

## **Navee educational project: potentialities and contributions to the teaching and learning process from the digital education perspective**

*Projeto educacional navee: potencialidades e contribuições para o processo de ensino e aprendizagem na perspectiva da educação digital*

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### **Abstract**

The Navee Educational Project was developed by the Center for Digital Education (CDI) through a technological and gamified approach. This project is a digital educational environment organized utilizing a game that aims to broaden, review and deepen students' teaching and learning processes in Basic Education. Through theoretical references of education and different contemporary methods, Navee provides great pedagogical potential by providing an environment that complements school practices, arouses students' interest in their educational process, and supports teachers and parents.

**Keywords:** digital educational project; gamification; digital technologies; games.

### **Resumo**

O Projeto Educacional Navee foi desenvolvido pelo Centro de Educação Digital (CDI), por meio de uma abordagem tecnológica e gamificada. Esse projeto constitui-se como um ambiente educacional digital organizado por meio de um jogo que tem como objetivo ampliar, revisar e aprofundar os processos de ensino e aprendizagem dos estudantes da Educação Básica. Por meio de referenciais teóricos da educação e das diferentes metodologias contemporâneas, o Navee admite grande potencial pedagógico oferecendo um ambiente que complemente as práticas escolares, desperte o interesse dos estudantes com seu processo educativo e sirva como meio de apoio para professores e pais.

**Palavras-chave:** Projeto Educacional Digital; Gamificação; Tecnologias Digitais; Jogos.

## 1. INTRODUCTION

Among the different impacts of the COVID-19 pandemic, the field of education was one of the most affected, right after health. Most of the world's population could only imagine learning happening in institutionalized school spaces, but as of 2020, this perception changed significantly (CORDEIRO, 2020; PALUMBO and TOLETO, 2020). The solution found was the replacement of face-to-face teaching with remote models mediated by technologies through computers and cell phones.

Technological and digital education is now part of school life, and we cannot return to the previous teaching models, since both teachers and students have been transformed in how they see education (GATTI, 2020). Among the possibilities for the future, it seems unquestionable that technology will be an increasingly significant resource in a world moving towards a digital age. Research already indicates that post-pandemic education has accelerated the entry of technology into schools in a permanent way (ALMEIDA et al., 2020; ORTEGA and ROCHA, 2020).

With this view of using technology and digital media in a post-pandemic education, with students increasingly connected and close to technologies, SENAI's Center for Digital Education (CDI) has developed an educational learning project called 'Navee.' It is a digital gamified environment designed to meet different stages of basic education and their respective areas of knowledge, offering educational support to the concepts learned in school and bringing new learning in a more engaging format for students.

The trigger point for this project was initially the recognition of the impact of the COVID-19 pandemic on school learning, as already pointed out by different studies (QUEIROZ, SOUZA and PAULA, 2021; SANTOS et al., 2022; BARBOSA et al., 2022). To meet the gaps left by the pandemic, school education needs to develop pedagogical support strategies, and this project could meet that demand.

Throughout its creation<sup>1</sup>, this project has shown itself capable of going beyond the goal of acting as a support or school support and providing different experiences and learning that can add innovative and differentiated learning for students. Navee's Educational Project<sup>2</sup> can be understood as a digital and gamified educational environment, consisting of a game that aims to broaden, review, and deepen the teaching and learning processes of students in Basic Education during their current school year.

For the development of this project, we are based on different theoretical aspects that have contributed to its development. Among them, we highlight the potential of gamification (SEIXAS et al., 2014), active methods (BACICH and MORAN, 2018), playfulness in games (ROMERO, 2015), the education for skills and abilities (BRASIL, 2018), and the perspective of forming a student who is a protagonist in their learning and acts critically, autonomously, and responsibly in society (SESI, 2020).

The main objective of this article is to **present and discuss Navee's Educational Project, its importance, and its potential for contemporary pedagogical practices.**

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1 Navee's name is still temporary. It will be updated later on, but for this article, we will use this temporary term.

2 Navee's Educational Project started at the end of 2020 and is still being structured. Therefore, we will not deal with it in this text as something finished, but as something in continuity and subject to change.

