



Creative Learning in Mathematics Education: a means to promote financial literacy

Aprendizagem Criativa na Educação Matemática: um meio para promover o letramento financeiro

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Abstract

This article will present a practice that was developed as part of a qualitative research in Mathematics Education and that has been discussing students' difficulties in solving problem-situations that involve financial knowledge. The objective of the practice was to apply the creative learning spiral proposed by Resnick (2020) for the promotion of financial literacy, in a group of high school students. The results indicate that the use of the creative learning spiral can awaken in the student the ability to be the subject of his own learning and responsible for the creation of creative products, which are important insofar as they become impulses for the learning processes and development of attitudes favorable to creativity.

Keywords: Creative Learning; Mathematical Education; Financial Literacy

Resumo

Neste artigo será apresentado uma prática que foi desenvolvida como parte de uma pesquisa qualitativa em Educação Matemática e que vêm discutindo dificuldades dos alunos na solução de situações-problemas que envolvem conhecimentos financeiros. O objetivo da prática foi aplicar a espiral da aprendizagem criativa proposta por Resnick (2020) para a promoção do letramento financeiro, em um grupo de alunos do Ensino Médio. Os resultados apontam que a utilização da espiral da aprendizagem criativa pode despertar no aluno a capacidade de ser o sujeito de sua própria aprendizagem e responsável pela criação de produtos criativos, os quais são importantes na medida em que se convertem em impulsos para os processos de aprendizagem e desenvolvimento de atitudes favoráveis à criatividade.

Palavras-chave: Aprendizagem Criativa; Educação Matemática; Letramento Financeiro.

Introduction

Financial literacy is fundamental for the exercise of citizenship, and the school is an important factor in this process. In the context of the work presented in this article, we understand financial literacy from the perspective of Pessoa, Muniz and Kistemann (2018): a set of pedagogical actions carried out in a transversal way in the school with the objective of

Submetido em: 22/12/2022 – **Aceito em:** 31/07/2023 – **Publicado em:** 19/12/2023

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providing students with the construction of knowledge about finance to help them in the analysis and decision-making in an ethical, critical and citizen way. Among the challenges that are presented in these actions, getting away from teaching practices considered traditional is needed, such as those that provide expository classes without active participation of students, decontextualized reading of texts or resolution of lists of exercises. This escape that can occur successfully when planning, execution and evaluation of classes are adopted from the perspective of creative learning.

In this context, the practice we discuss here was developed as part of a qualitative research in Mathematics Education which objectives align with the purpose of investigating tasks, methods and environments that present the potential to promote creative thinking and creativity in the process of financial literacy of high school students. In this way, "the data that matter are concepts, perceptions, mental images, beliefs, emotions, interactions, thoughts, experiences, processes and experiences manifested in the language of the participants" (Sampieri, Collate, & Lucio, 2013, p. 417), which were produced in class activities, so that we could analyze and understand them and, thus, answer the research questions and generate knowledge.

Fourteen students enrolled in the first year of high school in 2020, in the State of Santa Catarina, participated of the research. To preserve their identities, they are represented here by codes A1, A2, A3 etc. The data were produced in five remote meetings, promoted by the class teacher, first author of this article, and analyzed under the guidance of the second author. The analysis and discussion were made from the journal in which the observations of the first author on what he perceived during the meetings and from the students' productions.

The methodology chosen for the activities and meetings included **the creative learning spiral** proposed by Mitchel Resnick, a professor and researcher at MIT's Media Lab (*Massachusetts Institute of Technology*), presented in the book "Kindergarten for life: for a creative, hands-on and relevant learning for all" (Resnick, 2020). Resnick's discussions about the creative learning spiral start from a question that guides his practices and research on creativity, which served as motivation for our study: "How can we help young people develop as creative thinkers, so that they are prepared for a life in this world where everything changes so quickly?" (Resnick, 2020, p. 04).

Habowski and Conte (2018, p. 02) instigated us to think critically about the theme when they stated that creativity is "one of the indispensable aspects of the scientific and formative process, as it stimulates the confrontation of obviousness and brings novelty, in terms of a critical disposition for dialogue with differences, social identities and understandings of the world." This emphatic way of the authors referring creativity aroused our desire to perceive how this happens in contexts of Mathematics Education.

In the same perspective, the *International Group for Mathematical Creativity and Giftedness - MCG*³ has also been presenting its investigations in contexts of Mathematics

³ <https://www.igmcg.org/home>

Education, with the aim of bringing together mathematics educators, mathematicians, researchers and other interested parties to nurture and support the development of mathematical creativity and the realization of mathematical promises and mathematical talents, promoting the improvement of the teaching and learning of mathematics, and expanding the students abilities to apply mathematical knowledge in innovative and creative ways.

The Creative Learning Spiral

For Resnick (2020, p. 16), creativity "is developed from a certain type of effort, which combines curious exploration with playful experimentation and systematic investigation", and the "creative learning spiral " is the "engine of creative thinking" (Resnick, 2020, p. 10).

