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Analysis of a Gamified Tool to Promote Motivation and Enhance Global Competencies for Elementary School Students

Manuel Larrosa* 

DINTER - Universidad de la República
Montevideo, Uruguay

Leandro Wives , **Oscar Ortegón** 

PGIE - Universidade Federal do Rio Grande do Sul
Porto Alegre, Brasil

Virginia Rodés 

Instituto del Futuro de la Educación
Tecnológico de Monterrey, México

Ana Corbacho , **Lucía Minini** 

Espacio Interdisciplinario - Universidad de la República
Montevideo, Uruguay

Brenda Salenave 

Universidade Federal de Pelotas (UFPel)
Pelotas, Rio Grande do Sul, Brazil

Abstract. This paper describes the usage experience of a student response system that delivers badges as a pedagogical tool to enhance the development of global competencies among elementary school students. Badges are a gamified element that introduces game dynamics in school environments to promote students' motivation in learning curriculum content. The study followed an exploratory approach to determine teachers' and students' perceptions of their experience with the Global Network Badges rewards tool. A questionnaire was designed as data collection instrument that included gamified elements to be administered to students. For teachers, semi-structured interviews were employed. Analysis was conducted utilizing an interdisciplinary approach, including statistical techniques, data mining, and natural language processing. The results revealed that badges are an effective tool to build a narrative around characters from the general culture in teaching the

*Corresponding author: Manuel Larrosa, manuel.larrosa@gmail.com

curriculum content. Therefore, badges allow for building a gamified ecosystem of resources that works as a motivating ludic element that facilitates access to curriculum content. Among other gamified elements, badges are the most effective tool to build a narrative based on popular characters aligned with students' cultural consumption to reflect complex concepts for elementary school students.

Keywords: gamification; badges; global competencies; elementary school; data collection methods

1. Introduction

There are several definitions for the concept of *competency*, which emphasizes the development of different aspects of personality and skills. According to Luengo Navas et al. (2008), there are two dominant models in force. The first is an Anglo-Saxon model of influence that was popular in the 1990s. This model defines competency in an individual and cognitive manner but was later criticized for its excessive individualism and the absence of sociological, historical, and collective dimensions. On the other hand, years later, a model of French-speaking influence emerged, which developed a greater emphasis on the social component of skills (Esteve et al., 2013). A holistic approach to the concept of competencies defines them as a series of knowledge, abilities, skills, and attitudes that are essential for all individuals in their social relationships and not only in their professional performance (De la Orden, 2011).

Historically, the emphasis of public education in Uruguay has been on the development of skills in literacy and mathematics. This centrality is evident in the evaluation system, which prioritizes these skills, relegating global competencies to a secondary role, in which their evaluation does not require formal feedback or a systematic record. As part of this secondary position, global competencies are addressed in an irregular manner, depending only on teachers' willingness to give them visibility. However, since competencies are not explicitly included in the curriculum, the evaluation system does not allow them to be given a clear place and does not highlight their importance (Alonso et al., 2022).

To address this problem, the Uruguayan State is carrying out an educational reform that proposes a longitudinal view to respond to what children and young people should learn throughout their compulsory education. The country is also defining curricular structures that are capable of balancing academic needs with life training, to finally clarify educational actions, making them explicit through learning goals, objectives, and evaluation criteria (ANEP, 2022).

Although the development of the so-called 21st century skills (collaboration, communication, creativity, critical thinking) has been studied for more than 20 years, its importance lies in the comprehensive development of individuals so that they are capable of immersing themselves in a complex and changing society (Dede, 2009). Despite having been a focus of study, there is still no clear reference framework for the development and evaluation of the competencies that are applied in curricular frameworks (Fullan et al., 2018). In the context of the 21st century skills, the Global Learning Network (GLN), a program that promotes

work on competencies in Uruguayan public education, has added character and citizenship, forming what is referred to as the 6Cs (6 competencies) - in alphabetical order: character, citizenship, collaboration, communication, creativity, and critical thinking (Table 1). The development of these global 6Cs allows students to be aware of themselves and others, integrated as part of a whole in a society and as citizens of the world. The 6Cs foster social, interpersonal, and personal growth skills, which reach far beyond the workplace and have to do with comprehensive training as individuals throughout life.

Table 1: The 6Cs and their scope (based on Fullan et al., 2018)

	Name	Description
1	Character	<ul style="list-style-type: none"> - Learning to learn - Grit, tenacity, perseverance, and resilience - Self-regulation, responsibility, and integrity
2	Citizenship	<ul style="list-style-type: none"> - Thinking like global citizens - Considering global issues based on a deep understanding of diverse values and worldviews - Genuine interest and ability to solve ambiguous and complex real-world problems that impact human and environmental sustainability - Compassion, empathy, and concern for others
3	Collaboration	<ul style="list-style-type: none"> - Working interdependently and synergistically in teams - Interpersonal and team-related skills - Social, emotional, and intercultural skills - Managing team dynamics and challenges - Learning from and contributing to the learning of others
4	Communication	<ul style="list-style-type: none"> - Communicating effectively with a variety of styles, modes, and tools, including digital - Communication designed for different audiences - Reflection on and use of the process of learning to improve communication
5	Creativity	<ul style="list-style-type: none"> - Having an "entrepreneurial eye" for economic and social opportunities - Asking the right inquiry questions - Considering and pursuing novel ideas and solutions - Leadership to turn ideas into action
6	Critical thinking	<ul style="list-style-type: none"> - Evaluating information and arguments - Making connections and identifying patterns - Problem-solving - Constructing meaningful knowledge - Experimenting, reflecting, and taking action on ideas in the real world

Recently, the National Curricular Framework (MCN) developed by the National Administration of Public Education (ANEP) of Uruguay, which promotes so-called *educational transformation*, has made reference to the need to change the current educational curriculum to avoid what is known as curricular *time lag*, that

is, a study plan that is not appropriate to the time and reality in which it is inserted. This document explicitly mentions: “*the change in contexts, needs, and agendas forces us to look at the curricula again and ask ourselves if it responds to the new realities*” (ANEP, 2022, p. 22, our translation). This shift does not mean undermining the importance of essential disciplines in the educational process, but rather developing powerful tools to channel them, while relating their contents to real-life situations and in the everyday environments in which students experience them.