## 2. METHODOLOGY

The present project is based on different methodological perspectives that make up the contemporary pedagogical dimensions, defended by the different levels of education of the FIESC institutions. Firstly, due to the technological character, we highlight the biases of digital education. Next are the active methodologies, the games, and the gamification in searching for an autonomous, participative, and protagonist student. Not far from that, we bring the concepts of education by competencies that close this theoretical-methodological contribution that Navee's project uses.

### 2.1 Digital Education: technology as an ally

Technology and new media tools have transformed education and reconfigured teaching systems and educational environments. To disregard this is to lose the opportunity to keep up with social changes and keep the educational process updated (MOREIRA, 2018). With the COVID-19 pandemic, it has become even more evident the need to be connected and to assume a commitment to digital and inclusive education; it is by contributing to the insertion of the digital education that the Navee project is configured.

In line with Moreira and Schlemmer (2020, p. 8), we understand that “digital-mediated education is part of a new educational ecosystem that has greatly contributed to the reconceptualization of the teaching and learning processes.” Therefore, Digital Education can be understood as a set of processes that turn to teaching and learning, constituting a new means of exercising them by different technologies and digital instruments.

Contrary to popular belief, Digital Education is a human movement because technology alone does not transform anything without an

agent on the other side. Therefore, the appropriation of technology should not be seen as something that diminishes the social values of education but rather as an advance that allows digital tools to be used in favor of the school. The SESI Curricular Proposal also highlights the importance of this look:

In this case, treating digital culture as opposed to formal education can be disastrous. In fact, we need to use it as an enriched medium endowed with aggregative capabilities in which to adopt the newest languages and their modes of operation, unveiling possibilities of communication that educate for more democratic uses of technologies and for a more conscious dialogic participation in this society that emanates information and knowledge through digital elements. (SESI, 2020, p. 84).

Whether through virtual communication environments (web conferencing), different forms of interaction (forums, e-mail, chat groups), assessment tools (forms, slides, online documents, photos, and videos), or digital teaching resources (dynamic software, websites, and multimedia), these are all devices available to a society that can enrich teachers with new ways of working.

The BNCC (2018) also explains the importance of working within digital proposals. One of its general competencies brings this highlight: “Understand, use and create digital technologies of information and communication in a critical, meaningful, reflective and ethical way in various social practices [...]” (BRASIL, 2018, p. 45). Thus, it is up to all agents and professionals in education to mobilize means to build educational environments that bring students into contact with the technological and digital world.

## 2.2 Elements for motivation and engagement: Active methodologies, games, and gamification

When a new project or educational environment is developed, it is necessary to consider what means will be used to keep students motivated and interested in learning. Although we understand that these aspects are subjective and that each student can be motivated by different things, the use of technologies, games, active methodologies, and gamification has proven effective in this process (PIMENTA and TELES, 2015).

When talking about active methodologies, we refer to “any method of instruction that involves students in the learning process” (GAINOR, BLINE & ZHENG, 2014, p. 1). More specifically, such methodologies “should foster student self-management in the training process to promote greater effectiveness in varied teaching environments” (SOUZA et al., 2020, p. 3). Thus, in the view of active methodologies:

The student is always the protagonist in the development of activities; they need to assume a more participatory posture, in which they solve problems, develop projects, and create opportunities to construct knowledge; participate in practices that provoke curiosity, overcome challenges, work collaboratively, and develop autonomy in decision-making. (SESI, 2020, p. 112).

Once we understand the theoretical aspects of active methods, we need to reflect on ways to conceive them in educational practices. It is often difficult to think of strategies that place students as the main agents of their learning or even stimulate participation and engagement. To get around this, we believe

that using technologies, games, and gamification elements can be an interesting strategy to achieve these goals.

When we talk about educational games, we have several studies that show their effectiveness for learning (ALVEZ and BIANCHIN, 2010). The sphere of playfulness has been widely related as a factor that develops students’ interest in games (MENEZES, 2015). Games that aim to be educational must be “[...] linked to learning objectives, a game experience for the user, a positive learning experience, and the use of game mechanics and rules” (ROMERO, 2015). Therefore, the game has to be thought of in the different spheres that ensure a clear understanding of what is being played, its rules, scores, and how the concepts/contents will be explored through the game.

