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Family Planning: disclosing contributions from Problem Solving to Worker-Students' Financial Education

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Abstract: Conflicting situations between what one wants to acquire and the limit imposed by financial resources require financial planning. The current study presents an excerpt of a Master's research in Mathematics Education, based on qualitative approach, whose goal was to disclose contributions from Problem Solving, according to the Problem Solving methodology, to the Financial Education of a group of worker-students enrolled in the 1st year of a public night-shift High School. Observation, field journal, documentary records of assignments involving family planning and questionnaires were used for data collection purposes. Based on the analyses, Problem Solving, in the way it was organized – i.e., involves personal and family financial planning-enabled contributing to participants' Financial Education, which would be in compliance with their social and financial reality, and allowed them to exercise citizenship.

Key-words: Problem Solving. Financial education. Worker-Student. Night-Shift High School. Mathematics Education.

O Planejamento Familiar: desvelando contribuições da Resolução de Problemas para a Educação Financeira de estudantes–trabalhadores

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Resumo: Situações de conflito entre o que se deseja adquirir e o limite imposto pelos recursos financeiros exigem um planejamento financeiro. Apresenta-se o recorte de uma pesquisa de Mestrado em Educação Matemática, em abordagem qualitativa, cujo objetivo foi desvelar contribuições da Resolução de Problemas segundo a metodologia Resolução de Problemas para a Educação Financeira de uma turma de estudantes, trabalhadores do 1º ano do Ensino Médio noturno, de uma escola pública. Para a produção de dados, foram utilizados observação, diário de campo, registros documentais das atividades envolvendo planejamento familiar e questionários. As análises mostraram que a Resolução de Problemas, da forma como foi organizada, envolvendo o planejamento financeiro pessoal e familiar, possibilitou contribuir para a Educação Financeira dos participantes, segundo a sua realidade social e financeira, e para o exercício da cidadania.

Palavras-chave: Resolução de Problemas. Educação Financeira. Estudante-Trabalhador. Ensino Médio Noturno. Educação Matemática.

Planificación Familiar: develando aportes de la Resolución de Problemas a la Educación Financiera de estudiantes-trabajadores

Resumen: Las situaciones de conflicto entre lo que se quiere adquirir y el límite que imponen los recursos económicos requieren una planificación financiera. Se presenta un extracto de una investigación de Maestría en Educación Matemática, en un enfoque cualitativo, cuyo objetivo fue revelar aportes de la Resolución de Problemas según la metodología de Resolución de Problemas para la Educación Financiera de un grupo de estudiantes, trabajadores del 1° año de la Enseñanza Media Nocturna. en una escuela pública. Para la producción de datos, se utilizaron la observación, el diario de campo, registros documentales de actividades relacionadas con la planificación familiar y cuestionarios. Los análisis

mostraron que la Resolución de Problemas, en la forma en que fue organizada, involucrando la planificación financiera personal y familiar, posibilitó contribuir a la Educación Financiera de los participantes, de acuerdo con su realidad social y financiera, para el ejercicio de la ciudadanía.

Palabras clave: Solución de Problemas. Educación financiera. Estudiante-Trabajador. Escuela secundaria nocturna. Educación Matemática.

1 Introduction

Conflicting situations between what one wants to acquire and the limit imposed by financial resources for assets' acquisition demand financial planning to avoid indebtedness. Such a planning can be learned through Financial Education (FE), which was taken as public policy in Brazil, after the National Financial Education Strategy, also known as ENEF, was created through Federal Decree n. 7.397/10. This strategy was an initiative by financial entities like banks, to avoid individuals' indebtedness and, consequently, financial losses. It regards mobilization towards promoting financial, insurance, social security and tax education actions, in Brazil. Its goal is to contribute to reinforce citizenship by suggesting and supporting actions to help the population make more autonomous and informed decisions.

According to the Organization for Economic Cooperation and Development (OECD), FE (financial education) is the process through which individuals and society broaden their understanding about financial concepts and products, so they can develop the necessary values and skills, based on information, formation and orientation, to identify opportunities and risks at the time to make choices. Financial education is essential to anyone, anywhere, worldwide; consequently, "FE must start at school. People must be taught about financial subjects as early as possible in life" (OCDE, 2005).

Financial education is also seen as essential for students' lives, since it can influence their financial habits and attitudes by helping them manage their money during their development as citizens. Research on Mathematics Education has discussed the need of implementing FE in schools (SILVA; POWELL, 2013, 2014; RASCHEN, 2016; BARONI; MALTEMPI, 2019). Therefore, it is possible observing the relevance of debating about FE in the academic field and its likely effects on school and society.