Among the multiple pedagogical practices adopted that have been developed in this direction is the Global Network Badges (GNB), a student reward system that seeks to address this paradigm shift through an approach that introduces ludic dynamics as a method to channel educational content. This approach will be referred to throughout this study as *gamification*.

Therefore, this research is aligned with the current trend of understanding how a competent framework addresses global competencies as life skills, essential in a constantly changing world, to meet the needs of both teachers and students. The recent implementation of the MCN 2022 has introduced the challenge of adapting curricula and teacher training to this new framework. As a result, it is expected to size the contribution of a student reward system to channel concepts from the curriculum through gamified tools.

2. Study Purpose and Research Questions

The purpose of this paper is to describe research conducted on GNB. The first objective was to survey the perceptions of teachers and students regarding a student reward system using badges. The secondary objective was to evaluate its appropriation as a tool to address content in global competencies for elementary school students. The methodology applied a transdisciplinary approach, quantitative as well as qualitative, to describe the data collection techniques used, the analysis tools employed, and the difficulties and opportunities that the team encountered in the process to explain the decisions taken and the results obtained from the research. The paper is structured as follows: background of the platform to be studied; the methodology, sampling frame, and construction of data collection instruments; results of the experiment; and the conclusions obtained.

The following research questions guided the research:

1. What are the perceptions of teachers and students about GNB as a tool to facilitate content on global competencies?
2. How do gamified elements contribute to facilitating pedagogical content based on global competencies for elementary school students?
3. Which gamified elements are identified in GNB as the most useful to channel content about global competencies?

3. Background

For the project *Global Network Badges, a gamified learning ecosystem to develop global skills in the classroom*, the GNB tool was analyzed, a tool developed by Ceibal, an educational agency of the Uruguayan State. GNB is a student response system (SRS) whose objective is to make visible the competencies with which the GLN program works. This badge system uses renowned figures from the sciences

and arts and culture, as well as historical personalities from various fields of knowledge, to represent valuable concepts. These characters offer the possibility to build a narrative about their story to represent curricular content. Figure 1 represents some of the characters displayed in the badges.



Figure 1: Samples of badges from the GNB tool (examples of characters, shapes, and colorful illustrations available on the platform)

The 6Cs with which the GLN program works are structured according to 18 dimensions that define the conceptual content and scope of each of the competencies. In turn, to identify them and enhance the playful spirit of the tool, each one is associated with a color. Table 2 presents the competencies utilized by the GLN program, their corresponding dimensions, and the colors that identify them.

Table 2: Dimensions of the GLN represented in the Logros platform, grouped according to each competency and its respective characters

Competency		Dimensions	Character
Character	1	Self-regulation	Aikido
	2	Determination, tenacity, and resilience	Frida Kahlo
	3	Empathy, solidarity, and integrity	Malala Yousafzai
Citizenship	4	Global perspective	Mafalda
	5	Understanding diverse values and worldviews	Eduardo Galeano
	6	Interest in human and environmental sustainability	Greta Thunberg
Collaboration	7	Interdependent teamwork	Migratory Flight
	8	Social, emotional, and intercultural skills	Mayte
	9	Management of challenges and group dynamics	José Mora Otero
Communication	10	Communication designed for particular audiences	Social Networks
	11	Effective and multimodal communication	Youtuber
	12	Voice and personal and collective identity	Virginia Woolf

Creativity	13	Entrepreneurship	Francisco Piria
	14	Consideration and search for new ideas and solutions	Nikola Tesla
	15	Leadership	Autumn Peltier
Critical thinking	16	Evaluation of information and arguments	Infoxication
	17	Establishing associations and identifying patterns	Sherlock Holmes
	18	Construction of meaningful knowledge	Path to knowledge

4. Theoretical Framework

The types of practices that involve playful dynamics and the use of game elements are included in what is known as *gamification*. By definition, this term refers to the application of game logics to other contexts, with the purpose of inducing the motivating and relaxing experience that playing provides (Hamari et al., 2014). Likewise, there is broad consensus in defining gamification as a series of practices that seek to adapt elements of video game design to other areas of daily life (Deterding, 2011), with the aim of encouraging motivation and participation (Abramovich et al., 2013).

Gamification is a booming field of study in recent years, because its logic has been incorporated into multiple aspects of daily life, far beyond the education of children or young people. It is also present in several of the social networks that are available on the market nowadays; marketing strategies that use widely known trademarks; employee training for companies; mobile health applications; government procedures; and, of course, video game development (Sailer et al., 2017; Zichermann & Cunningham, 2011).

Gamification can be manifested in several ways. This includes the use of avatars, which encourage user personalization; countdown or time response, which introduces a climate of risk and integrates emotion; music and sounds to generate immersion; photos or images to illustrate the topic being discussed and build an aesthetic identity; and going through challenges until reaching a final goal (Larrosa et al., 2023).