Currently, with the great technological advances we have faced, games that used to be limited to physical media appear on different digital platforms. This field has opened space for gamified games, or simply, gamification. For Silva, Sales, and Castro (2019, p. 6), gamification “consists of the use of game design elements in the learning environment to engage, motivate, and improve student performance,” that is, one learns during the game. It has also been understood the importance of game emblems (i.e., artifacts linked to medal systems, uniforms, avatars, and other codes or resources that lead to certain visual representativeness) (ANTIN and CHURCHILL, 2011).

Unlike a traditional game, gamification has some characteristics such as it has a specific system of operation, interaction and monitoring among players, feedback and scores that accumulate, defined context; storyline, rewards for tasks, ranking, quali-quantitative analysis of data, entertainment, and playfulness, among others (MENEZES, 2015).

With the evolution of video games, computers, and cell phones, gamification activities have improved user experience and engagement (DETERDING et al., 2011). In this sense, a project incorporating such elements of gamification and methodologies activities can have a critical pedagogical role in teaching and learning.

## 2.3 Skills-based Education and the BNCC

In the different modalities and stages of education, it has been argued that training should focus on developing competencies and skills for social and professional use (WIT-TACZIK, 2017). For this, it is necessary to think of pedagogical formats that lead the teaching processes to promote such competencies, which contributes to the subject being able to “know how to make decisions, mobilize resources and activate schemes (re-viewing and updating habits) in a complex of complexity” (PERRENOUD, 1999, p. 8).

Working from this perspective requires teachers and institutions to think of teaching formats that go beyond a fragmented view of knowledge because, here, what matters is to develop the student as a whole. In other words, the focus is not to look at the error itself and design activities that seek to identify knowledge that the student has not acquired but rather to verify whether, during the process, there was an appropriation of competencies and, based on this, to design actions to promote it.

The Common National Curricular Base (2018), an official document of a normative and mandatory nature, provides the learning rights of basic education, organized into competencies and skills. The BNCC defends that:

“[...] pedagogical decisions must be oriented towards developing competencies. Through the clear indication of what students should “know” (con-

sidering the constitution of knowledge, skills, attitudes, and values) and, above all, what they should “know how to do” (considering the mobilization of this knowledge, skills, attitudes, and values to solve complex demands of everyday life, the full exercise of citizenship and the world of work), the explicitness of the competencies offer references for the strengthening of actions that ensure the essential learning defined in the BNCC (BRASIL, 2018, p. 13).

The BNCC understands that by developing the set of skills and abilities, we will be moving towards the implementation of a comprehensive education of students, i.e., teaching processes that “promote learning in line with the needs, possibilities and interests of students and also with the challenges of contemporary society (BRASIL, 2018, p. 14). Therefore, we understand that in developing an educational project, one must consider all the complexity of education by competencies and promote activities in which the student can develop objective skills and abilities.

## 3. RESULTS AND DISCUSSION

In this section, we will present the organizational structure of the present project, as well as some details of its functioning, tasks, connections with documents, guiding theoretical references, and gamification.

### 3.1 The structure of the gamified game

First, we need to return to some important points that were integrated into this project and justify the way it is thought: the gaps that the pandemic has provided in students, the growing debate of digital resources, the influence of BNCC in defense of digital culture in school, the profile of today’s students whose majority is in constant contact with

cell phones and computers. The intersection of these factors generated the idea of this project, which we call a gamified educational environment because this project offers not only a gamified game but a pedagogical system for monitoring students that aims to diagnose the learning of content.

In this initial phase, the Navee project was built to attend classes from the Final Years of Elementary School (6th to 9th grades). We intend to continue it for High School, making the necessary thematic adaptations for a more mature target public closer to the labor market and college entrance exams. At this point, the environment has been designed to meet

the age bracket of students from approximately 11 to 14 years of age. Therefore, the trend is for a more playful look. It can be used on cell phones or computers.

