%	30.61 (p<0.000)
	Government-subsidized	55.0%	
	Private	97.1%	
Question 4	Public	0%	27.23 (p<0.000)
	Government-subsidized	19.4%	
	Private	65.7%	
Question 5	Public	0%	8.96 (p<0.000)
	Government-subsidized	15.0%	
	Private	37.1%	

Regarding the level of financial competence reached, previous results were complemented by Figure 5. As can be seen, only 10.5% of students from public schools obtained the desirable minimum level of financial competence, while this percentage rise until 41% in the case of government-subsidized schools, being 92% in the case of private schools.

Despite 10.3% and 55% of participants from public and government-subsidized schools respectively overcame question 3, the percentage of students who got at least the level 3 of financial competences (the more advanced ones) was lower (3.5% and 29%) since previously they did not answer correctly questions 1 and 2.

Figure 5: Financial competence level reached by type of school



Finally, Table 5 presents the percentage of participants who successfully overcame each question depending on the enrolment in a Finance or Economics subject. Only significant differences are reported for questions 2, 4 and 5.

Previous evidence in Spain is mixed regarding the enrolment in a Finance or Economics course. While Cordero and Pedraja (2019) did not find significant differences in the level of financial competence reached by students if they received some kind of financial education in high school or not, Salas-Velasco et al. (2021) found a positive impact of the enrolment in a specific finance-related course on the level of financial competence presented. It is important to consider that this evidence is based on results of PISA 2012 report since financial education was mainly taught in other subjects and there was only limited experience on specific courses. This situation has changed in the last years thanks to the Financial Education Plan coordinated by CNMV and Bank of Spain which has increased the number of initiatives to enhance the level of financial competences of the whole population. Consequently, some specific subjects have been introduced in the high school curricula, although only for those students enrolled in Arts itinerary.

Our results indicate that the percentage of participants who passed question 2 is higher in those students who had no previous specific training in Finance or Economics. It could sound contradictory in some way, but it should be considered that Finance or Economics subjects are only taught as a part of the Arts itinerary, students with the highest grades usually opted for Science itinerary, and most students who decide to take Arts are really not good in Maths. This makes those students from Science itinerary usually perform better since they have better marks and continues training their logical reasoning. Martínez-García et al. (2023) supported the key role that maths competence performance has on the financial competence performance. This is one of the continuous claims from

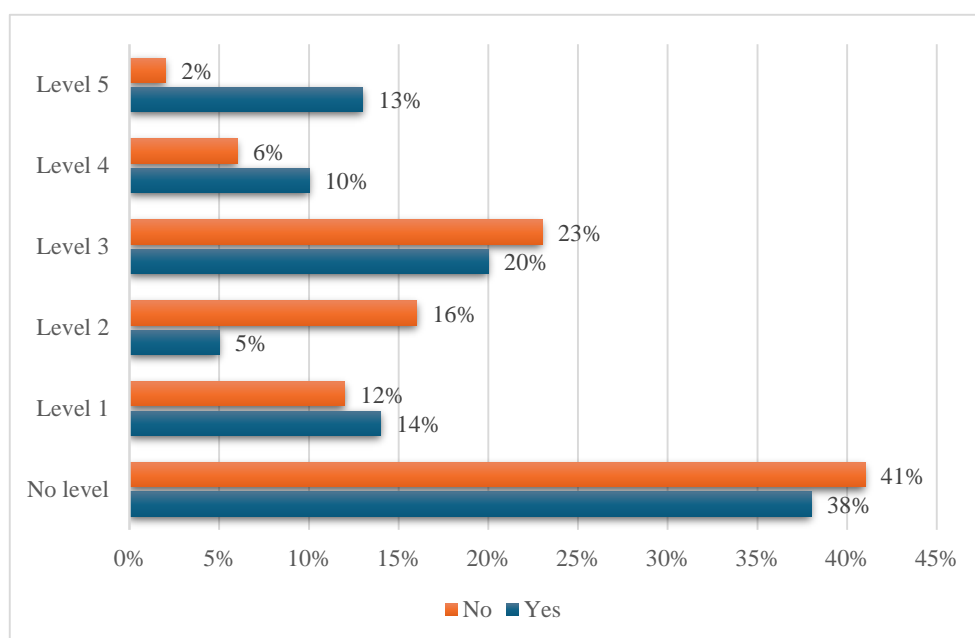
economics association. Studying Economy in high school should go beyond the training in cross-sectional subjects and be mandatory for all students and not only for those who choose Arts itinerary.

Table 5: Correct answers for individual questions. Percentage by enrolment on Finance or Economics subjects

	Enrolment	Percentage	Mean difference statistics (significance)
Question 1	Yes	62.5%	Non-sig.
	No	58.5%	
Question 2	Yes	57.1%	5.09 (p<0.025)
	No	71.7%	
Question 3	Yes	58.9%	Non-sig.
	No	53.7%	
Question 4	Yes	32.1%	6.87 (p<0.009)
	No	16.9%	
Question 5	Yes	24.1%	8.57 (p<0.003)
	No	9.4%	

Notwithstanding, it could also be seen that the percentage of students who passed question 4 and/or question 5 is higher if they were currently enrolled or have completed a Finance or Economy-related course. These findings suggest that this type of competences is trained in the specific subject taught in the third and fourth course of mandatory secondary education for those students enrolled in Arts itinerary.

Figure 6: Financial competence level reached by enrolment in Finance or Economics subjects



Regarding the level of financial competence (Figure 6), we could state that the percentage of participants who reached at least the basic level (i.e., level 2) does not vary when their enrolment in a Finance or Economics subject is considered. As we argue previously, the percentage of students who reached at least a level 4 of financial

competence is higher in those who takes a Finance or Economics subject (23% vs. 8 %) so that the implications stated previously are also supported.