Among the most commonly mentioned elements are the allocation of points, badges, leaderboards, rankings, levels, campaigns, and progress bars (Werbach & Hunter, 2012). However, as van Roy et al. (2019) mentioned, each of these elements separately has a different degree of significance in the effects it generates, determining a specific motivational function. For example, personalization promotes autonomy; badges aim to establish clear goals to achieve; leaderboards encourage competition. Therefore, when making a more detailed study of the game design elements grouped within what are considered gamified strategies, it is necessary to analyze each separately to quantify their effects. The literature reviewed in this research suggests that different gamified elements generate differential motivational effects, depending on how the user

functionalizes them, as described by Deci and Ryan (2010) in their self-determination theory. However, these effects have not been profoundly studied. For the purposes of this paper, the focus will be positioned only on the motivational effects that badges generate in the population studied.

5. Methodology

For the methodological approach, the target audience was segmented into two groups: adults and children. The first group corresponds to teachers, whereas the second group corresponds to students. For each group, data collection techniques were adapted to their age and the type of information expected to be accessed. Teachers are considered to be individuals with in-depth knowledge and active use of the GNB tool.

The selection of participants was based primarily on knowledge of how to use the platform, so there was no intention to segment participants according to other variables such as gender, age, or socio-economic characteristics of the school context. In this sense, the sampling was not representative. Subjects are selected based on their wide knowledge of the phenomenon studied, but their perspectives cannot be generalized to the whole country (Creswell et al., 2007).

Data collection for the GNB project involved collecting data from three sources of information. The first was the Logros platform, the environment in which the GNB are presented and displayed, from which the usage data of the platform were collected. The second source used for data collection was semi-structured interviews, carried out with six teachers, one from each of the schools that emerged from the mapping. Third and finally, information was collected using a gamified questionnaire developed in Kahoot.

In the case of the teacher, one-on-one semi-structured interviews were conducted through the ZOOM video call platform, which made it possible to record and transcribe the interviews for later analysis. This was a great advantage due to the location of the schools studied, which were positioned long distances away from where the research team was working. If face-to-face interviews had been mandatory, transport and living costs would have increased the cost of the fieldwork significantly. The video recordings of the interviews were transcribed into text, available to be analyzed afterwards.

In the case of the students, the proposal was to carry out group recreational activities to collect data. The platform chosen to administer the questionnaire and collect the information was Kahoot due to its quality of being ideal for working with children, given its playful, visual, entertaining, online, and easy-to-use nature for both students and researchers when preparing the questionnaire.

Kahoot is one of the most popular applications in the trend toward promoting more participatory learning. It was the first student-based response system and seeks to foster a game experience using the principles of game design and the theory of intrinsic motivation (Wang & Tahir, 2020). It is an educational platform designed to build questionnaires, debates, surveys, and exams, among other possible applications, in which students can interact from any device (mobile, PC, tablet) to participate in the challenges set. In addition, Kahoot can be used as an evaluation tool, since it allows students' answers to be saved for later analysis.

Likewise, this function was used for the GNB project as a data collection tool, since by storing the responses and offering a very well-structured systematization of the results, it is very useful for developing questionnaires to survey information (Casemiro & Costa, 2023).

5.1 Sampling Frame

The selection of participants for the study was carried out by crossing two sources of information, the first being the analytics of the Logros platform and the badges delivered. Since the intervention unit in which the work was executed was the classroom, and the awarding of badges was mediated by the group's teacher, based on this information, those groups whose use of the tool was more intensive were selected. Second, to complement the information obtained from the platform, qualified informants were consulted. These were teachers who had used the tool and mentors of the GLN territory team. The mentors were GLN employees who work directly with classroom teachers throughout the country. Their task is to accompany schools to promote and train teachers in the pedagogical and technical use of the available tools developed by GLN.

Based on the badge award statistics, a nationwide mapping was made showing the schools and groups where the use of the tool was most active. The information retrieved from the Logros platform was used for an initial selection of participants. This data revealed aspects such as the number of visits to the GNB site on Logros, which groups were awarded the most badges, which badges were used the most, whether badges had been delivered only once or several times repeated over time, the periods in which the badges were delivered, etc. The analysis of this information made it possible to map the use of GNB throughout the country. From this mapping, groups of students and their teachers were selected on whom to apply data collection (Table 3).

Table 3: Grades, groups, and total number of students with whom the fieldwork was carried out

School	Province	Location	Grades	Groups
1	Maldonado	San Carlos	5 th	5 th A
2	Lavalleja	Minas	3 rd , 4 th	3 rd - 4 th (together)
3	Durazno	Durazno	5 th , 6 th	5 th A and 6 th A
4	Canelones	Barros Blancos	4 th	4 th A and 4 th B
5	Soriano	Rodó	4 th , 5 th , 6 th	4 th , 5 th , 6 th
6	Flores	Trinidad	4 th , 5 th	5 th A and B, 4 th B
Total				12 groups
Students				211 students

5.2 Semi-Structured Interviews

Based on a selection of the most powerful experiences, individual and semi-structured interviews were carried out with six classroom teachers from each of the schools that arose from the mapping. The interviews sought to obtain information about the knowledge they have of the GNB tool, their involvement

and motivation with the tool, and the description of usage experiences. The interviews were carried out by social sciences researchers with training in conducting interviews and focus groups and collecting data from organic sources, such as body language and vocabulary.

The interviews were recorded using the ZOOM videoconference platform, transcribed, and the results analyzed using Python software for natural language processing (NLP) analysis. Since the use of the GNB tool is mediated by teachers, it is assumed that in the groups where the teacher has in-depth knowledge of and has used the tool intensively, richer information will be obtained from their students. This is because they know the tool and have actively used it, so they can contribute their points of view regarding the gameplay and ease of accessing the content presented.