Hence, offering this game to municipal and state education departments are potential possibilities for them to use this product as an educational tool to support schools and new learning opportunities. Currently, it is being tested in some partner schools to follow its progress and the students' impressions and identify elements that can be improved. In Table 1 below, we present the main elements of the game that is the flagship of the project:

Table 1 - Elements of the Navee Project

ELEMENT	DESCRIPTION
Context	The game begins by introducing the main character: SIG and the game's plot. He was piloting a spaceship that crashed on Earth and suffered various malfunctions. The cybernetic traveler SIG also suffered a breakdown upon impact and lost much of his memory with knowledge about the planet Earth. For each task you do correctly, you regain your memory.
Phases and levels	The phases of the game are the tasks that the players (students) need to do, and the game's levels are called 'tracks', which are like a set of tasks that make up the game's stages. At first, for a school year, the game intends to have ten trails, that is, ten levels that the student must go through throughout the school year.
Knowledge Exploited	At this moment, the game is addressing all the areas of knowledge of the BNCC (mathematics, languages, natural science, and humanities). In addition, it also has questions on socio-emotional and logic.
Task Types	The tasks that make up the game stages have different styles: Questions, Experiments, or Challenges. Questions can be in objective tasks (tick), fill-in-the-blanks, or pair formation. Experiments are activities where the student tests an experiment to learn about a phenomenon or skill that can be achieved through practice. The delivery format here is in the form of audio, videos, photos, or text in the specific field. Challenges are an activity that refers the student to construct or developing an object, using their own resources and everyday life, to challenge them to understand a phenomenon. The challenge delivery format is the same as the experiment. The Question type tasks have an automatic right or wrong answer, while the experiments and challenges the student will receive after a tutor corrects.
Visual elements (avatars, maps and design)	Besides the main character SIG, the student will have contact with different avatars throughout the stages. Most of them are historical characters from different areas of knowledge that will accompany them on their journey of knowledge. The maps are thematic, containing elements that refer to the concepts worked on in the tasks.

ELEMENT	DESCRIPTION
Interaction (Chat, feedback and comments)	The game has a Chat field where the player can ask questions to the monitor in case of technical difficulties or specific doubts about the task. For each completed task, the player will receive explanatory feedback about the correct answer for correct and incorrect cases. The specific tutors of the knowledge areas that will correct challenges and experiments, besides posting the score will also be able to comment on the player's delivery and help with misunderstandings that may arise in these deliveries.
Scoring and reward system	For each correct answer, the student will receive a specific score depending on the difficulty level and type of task. These points form a ranking in which the student will know his general position in relation to other players of the same grade and the entire school. Except for the first places, the other places will not be presented to everyone, leaving only the player to have this information and decide if he wants to share it. With the scores, the player will be able to exchange these points for some rewards that will be constantly updated. In the test phase, we offer World Cup stickers and free time to mess around on the cell phone. This last reward is made so parents can trade cell phone or computer use time with their children upon good performance in the game.
Pedagogical elements	Teachers with teaching experience in the knowledge areas and post-graduates are developing each task. Each phase is designed to achieve the general and special skills of the BNCC, as well as the skills of the objects of knowledge. This data is not available to the player but is made available to the school's educational team, the students' parents, and teachers.
The continuity of the game	In this kind of gamified game, it is important to have continuity. So the idea is that the game will be kept up to date throughout the school year and will start the following year again. The player must complete the Learning Tracks that will appear continuously throughout the game. Each track is like a season the student needs to beat to start the next one.
Extra storyline	In cases where there was an error in the task, the player can still earn points in another way with extra phases. SIG will provide another way to test the knowledge, to check if the correct understanding has been reached. These ways also provide the opportunity to reinforce the same skill as the phase in which the error occurred.

Source: From the authors (2022)

Table 1 specifies how gamification was incorporated into the game and that it is the main driver of actions with students. The initial context of a robot that keeps learning here on Earth will be the same throughout the game because the idea is that the student puts himself in the place of the character SIG over time. Through his journey through the stages, students will have access to graphs and indicators of which areas of knowledge SIG is advancing more or less. The intention is for the student to see which content they are developing the most and that parents or school

teachers can access these reports.

For the motivation and engagement of the players, a points and rewards system was organized, as well as individual and overall ranking. The goal is a healthy and responsible competition, seeking to keep students in contact and exchange their experiences about the game. The creative activities (experiences and challenges) bring an opportunity to put the student into action and make him/her remain participative and the game's protagonist, thus reaching the assumptions of the active methodologies explained above.

The fact that the game remains continuous throughout the year allows a student who is initially not achieving many points (task corrections) to have a chance to catch up in the medium and long term. This occurs in gamified games because it makes the player understand that rankings are volatile and new chances to win arise with each new task level. During the game, the student will have to go through several tracks corresponding to a season, which is a defined space of time to achieve the objectives of that track. The next season resets the ranking, allowing the student's engagement to try to achieve better results again, but keeping the skills gained from the previous tracks/seasons being the focus of this application.