The present article introduces an excerpt of a Master's dissertation in Mathematics Education, based on qualitative approach, whose aim was to disclose Problem Solving contributions, according to the Problem Solving methodology, to the Financial Education of a group of worker-students enrolled in the 1st year of a public night-shift high school. The Teaching-

Learning-Evaluating Methodology was employed based on problem-solving suggested by the Group of Research and Studies on Problem Solving, also known as GTERP.

The present article is organized into sections 1 – Introduction, 2 - Financial Education and School Financial Education, 3 – Problem Solving as teaching methodology, 4 – Research methodological path, 5 – Data and analysis (data about a financial planning issue were selected and analyzed based on the herein adopted theoretical references) and 6 – Final considerations.

2 Financial Education and School Financial Education

According to Lelis (2006), Financial Education emerged from the need of discussing the relevance of money; how to consciously manage, get, spend, save and consume it. The study includes information about how to increase income, reduce expenditures and manage funds; therefore, this article's main topic lies on forming individuals' behavior towards finances. It works as tool for people to manage their own money, based on Financial Math (FM). Financial Math, at school, must focus on Financial Education, i.e., on an education that helps designing the profile of citizens ready to deal with challenges posed by financial scenarios under constant change. Even if night-shift high school students do not have enough financial resources to make financial investments, they need to manage their own money.

Silva and Powell (2013) advocate for a School Financial Education (SFE),

> [that comprises] a set of information through which students are introduced in the universe of money and encouraged to understand finances and economics, based on a teaching process that makes them ready to analyze, make substantiated judgement, make decisions and have critical positions towards financial matters linked to their personal and family lives, and to the society they live in (SILVA; POWELL, 2013, p. 12-13).

Accordingly, SFE means that students have to make in-depth analyses and assessments of situations linked to consumption demand or to some financial issues to be solved, based on well-informed decisions supported by financial, economic and mathematical knowledge. Students must also operate according to financial planning and to a financial management methodology aimed at guiding their actions (consumption and investments, among others) and short-, mid- and long-term deliberations. In order to do so, they must develop the critical reading of financial information outspread in society (SILVA; POWELL, 2013).

Financial] Mathematics Education "is not supposed to only help students to learn some ways, knowledge and techniques, but also to invite them to reason about how these ways,

knowledge and techniques must be turned into action" (SKOVSMOSE, 2000, p. 68). It must also allow reasoning, critical reading skills and facts' interpretation for conscious planning and decision-making, according to interests and experiences to form individuals' behaviors towards finances and to help them exercise citizenship (ROSETTI JR, 2010).

The present article is an excerpt of a research that considered School Financial Education suitable for the socioeconomic reality faced by its target population. It is so, because of the need of forming behaviors towards finances, because "likely allowing reasoning by encouraging critical-reading skills and facts' interpretation is a task set for the education work aimed at forming a full citizen" (ROSETTI JR, 2010, p. 36).

The Teaching-Learning-Evaluating methodology, based on Problem Solving suggested by GTERP, is a current trend in Mathematics Education. It is supported by clear fundamentals, besides being an innovative approach that matches this methodology's stages. Yet, it points out the likely development of skills to better critically reading situations, planning and making decisions regarding consumption demand and any financial issue to be solved. The next section introduces Problem Solving as teaching methodology.

3 A Resolução de Problemas como metodologia de ensino

According to Morais and Onuchic (2014), the First Research Seminar on Problem Solving in Mathematics Education took place at Georgia University, USA, in 1975. At late 1970s, this theory started to consolidate itself and to gain outstanding room in discipline matrices in US and abroad, as a way to seek means to teach Math (MORAIS; ONUCHIC, 2014). However, it was after the book "How to solve it; a new aspect of mathematical method" was published by George Polya, in 1945, that the Problem Solving approach started to be emphasized in school discipline matrices.

In light of some theoretical references, Pironel (2019) addresses the meaning of problem and explains that Problem Solving is the main reason for having mathematicians. Therefore, Math truly lies on discovering or proposing these problems or on seeking their solutions.