5.3 Gamified Questionnaire

After identifying teachers who know and make active use of the GNB tool, data collection was performed with the students. However, during the research, a methodological challenge arose of how to evaluate the students' appropriation of the concepts that badges address, which is why an age-appropriate data collection tool was designed for elementary school students. Focus was placed on designing a playful, gamified tool capable of capturing their attention in a fun and entertaining way.

In this context, the possibility of constructing a questionnaire with gamified resources was discussed with the research team, to be applied to the participating students. The questionnaire was developed using Kahoot, an online platform that students know, use often, and that meets the requirements of being playful, visual, and capable of collecting and systematizing data in a way that facilitates its subsequent analysis. Its use is very common among teachers in their classrooms, which is why it is known to students.

Kahoot was chosen because it is an online platform designed to create quizzes, evaluate student learning, and review concepts. It has the particularity that it integrates various elements of game design, such as graphics, music, sound, scoring, leaderboards, etc., to promote motivation among participants by creating a playful and competitive environment that increases their commitment (Kapp, 2012). In particular, this method was chosen because GNB is a gamified tool that promotes playfulness and facilitates participation and exchange.

It also has great visual content and channel stories that include curriculum content. Therefore, the realization of playful group activities was ideal, through which data were collected. The questions were presented based on triggering images - that is, the badges themselves - to evaluate if the students recognized each one, what type of reaction the different characters generated, if students were able to identify the concepts of the GLN associated with each badge, etc.

In addition, online platforms are useful to observe and analyze the interactions between students with the game elements that the GNB tool provides. This method favors a variety of approaches and techniques to break the ice, engage those who may be shy, and remove the researcher from the center of attention so that they can be integrated into the group and go unnoticed in the activities.

Another benefit of Kahoot is that it encourages participation while reducing the fear of making mistakes, which in many cases is what prevents students from participating in class. In this way, trial-and-error processes are encouraged to motivate students to actively intervene in the classroom activities (Navarro, 2017).

Many of the mentioned characteristics are part of video game environments, which are common and widely used by children and adolescents. Therefore, students perceive the use of Kahoot as if they are participating in a game, which generates a feeling of security among users. It is a low-risk environment and is perceived as playful, entertaining, and fun, eliciting intrinsic motivation that positions the student positively toward the activity.

Given these qualities of Kahoot, it is considered an appropriate tool to channel educational content for students, without the pressure of feeling evaluated, and it enables relaxation by enabling playing among classmates. This allows for extra motivation, since, for low-performing students, the classroom can feel like a hostile environment, where there is a fear of making mistakes, being evaluated, and being mocked. There is evidence that so-called gamified student response systems (GSRs), such as Kahoot, improve attention capacity, increase attendance, promote interaction, and provide opportunities for reflection (Magadán-Díaz & Rivas-García, 2022).

Following the logic of Kahoot, different types of questions were administered, that is, multiple choice (quizzes), ranking, and open-ended questions with a word or phrase. Below is an example of a question asked in the gamified questionnaire (Figure 2). The red additions describe the gamified elements used.



Figure 1: Screenshot of the question, *what do you think this badge represents?* used during the questionnaire application

As can be seen in Figure 2, the questions are simple, designed to be answered during class time, consecutively. Moreover, questions have a time limit, which encourages students to focus and pay attention. Despite the time limit, students' answers are not evaluated based on whether they were the fastest, nor is a score or penalty given for correct or incorrect answers. The research team knew the correct answers in advance and compared them with the information provided by the students. This was done to avoid excessive competition between participants and discourage the emergence of winners or losers, favoring a

pleasant and non-frustrating atmosphere. The table in Appendix 1 displays the questions presented through the gamified questionnaire.

5.4 Questionnaire Validation

The validation of the questionnaire was carried out by applying the technology acceptance model 3 (TAM3) based on the one developed by Venkatesh and Bala (2008). According to this model, there are two main determinants when adopting a new technology: perceived usefulness (PU) and perceived ease of use (PEU). When planning the adoption of a new technology by a group of individuals, predicting their intention can offer valuable and accurate information for its implementation (Kriedman, 2016).

According to the TAM model, these variables (PU and PEU) focus on the intention to use a technology, which results in its positive adoption. For real and effective adoption, those reluctant or innovative users must perceive that the technology is easy to use as well as useful to apply. The TAM model indicates that the behavioral intention of an individual can predict the behavior of using technology. Tables 3 and 4, respectively, provide a description of the TAM variables and constructs that were taken into account for the gamified questionnaire design.

Table 3: Variables of the TAM model used to develop the gamified questionnaire

	Variable	Description
1	Perceived ease of use	If the technology is perceived as easy to use
2	Perceived usefulness	If the technology is perceived as useful
3	Behavioral intention	The intention for the use of the technology

Table 4: Constructs of the TAM model used to develop the gamified questionnaire

Construct	Description
Attitude	Describes how an individual expresses negative or positive feelings about performing an expected behavior (e.g., using a system)
Behavioral intention	The degree to which an individual consciously and intentionally formulates plans to execute or not execute certain specific future behaviors
Computer anxiety	The degree of an individual's apprehension, or even fear, when they are faced with the possibility of using a computer
Computer self-efficacy	The degree to which an individual believes that they have the ability to perform a specific task/job using the computer
Perceived usefulness	The degree of ease associated with using a system
Facilitating conditions	The extent to which an individual is confident that adequate organizational and technological infrastructure is in place to facilitate system usage
Image	The degree to which the use of an innovation is perceived to improve an individual's status in the social system

Job relevance	The degree to which an individual believes that the target system is applicable to their job
Output quality	The degree to which an individual believes that the system performs their job tasks well
Performance expectancy	The degree to which the individual believes that using the system will help them obtain gains in their work performativity
Perceived enjoyment	The extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use
Social influence	The degree to which an individual perceives that it is important to others that they use the new system
Subjective norm	The degree to which an individual perceives that most people who are important to them think that they should or should not use the system
Voluntariness	The degree to which the individual perceives the technology as optional

6. Results and Discussion

Data analysis was conducted on the two large sets of data collected. Quantitative data analysis was carried out on the data obtained from the gamified questionnaires administered through Kahoot. On the other hand, qualitative data collected through the semi-structured interviews with teachers were analyzed using text mining and NLP, which are techniques used in computing to process and analyze data and information in textual format. For the quantitative analysis, the first step was to clean the data that were extracted from Kahoot.