The creative learning spiral, as proposed by Resnick (2020), is presented in Figure 01.

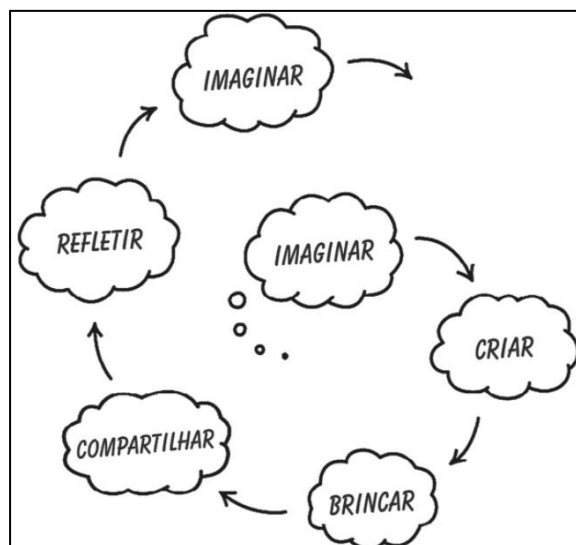


Figure 1 – Creative Learning Spiral

Source: Resnick (2020, p. 10).

The author presents the spiral making an analogy with a playful situation of Early Childhood Education, in which children play with wooden blocks and set up a castle:

- **Imagine:** In our example, children begin to imagine a fantasy castle and the family that lives in it.
- **Create:** imagining is not enough. Children turn ideas into actions, creating a castle, a tower, or a story.
- **Play:** Children are always interacting and experimenting with their creations, trying to build a taller tower, or bringing new possibilities to the story.
- **Share:** one group of children collaborates in the construction of the castle; another group helps in the creation of the story and the two groups share ideas with each other. Each new addition to the castle inspires a new story and vice versa.
- **Reflect:** When the tower falls, the teacher approaches and encourages the children to reflect on why it fell. How could they create a more stable tower? The teacher shows images of buildings, and the children notice that the bottom of them is

wider than the tops. They decide to rebuild the tower with a larger base than the previous one.

- **Imagine:** Based on the experiences that go through the spiral, children imagine new ideas and new guidance. What if we create a village around the castle? What if we create a puppet theater about village life? (Resnick, 2020, p. 11).

And concludes:

As kindergarten children move through the spiral, they develop and refine their skills as creative thinkers, learn to develop their own ideas, test them, experiment with alternatives, get other people's opinions, and create ideas based on their experiences. (Resnick, 2020, p. 12).

Alerting:

Unfortunately, after kindergarten, most schools move away from the creative learning spiral. Students spend much of their time sitting in their chairs, filling out worksheets and listening to lessons, whether from a teacher in the classroom or from a video on the computer. **Most of the time, schools emphasize the transmission of instruction and information rather than assisting students in the process of creative learning.** (Resnick, 2020, p. 12, emphasis added).

Resnick (2020, p. 16) states that "all children are born with the ability to be creative, but this creativity will not necessarily develop on its own. It needs to be nurtured, encouraged, supported." Despite being based on the kindergarten model, the author states that the creative learning spiral can be thought of in other contexts.

In his doctoral research, Amaral (2011, p. 16, our emphasis) points out that the "creative movement in learning is one of the ways for the student to connect with a primordial human condition: the possibility of **being the subject of one's own development processes.**" Relating creative learning with creative expression, the author thus analyzes its productive and subjective dimensions:

We understand that creative learning, like any creative expression, can be studied from its productive dimension and/or from its subjective dimension. **The productive dimension is linked to the products of creative learning that can be, for example, activities and creative work carried out, or even interesting and original questions and ideas elaborated in the classroom.** The subjective dimension of creative learning is related to the subjective processes that favor the creative construction of personal knowledge. When we refer to personal knowledge, we refer to the personal collection of knowledge that everyone has appropriated throughout development. (Amaral, 2011, p. 19, emphasis added).

From these understandings of Amaral (2011), we adopted the idea that creative learning is a creative expression. And, to present an excerpt of our research in this article, we chose to study it from its productive dimension, however, without losing sight of the existence and relevance of the subjective dimension of creative learning.