Another interesting point is that in some tasks that the student gets wrong, they will be forwarded to some extra questions about the same skill of the question that they got wrong so that in addition to gaining points, they can have new opportunities to learn that knowledge mobilized in the task. This is important in an educational proposal because the interface should allow the player's previous experiences to be known and how his development concerns the objects of knowledge objectified by the educational game (ZOURHLAL, 2015).

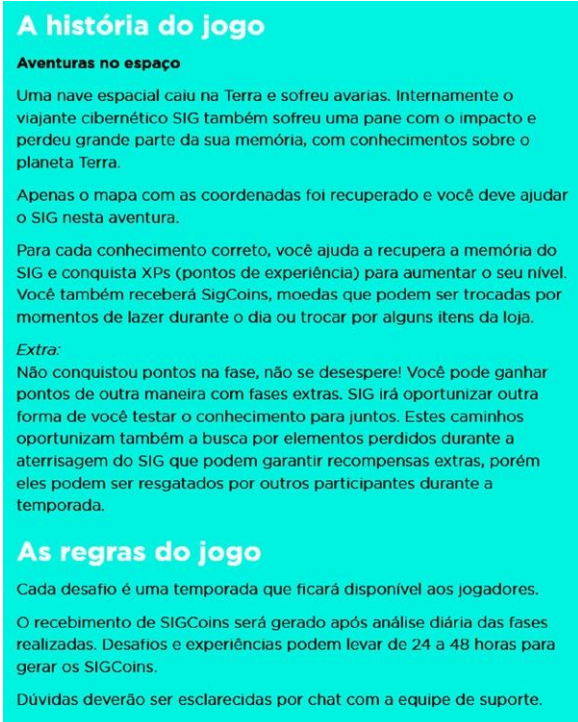
Koster (2013) understands that a game needs to have intuitive rules to explore the user in its environment. In our case, the game was prepared with a rule system explained in the first access for the player to know the rules and the operation of the phases. Moreover, the interactions that the game allows through Chat and the tutors' feedback contribute to the players understanding that they are immersed in an educational environment that goes beyond the limits of any game but is conducted by people who are accompanying them in their digital journey.

The number of phases (tasks) throughout the year is still being determined; however, the goal is to reach around 800 phases throughout a school year, contemplating the disciplines that make up the knowledge areas. In the next topic, we present examples of the visual configuration of the environment and the phases.

## 3.2 Getting to know the environment and the phases

For the purpose of exemplification and clarification of the elements of this project, we present here some images taken from the game. When the player starts for the first time in the environment, they will receive the instructions present in the following image:

Figure 1 - Opening screen of the game with the game's premise, explanations and rules



**A história do jogo**

**Aventuras no espaço**

Uma nave espacial caiu na Terra e sofreu avarias. Internamente o viajante cibernético SIG também sofreu uma pane com o impacto e perdeu grande parte da sua memória, com conhecimentos sobre o planeta Terra.

Apenas o mapa com as coordenadas foi recuperado e você deve ajudar o SIG nesta aventura.

Para cada conhecimento correto, você ajuda a recupera a memória do SIG e conquista XPs (pontos de experiência) para aumentar o seu nível. Você também receberá SigCoins, moedas que podem ser trocadas por momentos de lazer durante o dia ou trocar por alguns itens da loja.

**Extra:**

Não conquistou pontos na fase, não se desespere! Você pode ganhar pontos de outra maneira com fases extras. SIG irá oportunizar outra forma de você testar o conhecimento para juntos. Estes caminhos oportunizam também a busca por elementos perdidos durante a aterrissagem do SIG que podem garantir recompensas extras, porém eles podem ser resgatados por outros participantes durante a temporada.

**As regras do jogo**

Cada desafio é uma temporada que ficará disponível aos jogadores.

O recebimento de SIGCoins será gerado após análise diária das fases realizadas. Desafios e experiências podem levar de 24 a 48 horas para gerar os SIGCoins.