A virtue of the application is that it has a very user-friendly data output that performs an initial grouping and systematization of the results, depending on how the questions have been constructed. However, despite clear data output, data cleaning is necessary for subsequent analysis. For this purpose, data were grouped and segmented according to age, gender, and students' level of education for later analysis, which allowed us to utilize diverse approaches and find subtle nuances on the topic.

To gain insight into the correlation between the characters and the competencies they represent, students were shown different badges and had to select from a series of options which ability each badge represented. Students were asked the question: *What do you think this badge represents?* (see Figure 2). Figure 3 illustrates the frequencies of right guesses to the question. At the same time, beyond the preference for badges from one competency or another, there were great differences between the badges, even within the same competency.

In some cases, the percentage of right guesses was high (above 50%), while in other cases, it was quite marginal. As an example, the badges of José Mora Otero, Migratory Flight, Youtuber, and Social Networks from the collaboration and communication competencies were among the ones that had a high percentage of right guesses (see Figure 3). This approach is consistent with the overall results,

since, among all the competencies, collaboration and communication were by far the most clearly interpreted and remembered by the students.

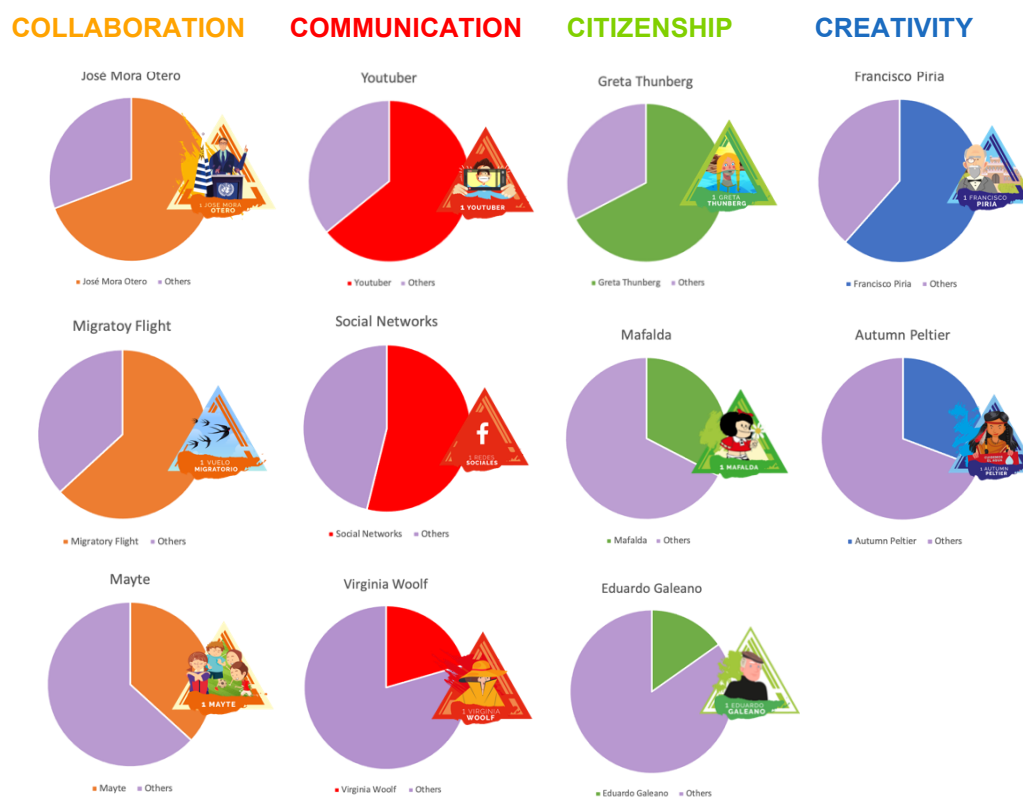


Figure 3: Frequency of right guesses among 4th Grade students in recognizing the meaning of a particular badge from the image

According to the research questions posed, clear differences emerged between teachers and students. Their approach to the tool varied significantly, aligned with their age, preferences, and personal motivations. The first research question, namely, *what are the perceptions of teachers and students about GNB as a tool to facilitate content on global competencies?* highlights that the GNB is an engaging tool to apply in the classroom. It favors the active involvement of students and, at the same time, facilitates teachers' content design focused on global competencies.

Based on the second research question, namely, *how do gamified elements contribute to facilitating pedagogical content based on global competencies for elementary school students?* it could be concluded that the selection of characters associated with pedagogical content from the curriculum promotes opportunities to design classroom activities and dynamics to motivate students through active learning and deep immersive engagement.

Regarding the third and last research question, namely, *which gamified elements are identified in GNB as the most useful to channel content about global competencies?* several gamified elements could be identified from the experience. For instance, the colorful illustrations; the usage of cartoon characters instead of photographs; the different shapes of the badges, depending on the level achieved; the feedback

given when a badge is received by the students; etc. However, the most engaging gamified element was the narrative built around each of the characters. This element was the most effective in channeling curriculum content because the story of the character, their life experience, and the approach to the qualities linked to everyday students' lives are powerful resources available for teachers to carry out their duties.