Financial Literacy

In the research reported here, we chose to use the term financial literacy to refer to the teacher and student movements that took place in the meetings that were part of a practice of Mathematics Education focused on financial education. We justify this choice with the notes made by Vieira, Souza and Kistemann Junior (2021) when they declare to adopt, in their

research, financial literacy as a synonym for financial literature and explain the meanings of financial literacy, financial literature, financial education and financial mathematics. In this context, they stressed the importance of clarity that financial education and financial mathematics are different things:

Financial Mathematics works on Mathematical concepts, such as formulas and the technical knowledge of formulas. **Financial Education aims, for example, in assisting consumers in the management of their income; assisting consumers in making decisions; in creating conscious consumers. Financial Education helps consumers to work on their emotions, habits, and attitudes in the economic daily life in which they are inserted in the consumer society of the twenty-first century.** (Vieira, Souza & Kistemann Junior, 2021, p. 23, emphasis added)

As we are interested in the discussion on financial education, we continue to follow the foundations of Vieira, Souza and Kistemann Junior (2021) on different sources that conceptualize financial literature and financial literacy. The first is the one that realizes that financial literacy is "the ability to read, analyze, manage, communicate and understand the various financial problems that arise before the material well-being of citizens (Noctor et al, 1992)" (Vieira; Souza; Kistemann Junior, 2021, p. 27). The second one explains that

According to the Program for International Student Assessment - PISA (2012), financial literature is the knowledge and understanding of financial concepts and risks, the skills, motivation, and confidence to apply this knowledge in order to make effective decisions in a variety of everyday financial contexts, to improve the financial well-being of individuals and society. (Vieira, Souza & Kistemann Junior, 2021, p. 27).

Finally, "the United Nations Educational, Scientific and Cultural Organization (UNESCO), considers literature as synonymous to literacy. (Vieira, Souza & Kistemann Junior, 2021, p. 27).

Still with the intention of characterizing the adoption of financial literacy as a research theme, we found in the academic master's dissertation in Mathematics Education of Sena (2017) some definitions and we realized that the one brought from the following descriptions elaborated by Shamos (1995) served our discussions on the subject and also made sense with the discussions made in Vieira, Souza and Kistemann Junior (2021):

- Ability to read, analyze and interpret financial situations;
- Knowledge of basic and necessary elements of financial mathematics pertinent to the context of the subjects;
- Ability to take a reasoned critical stance;
- Ability to consider variables and implications of their actions;
- Conscious decision-making aimed at individual and social financial well-being. (Sena, 2017, p. 39)

Thus, we inserted our research in the set of studies in Mathematics Education that have been discussing students' difficulties in solving problem-situations involving financial knowledge. Particularly, those who turn to the difficulty as pointed out by Hofmann and Moro (2012): lack of understanding of the meanings of financial terms present in the statements of the mathematical problems that are proposed in the classroom. This is because it was precisely the perception that the class of students of the first author went through, in

the year 2020, the same difficulty reported by the authors in 2012 that led us to carry out the practice that became the object of research.

At this point, we return to Vieira, Souza and Kistemann Junior (2021) when the authors talk about Financial Education School:

School Financial Education does not lend itself only to themes that involve the concepts related to the financial world, or to decontextualized and repetitive calculations, but to the construction of a financial thought that enables the individual to make his/her decisions autonomously and critically to the social and economic context that surrounds him/her. Such aspects necessarily require the channeling of efforts in order to conceptualize how the construction of financial thinking takes place. (Vieira, Souza & Kistemann Junior, 2021, p. 27).

It was observed there a potential for discussion, in the scope of Mathematics Education, with the student's financial education responsibility from the development of their financial literacy to, thus, contribute with their formation as responsible, conscious and critical consumers in relation to the reality of their life contexts.

Report of Practice

The objective of the practice was to apply the creative learning spiral proposed by Resnick (2020) as a promotion of financial literacy in a group of high school students. His report is presented below, in the voice of the first author of this article, who was the teacher who mediated the activity.

The interest in this investigation occurred when, teaching financial mathematics to my students of the first year of high school, after reading several problem-situations presented in the textbook that involved financial knowledge, I realized that few of them knew the meaning of the terms present there. This situation is like that one reported in Hofmann and Moro (2012, p. 46), because like these authors, I came across a situation in which "the 'context' of a mathematical problem in the classroom appears as the text of a financial statement, without greater concerns with students' understanding of the terms evoked". Still, in my class, I realized that this difficulty needed to be overcome so that I could make any discussion about financial education. I needed to develop some practice focused on financial literacy (Vieira, Souza & Kistemann Junior, 2021; Sena, 2017), acknowledging, as well as Hofmann and Moro (2012, p. 51) the importance of financial literacy for the formation of students and the role that Mathematics Education has for financial education, "to the extent that the link between both is not restricted to the contextualization of mathematical problems in financial terms."

To escape the traditional practices centered on the resolution of textbook exercises, I adopted a planning of after school meetings, which methodology was thought around the creative learning spiral proposed by Resnick (2020). I believe that this methodology promotes a learning environment different from the traditional one because it places the student in an investigation scenario with potential for the development of creativity since,

"the mere resolution of exercises is a much more limiting activity for the student than any type of investigation" (Alrø & Skovsmose, 2006, p. 50).