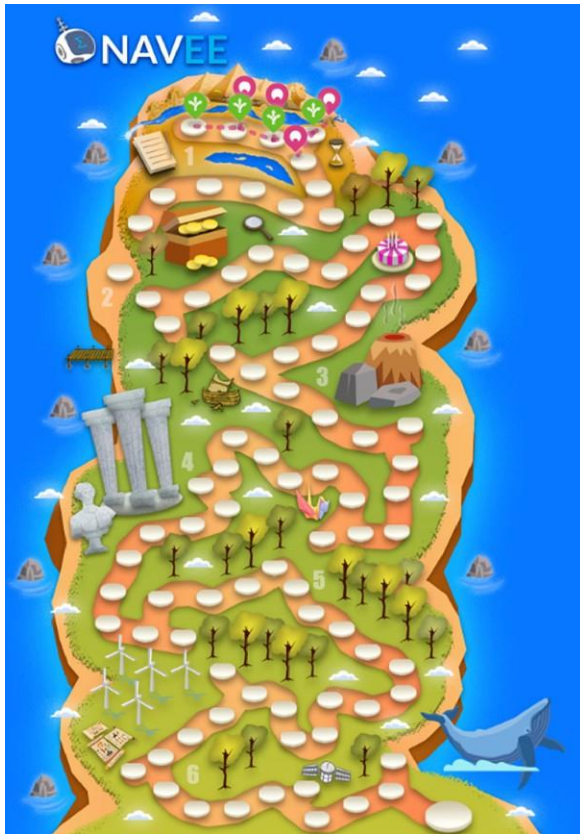
Dúvidas deverão ser esclarecidas por chat com a equipe de suporte.

Source: From de authors (2022)



From this reading, players know the context of the game and its basic rules. Next, they are directed to the map, where they will see a path to go through the phases (Figure 2).

Figure 2 - Example of a game map



Source: From the authors (2022)

The map was designed to be continuous; that is, it does not have an end. As the student advances, new paths to the phases emerge, which are the little white dots forming a sequence along the map. The choice of graphics is related to the themes of the questions, such as a volcano that indicates phases that will have concepts about rocks or tectonic plates. In Figure 3, we see an example of a phase that has a Question type task (forming pairs).

Figure 3 - Example of phase with pair formation task

A água, assim como outros elementos e substâncias da natureza, passa por mudanças no seu estado físico (sólido, líquido ou gasoso) e é transportada para diferentes lugares conforme essas mudanças acontecem.

SIG já percebeu que o ciclo da água é essencial para a existência da vida na Terra. Agora é sua vez, relacione os nomes dos fenômenos envolvidos no ciclo da água na natureza, na ordem que estão identificados na imagem. Relacione:

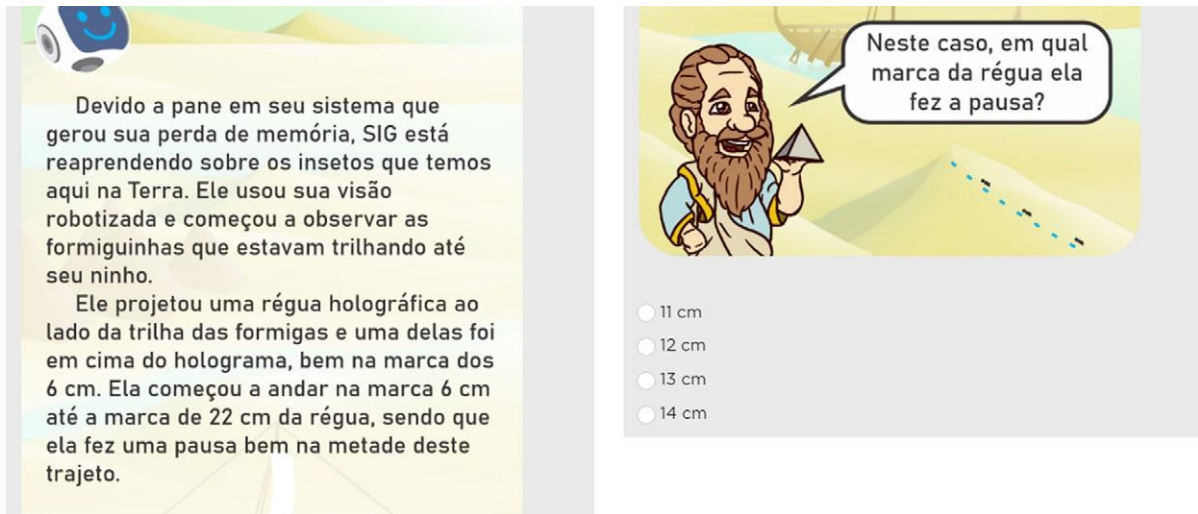
Sua resposta

1	Condensação
2	Precipitação
3	Evaporação

Source: From the authors (2022)