In the case of the teachers, it emerged that some competencies were more accessible for content design than others. This is clear for the competencies of collaboration and communication, which were the most often and repeatedly mentioned during the semi-structured interviews, especially the communication competency. Figure 4 shows the frequency of each of the competencies (6Cs) in each of the interviews conducted with the teachers.

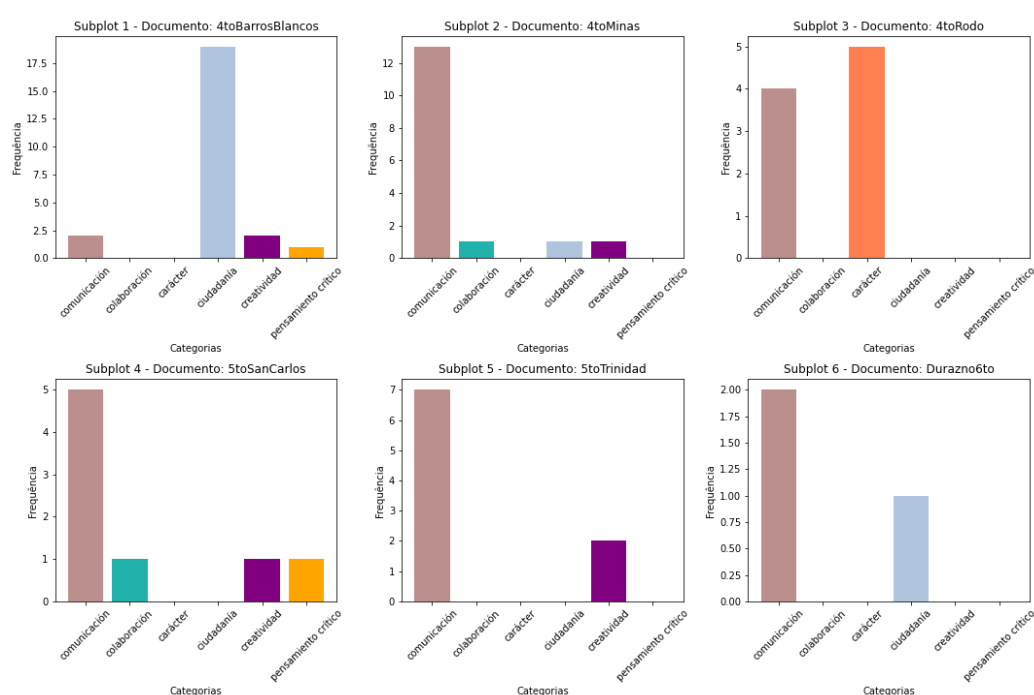


Figure 2: Frequency of each of the 6C competencies in the interviews with teachers

As can be seen, the communication competency (brown bar) was mentioned in all cases, and in most of them, it had the highest frequency by a wide margin. In the case of the collaboration competency (green bar), its results are more marginal according to the analysis; nevertheless, when analyzing the usage data taken from the Logros platform, its presence is important. At the same time, to reinforce this point, analysis carried out using NLP showed that in the interviews with the teachers, the communication competency was one of the most mentioned topics, second to formative assessment (Figure 5).

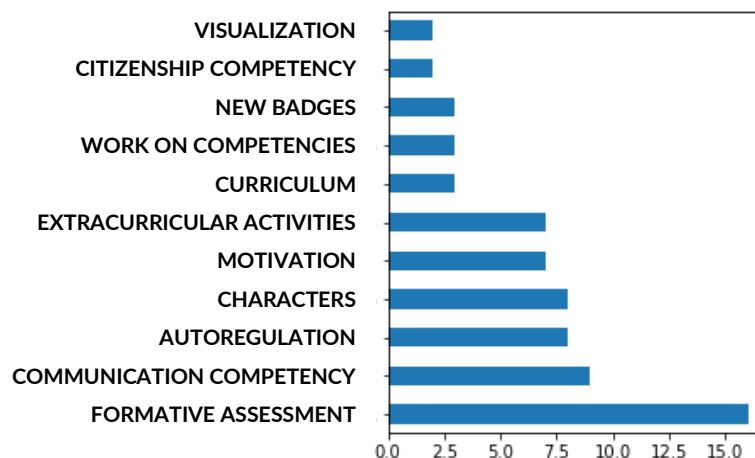


Figure 3: Frequency of topics in the number of times mentioned during the interviews with teachers

The triangulation of the three sources of data collected (i.e., from the Logros platform, interviews with teachers, and gamified questionnaire with students) is consistent with the above results and accentuates the preference towards the communication and collaboration competencies (see Figures 3, 4, and 5).

Figure 6 shows the results of students' responses to the question, *which badge would you award yourself?* As can be seen, students' preferences differed from those of the teachers. For instance, the two most preferred characters and their corresponding competencies did not coincide with the competencies most mentioned by teachers (see Figure 4).