The activity was carried out in five meetings lasting 60 minutes each, one per week, in 2020, in a private school in the State of Santa Catarina. Invited students aged between 15 and 16 years-old of a first-year class of high school participated, since participation was not mandatory. The meetings took place in the countershift (afternoon period) remotely and synchronously through the Webex videoconferencing platform.⁴ We communicated using the cameras and microphones of the digital devices in use (lapbook, desktop computer, tablet, smartphone). Google Classroom, already known by students, was used as a virtual space for interaction.

Table 1 presents the description of each meeting, showing which stage of the learning spiral it refers, date of realization and objective. Next, the activities carried out in each meeting are presented.

Table 1 – Data on the meetings

Meeting	Date	Objective
Imagine	09/22/2020	To instigate the students to express what they understood about the financial formation and the terms related to this theme.
Create	09/29/2020	To make concrete the fruits of the imagination.
Play	10/06/2020	Experiment with the creations.
Share	10/20/2020	Generate everyone's collaboration for a common product.
Reflect	10/27/2020	Consolidate the knowledge acquired through the appreciation of learning.

Source: Production of the authors

Imagine

At the opening of the first meeting, the students were welcomed and then presented to the general plan of the activities and the form of work that would be adopted in the Google Classroom platform. Each student was given a code to access the platform. It was a quick moment; they were already familiar with the tool due to using it in the classes of all curricular components in the morning shift.

The students' **Imagining** was stimulated from four questions triggering discussion. I created and suggested them in order to present the theme of the activity and mobilize the previous knowledge of the participants and, to respond to each of them, the students used

⁴ Interaction between the teacher and the students happens in real time, since everyone needs to be at the same time and in the same virtual environment.

different types of technology: orality, writing in the online text editor Google docs and word cloud).⁵

When I asked, "**What do you believe to be financial education?**" there was a brief silence and then some students related to "knowing how to take care of money"; "being able to be financially independent"; "be mindful" and "think before you spend."

Student A1 expressed herself:

I'm shocked by the calculation we made this morning, of how much I spend per year in the school canteen, I had never thought about and I don't think even my father should imagine.

Student A2 mentioned that her father has investments, but that he never explained what it was and how it worked. At this moment, he said jokingly:

So, I'm not educated financially.

Closing these first comments, student A3 spoke up saying:

Financial Education is knowing the meaning of everything that involves finances.

The manifestations of A1, A2 and A3 showed that financial education encompasses habits such as saving, personal finance management and conscious consumption and that this is something that needs to be built between them, since "the economic, social, legal and even linguistic foundations underlying everyday economic practices is a condition for the interaction and economic socialization of the population". (Hofmann & Moro, 2012, p. 47)

The second question was "**What terms, in the context of financial education, do you remember hearing/reading, at school or at home, but don't know what they really mean?**"

To respond, I asked students to write their words in Google docs through Google Classroom within five minutes. After the time, I shared with them the screen of my laptop to show the words and terms written by them, and then with the *Word Cloud Generator* feature I generated the word cloud, which is presented in Figure 02.

⁵Google application that allows users to create and edit documents online, collaborating in real time with other users.



Figure 02: Word cloud elaborated with financial terms

Source: Collection of the authors, 2020.

Observing the word cloud (Figure 02), we noticed that the terms inserted in it are part of the context of the financial education, therefore showing that the students had a previous notion about the theme. The word cloud was the starting point for the third question: **"Do you consider important to learn what the words and expressions you have written represent?"** The answer yes was unanimous. Asking this question, in this way, was fundamental for the students to realize that the sequence of activities was part of the process of learning about something that they agreed was important.

Finally, the last question was, **"What could be done to learn about financial education and the terms related to it?"** This question wanted to lead the student to a reflection, in the sense of what Resnick (2020) states about effort and investigation, encouraging them to be the protagonists of the construction of their own knowledge.

Some time was left for the socialization of the students' arguments. Each of them reported what they would like to do. For example, one of the participants said that she would read texts about financial education on the internet and write a report about what she understood; another one said that she would use an online dictionary to make a glossary – a process she learned from the Portuguese Language teacher – and would use a notebook to write the meaning of the terms related to financial education and one student said he would like to talk to an economist.

After the first meeting, the participants compromised to research about the theme during the week to exchange ideas on the next meeting.

Evaluating this meeting, I realized that the class was interested on the subject and there were individual efforts of the students in the proposition of what could be done to learn. I also realized that the questions fostered curiosity, a fundamental feature of creative learning. Another aspect to be mentioned is the fact that the meeting exceeded the pre-established time (60 minutes). The students were so motivated in the creative process that I did not deem it convenient to interrupt the discussions due to the end of class time. It was a moment when students were having their *insights* into what they could do to learn, since, according to

Amaral (2011, p. 20) "to develop a creative product it is necessary to reach a certain level of depth in some specific knowledge".

Create

At the beginning of the second meeting, I noticed the students' enthusiasm to share their findings. I asked who would like to socialize what they had studied and researched during the week. Student A1 socialized a text written by her about what she considered to be financial education.