5. CONCLUDING REMARKS

Given that Spanish high school students showed a low level of financial competence, this research aims to highlight the importance of complementing the formal high school education with non-formal activities. Such activities could enhance the financial competence performance of tomorrow's adults and enable them to achieve at least the basic level that allow them to manage their adult life in the financial domain and fully participate in society as an independent and responsible citizen.

Considering this premise a game called "Ranoka" was designed under the conviction that students are more motivated and involved by innovative educational methodologies which allows them to be the protagonist of the process. The activity was valued very positively by the participants.

At this point, it is needed to highlight that it has not been intended to value the effectiveness of the activity designed for enhancing the level of financial competence, but the initiative has allowed us to contribute to the widespread of financial education in Andalusia.

The level of financial competence of students was valued through an extract of PISA questionnaires, which provides useful evidence to explain the low level of financial competences shown by Spanish high school students as well as suggesting some potential measures for future development.

Then, there are about 53% of the participants who did not reach the minimum level that would enable them to be able to manage when they become adults. Also, it is remarkable that when the question refers to sensitive topics for them (such as payment related to the use of mobile phones), the percentage of participants who successfully answers the question increases even though it theoretically required a more advanced level of knowledge and skills. The fact of studying in certain types of schools as well as the fact of being (or had been) enrolled in a specific Finance or Economics subject have emerged as key aspects to be considered. In particular, it is interesting to note the results found depending on the enrolment. While for the questions representing more basic levels of financial competences the participants with the highest percentage of correct answers are those who are not enrolled in specific formal training in Finance or Economics, for the more advanced competence questions the highest percentage of correct answers are given by students taking this specific formal training.

This highlights that the most trained financial concepts and skills in Finance and Economics subjects are those related to questions of more advanced levels of financial competences. However, some of them did not successfully answer the questions related to the more basic competences.

Despite the adaptation of the activity to COVID-19 scenario, several schools decline our invitation to participate due to the protocols implemented as a consequence of pandemia. Although the sample size was enough to get some insights, it should be enlarged to get more robust results.

Education authorities should take the insights of this research into account in developing the educational curricula of high school students. It would be reasonable that more basic competences should be trained in specific course but not only for those students enrolled

in Arts itinerary to ensure that all have the minimum skills to manage in the future. At this regard, training in financial concepts and skills cannot only be relied on non-formal activities, but also requires cross-sectional courses and specific subjects throughout mandatory education. Despite the fact that the last Education Law in Spain - LOMLOE - (Law 3/2020) have given less importance to Finance and Economy subjects and more freedom to regions to decide on them, regions should play a key role in fostering financial literacy in high school students including specific training in the curricula.

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CRedit author statement

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APPENDIX A. QUESTIONNAIRE ON FINANCIAL COMPETENCES

PERSONAL DATA

Age: _____

Gender: _____

Type of school (Public, Private, Government-subsidized): _____

Have you taken or are you currently being enrolled in Finance or Economics subjects? YES ☐ NO ☐

RELATED TO THE ACTIVITY

What would be your overall assessment of the activity (between 1 and 10)? _____

FINANCIAL COMPETENCES

Question 1. Tomatoes in the market can be purchased by quantity or box. A customer states: "The box of tomatoes is cheaper". Provide a reason that justifies this statement:



2,75€/kilo



22€ (box of 10 kilos)

Question 2. Alberto wants a mobile phone but is not old enough to sign the contract. Alberto's mother buys the phone for him and signs a one-year contract. Alberto agrees to pay the monthly phone bill. After 6 weeks, Alberto's mother discovers that the bill has not been paid. **Are these statements about the phone bill true or false?**

	True	False
Alberto's mother is legally responsible for paying the bill		
The mobile store must pay the bill if Alberto and his mother don't pay it		
There is no need to pay the bill if Alberto returns the mobile phone to the store		

Question 3. Mr. Dávila takes out a loan to buy a family car. The interest rate on the loan is fixed. One of the costs Mr. Dávila will have are the monthly loan payments. There are also other costs associated with owning a car, such as fuel costs, and maintenance and repair expenses. Some costs increase if the family uses the car more, while others remain constant.

For each of the costs identified in the table, please indicate whether it "increases" or "remains constant" to show what is likely to happen if the family uses the car more...

	It increases	It remains constant
Cost of monthly loan payments		
Cost of fuel		
Costs of repair and maintenance		

Question 4. Carmelo sees this ad on social networks.

Carmelo has 30 zeds on his phone. He texts the word MONK to 134567. Carmelo does not use the phone again to make calls or send text. He does not add any more credit.

How much credit will Carmelo have on his phone exactly one week later? _____



Question 5. Alex is starting a temporary job that will last 8 months. He has registered in ZBicis app with an annual subscription to commute. It takes Alex between 50 and 65 minutes depending on traffic.

Was it a good economic option for Alex to select the annual subscription? Explain your answer
Yes No

Additional information:

- Annual fee: 180 zeds.
- Monthly fee: 20 zeds.
- Rides between 61 to 120 minutes: 4 zeds
- Rides longer than 120 minutes: 6 zeds

Membership Fee		Zeds
<input type="radio"/> Annual		
<input type="radio"/> Monthly		
<input type="text"/> Number of Months		

Number of Rides	Length of Rides (minutes)	
Unlimited	Up to 60	FREE
<input type="text"/>	61 - 120	
<input type="text"/>	121 or more	
TOTAL		

Source: Own elaboration based on the PISA 2018 Report (Spanish Ministry of Education, 2020).