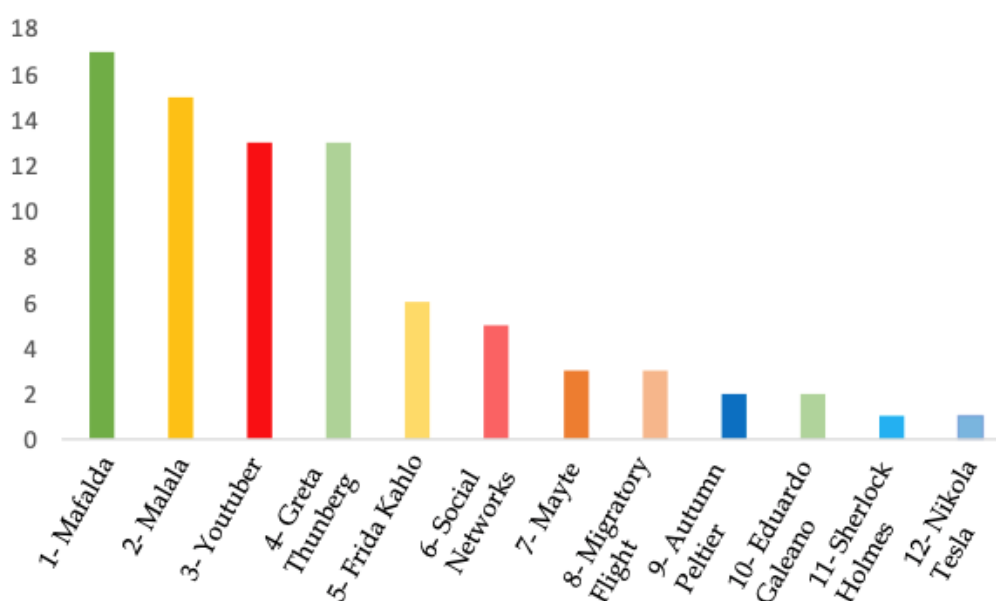


Figure 4: Results of the question, *which badge would you award yourself?* among the 4th Grade students

For the students, the results varied slightly, since the competencies chosen by the students differed from those chosen by the teachers. When asked, *which badge would you award yourself?* The five most chosen badges were Mafalda, Malala, Youtuber, Greta Thunberg, and Frida Kahlo, as shown in Figure 6. Among these, there is no collaboration competency. Moreover, added to this are the character and citizenship competencies, which were also not among teachers' preferences.

This is significant. It suggests that for the students, the figure of the character, its story, and the daily link it has with their cultural consumption is stronger, rather than the concept it transmits, and not necessarily the content of the competency to which it refers. This is clear for the Youtuber and Social Networks badges, which were the most used, the most chosen by students, and for which it was easier for students to identify what they represent. This is because, despite their age, these are elements that are part of their daily lives and with which they regularly interact.

To evaluate the students' appropriation of the concepts that each of the badges represents, they were asked the question, *what do you think this badge represents?* (Figure 2). Figure 3 was created based on their responses and shows that some badges had a higher right-guess rate than others. In this sense, several hypotheses emerged, which have to do with the fact that some characters are more linked to the daily lives of students, are part of their cultural consumption, and, therefore, they identify with them. In other cases, the choice was determined by the design of the badge, which awakened their interest and aesthetic taste.

In the case of the other badges mentioned (Mafalda, Malala, Greta Thunberg, and Frida Kahlo), interpretation of the results implies that the concepts they transmit are more accessible for the students' age and cognitive development than more complex concepts associated with other competencies. This is because they transmit clear ideas that are simple to assimilate and accessible to be channeled to elementary school students.

As for aesthetic identification, some badges simply convey a taste for the character's design. However, gender identification was also significant, since, when segmenting the preferences of girls and boys, when asked, *which badge would you award to yourself?* in the case of the girls, a tendency manifested to choose female characters (Figure 7). This was particularly evident among the girls in the 4th and 6th grades. Conversely, the boys' selections did not manifest this bias. Overall, the tendency is diluted, but it is nevertheless significant.

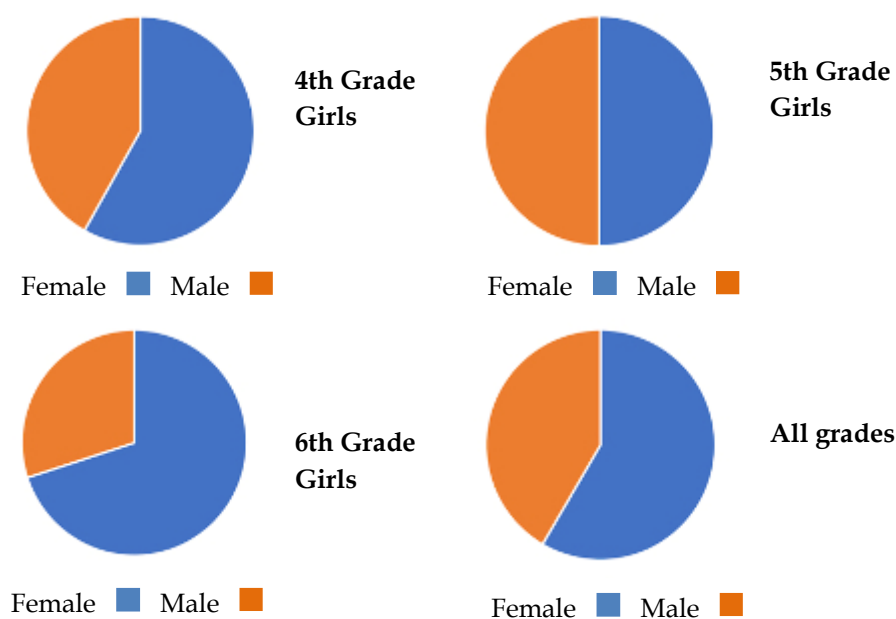


Figure 5: Results of female students' preference for badges of female or male characters

Another important observation is that from all the badges displayed on the Logros platform, not all were of the students' preference. In fact, of the 18 badges presented, only 12 were mentioned, and only 6 were the most remembered, as seen in Figure 6. This result shows that there is a great conceptual dispersion, since each of the 18 badges represents a particular concept, but in many cases, has very close intersection points with other badges. These conceptual similarities mean that in some cases, the concepts become confusing and the differences between them are unclear. This makes it difficult to link the character with the concept they convey, or the one can be confused with the other, as shown in Figure 8 below.