An excerpt from this text reads as follows:⁶

A1: It's **learning** to deal with one's own money, something that is so present and important in our lives. **It is the search for a better quality** of life with the material security necessary to enjoy the pleasures of life and have a guarantee for any unforeseen events. **Possessing this knowledge** of how to properly handle money may seem distant, and even irrelevant as minors, however, in just a few years it will be of utmost importance, since a comfortable life, for example, will **only be obtained with a certain financial awareness**. (Text from participant A1, 2020, emphasis added)

When A1 shares that for her it is to have "financial awareness" to improve the quality of life, it is deduced that this is related to behaviors, attitudes, and values (Silva and Powel, 2015). And in addition to the awareness that this student presented about financial education, she seems to have awakened to a process of investigation for her learning, that is, unlike her having received from the teacher a product – a predefined and formatted class – she had the opportunity to produce her own product because of her creative learning.

Student A5 asked for the floor and socialized the glossary she built. She explained to her colleagues the meaning of the terms she thought were most important to be understood by the class: SELiC, inflation, simple interest, compound interest, investment, savings, family budget, financial reserve, and income tax.

After this moment of socialization, I asked the class if everyone understood the terms explained by A5. Some students said they would need to read more about them. At that moment, I warned about the importance of knowing the meaning of the terms addressed not only for math classes, but for financial literacy.

If that is an important point, the following question is fundamental in the debate about the meanings and purposes of the financial education of young people: how to promote a discussion about values, without students having basic financial knowledge? In this perspective, the glossary built and presented by student A5 helped in the construction of the most relevant basic knowledge, together, in the class. In addition, the elaboration of the glossary met the objective of this second meeting, which was to make concrete the fruit of the imagination (Resnick, 2020).

Student A3 introduced the topic of conscious consumption into the discussion by socializing several examples of what could be done at home, such as growing a spice garden,

⁶ The full text is stored in *Google Classroom* for this class.

fewer food orders for *delivery*, calculating how much could be saved by reducing lunches in a restaurant. He also presented his colleagues with a spreadsheet prepared in Excel. His joy was evident because his father had taught him how to use the software while they talked about conscious consumption. The student was impressed by the amount of possibilities in Excel. He told the group:

Folks, look, we can even make the graph of our consumption.

The other students continued with contributions in the presentations of the results of their researches.

The A4 student brought a proposal that surprised me. He suggested to colleagues that they could use the knowledge built and socialized by everyone to study and prepare for the edition of the Financial Education Olympiad - OBEF⁷. Using the screen-sharing mode, he showed on his computer one of the proofs from previous years saying that it contemplated a lot of information coinciding with what was presented in this second meeting. After the euphoria of the students wanting to answer the questions of the test, I asked the group: "**How could we organize the material, researched in a way that everyone can have access to and continue contributing?**"

Consequently, a project of creation was born that I can consider spontaneous, because it was not in the planning of the meetings, which started from an idea of one of the students while the class participated in the activities.

As Resnick (2020) points out, ideas have moved towards transformation into actions, a movement that gives meaning to the Create stage of the creative learning spiral.

Students discussed various possibilities, such as printing the material and studying or building a website. Student A2 told the group that she wrote down the ideas that were exposed by her classmates and posted them on the Google Classroom wall, as shown in Figure 03. So, they could vote on which one would be adopted, she shared her notes using screen sharing mode.

⁷ The Financial Education Olympiad aims to promote studies and research in Financial Education and is part of a perspective of contemplating social development in which it unites and strengthens political actions aimed at the three pillars that emerge from Society: Family Structure, School Environment and Professional Life. Available at: <<https://www.ufpb.br/educacaofinanceira/contents/menu/opef-1>>. Accessed: September 29, 2020.

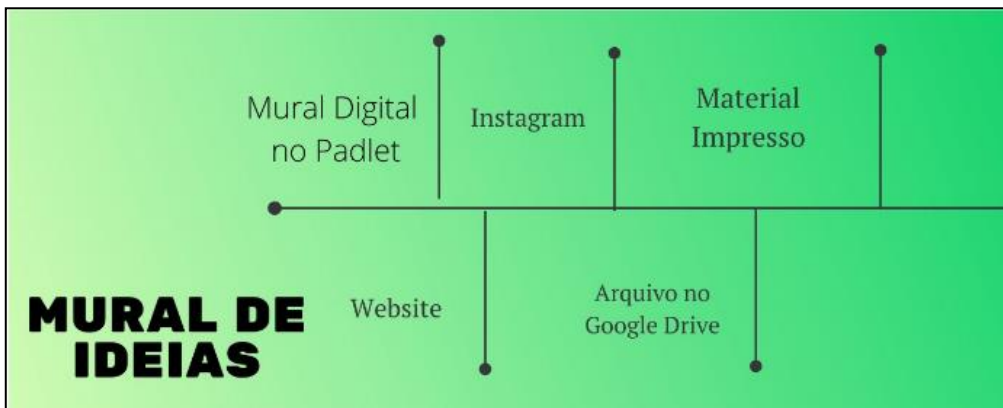


Figure 03: Wall of ideas shared by student A2

Source: Authors' Collection, 2020

After discussing the options, the students concluded that what would facilitate the organization, storage and sharing of materials researched by them would be the construction of a digital mural. Students A2, A7 and A11 were willing to research and study a digital platform that would meet the needs of the group. Everyone decided that the material worked on in the meetings so far would be used on this platform and socialized at the next meeting.