In this phase, aimed at a sixth-grade player, knowledge about the water cycle is mobilized. Based on reading the text and the image, the player must form the correct pairs relating the number to the phenomenon involved. This phase is connected to skill **EF05CI02** of the BNCC science area. The skill, in this case, is from the fifth grade, as it is a review question for those starting in the sixth grade. In the following figure, we have a phase whose task is of the Question (objective) type:

Figure 4 - Example of a phase with an objective task



Source: From the authors (2022)

In this phase, the student will be exercising skill **EF06MA03** in mathematics. In case of an error, the student will receive feedback with an explanation:

Figure 5 - Example of feedback provided to the player

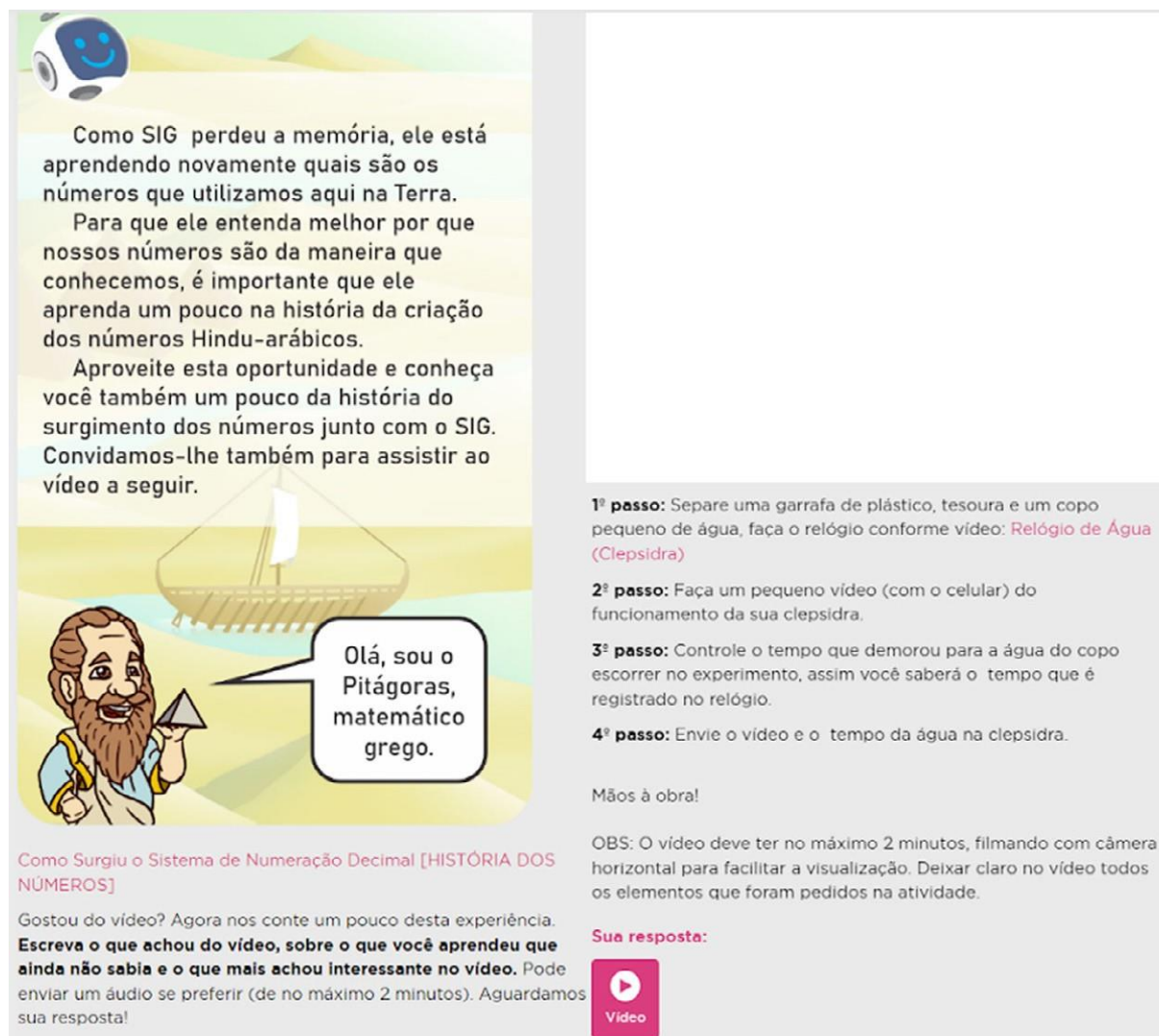


Source: From the authors (2022)

Such feedbacks are important not only to guide the student in understanding their mistakes but also to stimulate his bond with the game interface and enable them to learn the skill they were unable to succeed in. Figure 6 presents two examples of activities that fit as experiments or challenges.

The student has a moment to put themselves into action and perform dynamic activities in their home or school to attend the game. Throughout the phases, they will have several moments where they will need to research on the internet, ask for help from family members, or build things with materials they have at home. Always starting from the assumption that they are the protagonist agent of this process.

Figure 6 - Example of a phase with a Challenge style task



Como SIG perdeu a memória, ele está aprendendo novamente quais são os números que utilizamos aqui na Terra.

Para que ele entenda melhor por que nossos números são da maneira que conhecemos, é importante que ele aprenda um pouco na história da criação dos números Hindu-arábicos.

Aproveite esta oportunidade e conheça você também um pouco da história do surgimento dos números junto com o SIG. Convidamos-lhe também para assistir ao vídeo a seguir.

Olá, sou o Pitágoras, matemático grego.

Como Surgiu o Sistema de Numeração Decimal [HISTÓRIA DOS NÚMEROS]

Gostou do vídeo? Agora nos conte um pouco desta experiência. **Escreva o que achou do vídeo, sobre o que você aprendeu que ainda não sabia e o que mais achou interessante no vídeo.** Pode enviar um áudio se preferir (de no máximo 2 minutos). Aguardamos sua resposta!