To mention one case, the dimension of Mafalda's badge is called *global perspective* and refers to the active involvement in thinking and taking actions, individually or in groups, on issues of global scope. Conversely, the dimension of Eduardo Galeano's badge is called *understanding diverse values and worldviews* and refers to interest in the world and the people who inhabit it, and curiosity about different cultures and points of view.



Figure 6: Images of the badges of Mafalda and Eduardo Galeano, which belong to the same competency and transmit very similar conceptual content

Note that in the case of the teachers, reference is made to the competencies that are included in the 6Cs, while among the students, the skills from each competency are addressed with badges. This is because the concept of competency and what it represents are abstract ideas that are difficult to understand by elementary school students. This is the most important functionality of the tool: being able to transmit through simple stories, associated with characters, educational content from the curriculum.

For this reason, to adapt the contents to the age of the students, these are associated with badges and the characters they represent. This fact was reflected during the study. The most used badges were those for Social Networks and Youtuber, given the easy understanding that these concepts have among students and because they clearly know what they refer to. However, in other cases, badges such as Autumn Peltier or Eduardo Galeano had less impact among the students. This is mainly because they are figures that are not part of the students' daily cultural consumption, but more profoundly, because the concepts they transmit are more complex, and therefore, more difficult to approach in the classroom.

7. Conclusions

From the analysis carried out, it emerged, in the first instance, that there were clear preferences among the teachers and students for particular badges, and even more so, for certain competencies. However, the richest aspect of analysis was the interpretation of the reasons for the tendency towards the choice of certain badges or competencies. In the case of the students, the character that the badge presents, its image, their daily connection, their gender identification with the character, and even their aesthetic preferences, weighed more than the concepts associated with the badge.

This is evident in the choice of certain badges, such as Youtuber and Social Networks, which were the most common among students in all studied grades and from different locations throughout the country. Furthermore, these badges were among those with the highest right-guess rates, that is, they were clearly identified by the students, and even when asking the students which *badge would you award yourself?* They were also among the most mentioned (Figure 6).

Triangulation between the three sources surveyed (i.e., Logros platform usage data, gamified questionnaire by Kahoot, and semi-structured interviews with teachers) revealed that, in all cases, the communication and collaboration competencies were the most widely used, carried the strongest preferences among teachers, and were the most remembered by students. This fact reinforces the hypothesis that they represent more easily accessible concepts for classroom dynamics design and that they can be transversal to any topic to be addressed. The main finding of this study, as well as the experience accumulated since the launch of the GNB tool in 2020, is the richness of resources that allows the use of characters to weave a narrative around concepts that can be complex for girls and boys of elementary school age.

7.1 Recommendations for Elementary School Practitioners

A strong recommendation that emerges from the study is the selection of characters and stories close to students' daily life, interests, and cultural

consumption. In many cases, widely known characters that are far removed from the everyday lives of the students were not well received, beyond the fact that their lives and work could be very valuable and are directly linked to the content of the competency and skills they represent.

7.2 Limitations

The main limitations of the study are related to the methodology applied. Any research methodology that uses interviews as a data collection method involves the presence of social desirability bias. This is a common bias that must be kept in mind when conducting interviews, as it can significantly contaminate the collected information. This bias relates to the tendency among interviewees to present their best selves and, therefore, avoid speaking openly about certain topics that may be uncomfortable or expose negative aspects of themselves.

In this research, this bias was less prevalent, since the subject of research is not a sensitive topic, as is the case with other topics where this bias is crucial, such as illicit drug use, sexual abuse, or domestic violence. However, to a greater or lesser extent, it may have been present and had to be taken into account. For example, unconventional use of the GNB tool may be underrepresented in the interviewees' responses, or the recognition of low use of the tool in the classroom, due to them not finding it to be of substantial use.

For this reason, Groves et al. (2004) suggested that, to counteract this bias, it is important to combine the use of interviews as a data collection method with the use of collection methods called "objective measures", for example, administrative records, direct observation, and statistical data, among other methods. The purpose of combining methods is that the discourse offered by the interviewee may be colored by their subjectivity, thereby offering information that presents them in a positive light. Meanwhile, by using different data sources, the object of the study can be approached from various perspectives, and the information collected by each source can be contrasted. This complementary information can help overcome the weaknesses of the different data sources and fill in any gaps that may exist between them.

However, it must not be ignored that the objective measures suggested by these authors can circumvent the subjectivity that creeps into the interviewee's discourse but are also colored by the subjectivity of the interviewer. For this reason, the choice of data collection method is crucial. The more impersonal the method - for example, on a continuum: face-to-face interviews, telephonic interviews, or self-administered online questionnaires - the more social desirability bias becomes present. In this sense, videoconference interviews were a choice that sought to mitigate contamination of the collected information, while offering advantages in terms of costs, logistics, and data processing.

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Appendix 1

Questions deployed in the questionnaire

	Question	Type
1	Which of these badges did you receive?	Multiple choice
2	How did you receive it?	Survey
3	Would you prefer to receive it in paper or digitally?	Survey
4	How did you feel when you receive it?	Word cloud
5	When was delivered, did you tell anyone? To whom?	Word cloud
6	What do you think this badge represents - Eduardo Galeano	Multiple choice
7	What do you think this badge represents - Greta Thunberg	Multiple choice
8	What do you think this badge represents - Mafalda	Multiple choice
9	Order the badges, from the one you like most to the one you like less.	Puzzle
10	Imagine you have to give a badge to yourself, which one would you choose, why?	Open question

Screenshots of the whole gamified questionnaire:

QUESTIONNAIRE