The second meeting achieved its goal. The students put their ideas into practice, which contributed to them autonomously choosing a learning path that they deemed appropriate. As in Silva et al. (2021, p. 61554) the "creative practice advance development and are those that make the subject rethink their conceptions and attitudes and, mainly, those that produce meanings about what is being learned".

Play

The third meeting began with student A7 asking to socialize the discovery of a financial application called Binomo, which allows the user to move applications using various trading tools, analysis and chart types. As it has a demo version, it would be possible to use it both to experience in practice some of the concepts seen in the theory⁸, and to know more about the theory from what they saw in practice.

After that, the A10 student also asked to present an application he had found, called Mobills. He told colleagues that the application helps the person know where their money is being used and allows them to categorize expenses and revenues manually, entering expense by expense and gain by gain, as well as creating a monthly plan.⁹

Both A7 and A10 used Webex screen sharing mode to introduce how the applications work.

The group that had been responsible for researching a digital mural to be used by the class presented to the group the benefits of using Padlet, stating that it is an¹⁰online tool that

⁸ Available at: <<https://binomoofficial.com/>>.

⁹ Available at: <<https://www.mobills.com.br/>>.

¹⁰ Available at: <<https://padlet.com/>>.

allows the creation of a dynamic and interactive mural or virtual whiteboard to record, save and share multimedia content. It would work as a repository, where one can insert any type of content (text, images, video, hyperlinks) and share with others. Everyone approved the idea and student A2 suggested that they could present this material to other classes and communicate the importance of financial education.

At the end of the meeting, I asked the students to make available, on the Classroom wall, the material researched, built and presented at this meeting, so that those responsible for the Padlet could continue the work.

In this third meeting, we fulfilled the objective of experimenting with the creations. According to Resnick (2020, p. 118) people usually associate play only with laughter and fun, and forget its importance for creativity, since "creativity does not come from laughter and fun, but from experimentation, from taking risks and testing the limits", which I realized happened when the group that was willing to research and study a digital platform challenged itself to transform into a final product the ideas discussed.

Share

In this meeting, we started with the group of students responsible for the construction of the Padlet sharing what they had already produced. Figure 04 shows the layout of the initial construction of the Padlet made by them. In her presentation to the class, student A2 clicked on each icon explaining to her classmates how they had organized the material that was shared by everyone on the Google Classroom wall. The group explained to the class the importance of the first icon leading to the concept of financial education, and then presented examples of how to save, considering some reflections on conscious consumption, followed by key words about financial literacy.



Figure 04: Layout of the initial Padlet build

Source: Collection of the authors, 2020

Following the presentation, the group opened a space for colleagues to suggest what they thought it needed to be complementary. The class approved the idea and asked to add an item about the OBEF, to include questions from previous years for the purpose of studying. Also, they suggested changing the order and some titles, such as: replacing "introduction" with "Financial Education", "keywords" with "key concepts", and this term should come after "Financial Education", giving a chronological aspect. The group responsible for the

construction of the Padlet recorded the ideas and promised to present the final construction at the next meeting.

Observing the interaction between the group, I realized their satisfaction with the work built. Agreeing with Amaral (2011, p. 188), I see that this situation "is extremely necessary, because it moves the learner from his own satisfaction and a particular interest in learning that, in the inter-play of the relationship with another, stimulates creative learning".

At the end, each student was asked to create a mental map of the learnings built from the last meeting and post it on the Google Classroom wall. The mind map is a creative way of organizing and recording information that allows you to "reflect outwardly what is going on in the mind. It is a way of organizing thoughts and making the most of mental capacities" (Keidann, 2013, p. 01). I informed them that this mind map could be built using both digital technology and pencil and paper, as well as told the class that I would give *feedback* on these constructions via Google Classroom.

Reflect

The fifth and final meeting was dedicated to the appreciation of the learning built by the students. It began with the sharing of the final version of Padlet (Figure 05) by the students who made it.



Figure 05: Layout of the final production in the Padlet

Source: Author's Collection, 2020

This material was created with the collaboration of all participants. As they shared, the students discussed not being a finished product, but rather a space that can and should be nurtured whenever there is interest in its updating. All praised the production and exchanged ideas about continuing their studies to participate in the OBEF.