**1º passo:** Separe uma garrafa de plástico, tesoura e um copo pequeno de água, faça o relógio conforme vídeo: [Relógio de Água \(Clepsidra\)](#)

**2º passo:** Faça um pequeno vídeo (com o celular) do funcionamento da sua clepsidra.

**3º passo:** Controle o tempo que demorou para a água do copo escorrer no experimento, assim você saberá o tempo que é registrado no relógio.

**4º passo:** Envie o vídeo e o tempo da água na clepsidra.

Mãos à obra!

OBS: O vídeo deve ter no máximo 2 minutos, filmando com câmera horizontal para facilitar a visualização. Deixar claro no vídeo todos os elementos que foram pedidos na atividade.

**Sua resposta:**

Video

Source: From the authors (2022)

The presentation made up to this point is a sample of the Navee Project and its educational environment with gamified games. All the theoretical references mentioned in the previous sections are directly or indirectly present in the elaboration of the activities, the choice of the objects of knowledge, and the intentionality we have in naturalizing the student with technology and digital culture.

## 4. FINAL CONSIDERATIONS

We consider Navee to have pedagogical relevance for the current times, as it can meet different demands, such as serving as post-pandemic pedagogical support, helping teachers and parents to follow up learning through concrete tasks to BNCC competencies and skills, and promoting engagement

through gamification elements. Not least, the fact that the environment is organized within a digital educational system offers motivating and different experiences to players.

The game is designed to use gamification as a driver and active methodologies when creating tasks with experiences and challenges. The use of competencies and skills in all phases aims to maintain our commitment to teaching by contemplating tactics and through indicative reports, enabling the construction of strategies developed by teachers to guide actions and diagnose each student's strengths, as well as the demands that need to be understood.

With a well-prepared team with experience in digital education, we have the potential to become a reference educational tool in the market. Lastly, we defend the importance of updating the project with the reality of the students and heavily on their feedback to constantly move for improvement. Educating requires this, to be close to those being taught and to meet the educational demands contemporaneity demands, and we are willing to face these challenges.

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