So, I asked the following question: **"Besides this enthusiasm for participation in the OBEF, what do you consider most important in learning about our meetings?"** The following conversation presents some of the answers, which highlighted aspects of the financial literacy of the participants that was built during the meetings in a perspective presented in Sena (2017, p. 39): important notions for "making conscious decisions aimed at individual and social financial well-being":

DOI: 10.20396/zet.v31i00.8671806

A3: I certainly understand the meaning of the terms written in the problems in the book.

Teacher: What terms?

A3: Inflation; financial market; stock exchange, difference between simple and compound interest; overdraft, savings...

A5: For me, it was understanding the importance of managing our money well.

A10: I, as I like games, was learning how to simulate investments in the stock market, because to me it seemed like a high-risk game.

(Dialogue between teacher and students, 2020)

At the end of the meeting, I expressed to the students my joy for the enthusiasm of all, for the creativity, proactivity, autonomy and protagonism with which they conducted the meetings.

Discussion on Creative Learning in Financial Literacy

In view of our objective that was to apply the creative learning spiral proposed by Resnick (2020) for the promotion of financial literacy, in a group of high school students, which led us to escape from traditional practices centered on the resolution of textbook exercises, we can evidence that throughout the process there was the construction of knowledge, in an environment that the student can express him or herself about financial education, as an imaginative and creative being. In view of this, Vaz and Júnior (2020, p. 141) understand that creative learning happens when the student investigates, produces, and feels the "pleasure of discovery and, aware of its incompleteness, goes in search of a learning that allows him to create or recreate knowledge autonomously, imprinting his personal mark in the process".

To illustrate the students' output and discuss evidence of financial literacy achieved through an intentionally planned practice around the creative learning spiral, we present in Figures 06 and 07 two mind maps produced by two of the participating students (A1 and A10 respectively). The map of Figure 06 was elaborated with the technology of pencil and paper; the map of figure 07 was elaborated with digital technology of a Google docs tool called *MindMup*.



Figure 06: Mind map prepared by A1
Source: Author's Collection, 2020

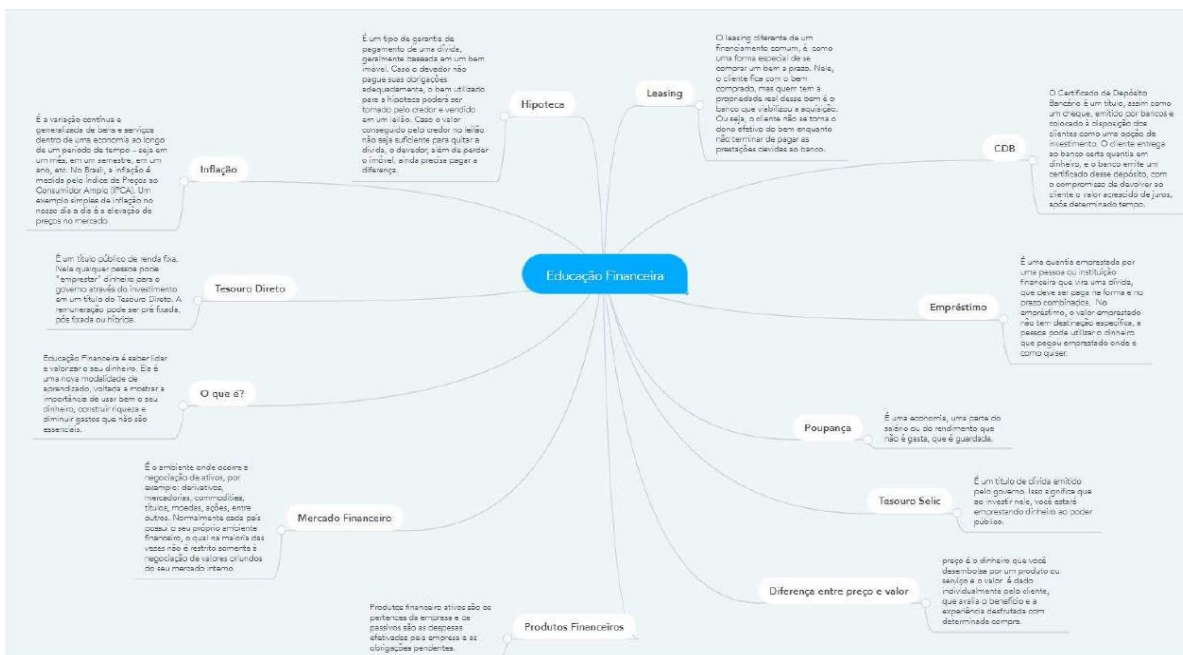


Figure 07: Mind map prepared by A10
Source: Collection of the authors, 2020

Both present a definition of financial education from terms that the students judged most important. The terms connected to financial education, which are part of financial

literacy, were presented with their respective definitions. The students expounded the following terms: Loan, Leasing, Savings, CDB, Selic, Direct Treasury, Price and Value, Mortgage, Financial Market, Financial Products, Assets, Liabilities and Inflation. These terms were described in problem situations used in the Financial Mathematics classes that these students attended in the regular morning period.

With regard to the meetings, they had the objective of proving financial literacy through the practical prediction, considering that this group of students had little or no notion of the terms evoked in the problem-situations proposed in the Financial Mathematics classes, nor did they have the knowledge for a discussion about financial education. So, the use of the creative learning spiral proposed by Resnick (2020) favored financial literacy through a creative construction of the personal knowledge of each student, making them explore and share their ideas freely, without fearing of being "judged" by colleagues, but attentive to the contributions of each one, making them learn from each other.

The Google Classroom tool facilitated the sharing of materials researched and built by students for use in the construction of Padlet. This Padlet was built with the aim of being a repository of the records conceived throughout the meetings. This feature remains open (the 14 participants have the access password), so that they can, when they wish, add learning objects, results of new research. It is worth remembering that the students designed it to collaborate with the preparation for next year's OWEL.

I noticed students going through the creative learning spiral, as "they develop and refine their skills as creative thinkers, learn to develop their own ideas, test them, experiment with alternatives, get other people's opinions, and create ideas based on their experiences" (Resnick, 2020, p.11).

The technological tools used to support the activities developed during the spiral course are described in Table 2:

Table 2 – Technological tools and their descriptions

Tools	Description
Webex ¹¹	Plataform of videoconferencing used by the school to hold synchronous meetings, the use of which began during the COVID-19 pandemic for remote classes in the period of social distancing.
Google Classroom ¹² ,	Resource that facilitates the work of the teacher regarding communication and sharing of materials.
Padlet	On-line tool that allows the creation of a dynamic and interactive mural or virtual board to record, save and share multimedia content.

¹¹ Available at: <<https://www.webex.com/pt/index.html>>. Access on: Jul 7, 2020.

¹² Content management system for schools looking to simplify the creation, distribution, and evaluation of assignments.

Google Docs	Application that allows the production, editing and visualization of various contents, from documents to print, mind maps, word cloud and data sheets.
Google Slides	Presentation program included as part of the Google Docs Editors package.
Binomo	Application that allows the user, in a trial account, move investments using various trading tools, analysis and chart types.
Mobills	Financial management application to control expenses, accounts, invoices, and credit cards.

Source: Production of the authors

About the technological tools used to support the activities developed during the spiral of creative learning, we highlight those used by students, such as the Binomo and Mobills applications. The acquisition of knowledge, technique, and skill to use these applications allowed students to use the knowledge about financial education built in the research in a practical experience in the interaction between their colleagues, which potentiated the development of creativity. We assume this fact, because before the presentation of the operation of these applications, the students needed to imagine and create "real" situations to make sense of what they presented. Regarding Google Docs/Slides and Padlet, it was noticeable that they are digital environments that can be used for students to express creativity during learning, since they allow the construction of mental maps, presentations and other possibilities; That is, the use of these technological resources in classroom activities can help in creative learning, since students have the opportunity to become authors during the spiral course. Webex and Google Classroom came in as support for the remote classes that took place due to social distancing due to the COVID-19 pandemic.

Final Considerations

The creative learning was achieved through planning, execution and evaluation of classes based on the use of the creative learning spiral proposed by Resnick (2020). She promoted a means to put the participant students at the center of the school education process and in an active way, which valued their ideas and personal interests. Therefore, the creative learning spiral, applied during practice, provided the meetings with the stimulus in the creative processes, since they offered the participants the "opportunity to develop as creative thinkers. After all, creating is at the root of creativity" (Resnick, 2020, p. 32).

The research carried out by the students, the sharing of information during the discussions, the construction of a Padlet with a collection of materials researched and built throughout the meetings and the elaboration of a mental map for the appreciation of the acquired learning, contributed, somehow, for the constitution of financial literacy using digital technological resources. Thus, in creative learning, the creative product took place, as stated in Muniz and Martínez (2015, p. 1043) in the "authorship of thought and productions

that individualize the process of learning, in the interesting and original questions that it elaborates in the face of confrontation with the data, among other possibilities."

Finally, it might be noted that creative learning, used as a strategy by the teacher, can awaken in the student the ability to be the subject of his own learning and responsible for the creation of creative products, which "are valuable to the student to the extent that they become a driving force for their learning and development processes" (Amaral, 2011, p. 102). In addition, the work done by students during the creative learning spiral sees a productive investigative character – and not reproductive – since, in the search for new learning, students created or recreated in a unique, original and creative way .

Acknowledgements:

The research reported here was carried out with the support of the UNIEDU/FUMDES Scholarship Program – Graduate Program of the State of Santa Catarina, through the granting of a scholarship to the first author of this article.

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