According to Pironel (2019), a situation "is only a problem when someone experiences a problematic state, embodies the task to give meaning to the situation and gets involved in an activity that makes sense to it" (ONUCHIC; ALLEVATO, 2011, p. 81). This statement is in compliance with the following definition: "problem is everything we do not know how to solve, but that we are interested in solving" (ONUCHIC, 1999, p. 215). Pironel (2019) also cites Lambdin (2003):

> [...] a problem is, by definition, a situation that leads to unbalance and perplexity. A paramount principle of teaching through Problem Solving lies on the fact that individuals facing genuine problems are forced to a state of needing to connect what they know to the proposed problem. Therefore, learning through Problem Solving develops the understanding. Students' mental networks of ideas get more complex and robust when students solve problems […] (LAMBDIN, 2003, p.7, translation by PIRONEl 2019, p. 139 -140).

Pironel (2019) explains that Polya went against traditional teaching in his time by describing the relevance likely given to using Problem Solving in classrooms and by disclosing opportunities created by problems to help Math teachers.

> If [the teacher] uses the time given to it for exercising its students in making routine operations, it annihilates their interest and impairs their intellectual development by wasting its opportunity, this way. However, if [the teacher] challenges students' curiosity, introducing problems that match their knowledge by helping them through encouraging enquires, it may develop the will for independent reasoning and provide them with certain means to reach this goal (POLYA, 1995, "Preface to the first edition", p.V.).

According to Pironel (2019), this information helps understanding the meaning of Math Teaching-Learning-Evaluating Methodology through Problem Solving. This methodology is a tool aimed at interpreting the need of exceeding the concept by Polya (1978), who developed a heuristic process to help teachers, students and people interested in solving problems.

Onuchic (2003) highlights that Problem Solving, as teaching methodology, can help replacing the passive attitude, traditionally imposed over students, by a more active and interested attitude towards learning. Problem Solving has been also approached as methodology, according to which, a problem is seen as starting point for the school math activity.

Several researchers and writers, after Polya, have been publishing about Problem Solving in several countries, including Brazil; among them, one finds Lester and Randall (1982), Schoenfeld (1985) and Lambdin (2003).

According to Machado (1987), Problem Solving is a strong trend in Mathematics Education, since it expresses the attitude of a teacher engaged in rethinking its Math teaching methodologies at school.

The National Common Discipline Matrix Basis, also known as BNCC, approached Problem Solving in discipline matrices: Problem Solving Math processes, and others, are privileged ways of Math assignments, and this is the reason why they are learning object and strategy, all at once, in Basic Education. Being object means that teaching students to solve problems is one of the

contents to be approached. Being strategy means being the learning means for students to learn (BRASIL, 2018).

Math teaching through Problem Solving emerges as the most up-to-date approach, because it can be a suitable methodological alternative to the complex scenario schools are inserted in, nowadays. Problem Solving to learn Math is GTERP's proposition: Math Teaching-Learning-Evaluating Methodology based on Problem Solving.

BNCC (Brasil, 2018) provides on High School:

> […] students must develop skills linked to investigation processes to build models and to Problem Solving. Therefore, they must mobilize their own way of reasoning, representing, communicating, arguing and, based on joint discussions and validations, of learning concepts and of developing more sophisticated representations and procedures (BRASIL, 2018, p. 529, our emphasis).

According to Onuchic and Allevato (2004, p. 218), general objects of the National Discipline Matrix Parameters (PCN) (BRASIL, 1997,1998)

> […] aim at making students think mathematically, rising mathematical ideas, establishing connections among them, knowing how to communicate when talking and writing about them, developing ways of reasoning, establishing connections among mathematical topics, or among topics outside Math, and developing skills to solve problems, to extrapolate and generalize them, and even to create new problems from them.

We have investigated likely contributions to the Financial Education of worker-students enrolled in a public night-shift high school by taking Problem Solving as the means to get to learning. It was done by using the Math Teaching-Learning-Evaluating Methodology based on Problem Solving that will be approached below.

The compound word Teaching-Learning-Evaluating is explained by Pironel (2019, p. 280), who states that it is not suitable "thinking about a teaching process that does not lead to students' learning" and that "evaluation must be constant, and give teachers the opportunity to rethink their practice and to have students confronting its beliefs, strategies and concepts, to refute and confirm them". With respect to evaluation, the National High School Discipline Matrix Parameters (BRASIL, 2000) state that it is not suitable only having one single text:

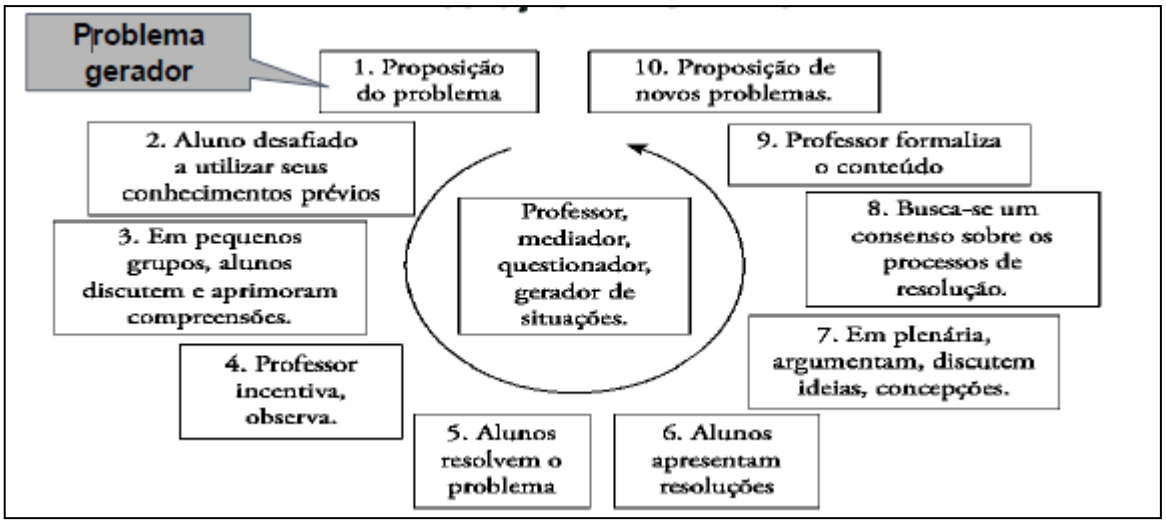
> […], because it must be a continuous process that works for the permanent orientation to the teaching practice. As part of the learning process, it must include records and comments about knowledge's collective and individual production and, therefore, it must not be a procedure applied to students, but a process that counts on their participation (BRASIL, 2000, p. 265).

Pironel (2019) concluded in his research that evaluation and learning truly happen simultaneously through the Math Teaching-Learning-Evaluating Methodology based on Problem Solving and that it did not rise as alternative, but as key instrument for knowledge construction by students, themselves.

Onuchic (200, 2008) explains that "teaching and learning must happen simultaneously over knowledge constructions, the teacher is the guide and students are co-constructors". She also states that "evaluation is built over problem solving, and it is added to teaching through follow-up students' growth by boosting their learning and reorienting classroom practices, whenever necessary" (ONUCHIC, 2008, p. 8). This statement is corroborated by Viana (2002), according to whom: evaluation is part of the teaching-learning process.

Chart 1 shows a flowchart with the last version of the Math Teaching-Learning-Evaluating Methodology based on Problem Solving, which keeps on evolving through research carried out by GTERP.

Chart 1: Flowchart of stages set for the Math Teaching-Learning-Evaluating Methodology based on Problem Solving



Source: Allevato and Onuchic (2014, p. 45).

It is possible considering that students can build new Math knowledge from a problem generator. Content formalizing emerges when the process ends rather than at its start, as suggested by other pedagogical concepts substantiated by Math Problem Solving. According to this methodological approach, "the problem is the starting point and, in the classroom, through Problem Solving, students must make connections among different Math branches to generate new concepts and new contents" (ONUCHIC; ALLEVATO, 2011, p. 81). The next section approaches methodological research aspects.

4 Methodological Path

The aim of the present research is to contribute to the Financial Education of worker-students enrolled in a public night-shift high school, so its question must be “who is the worker-student?”.

According to Carvalho (1994, p. 27), historical data about night-shift education in Brazil point out that it is offered to those whose age and need to work stop them from attending day-shift classes. Therefore, their study condition is different; studying at night is “a condition only [available] to the poorer and it always aimed at the professional qualification profile, such as that linked to learning a profession” (GONDO, 2009, p. 6).

Daniel (2009, p. 6) uses the term worker-student to introduce propositions about the reality of night-shift students: “despite the most varied reasons for choosing the night-shift school, the most significant one lies on working at day-shift or to be looking for a job. The night-shift school is mainly based on workers’ demand”.

The worker-student condition demands the night shift and it has marks on and interferes with youngsters’ school trajectory, since these individuals can seek a certificate to get best positions in the labor market. At some extent, this double-shift condition influences their life projects, compromises their schooling and often contributes to state public school dropouts. The worker-student is part of a group that mostly fails due to fatigue, that often quits school, but that has work experience in the market because they have to work to help family income and to ensure their own survival. The sense of attending school must be exclusively reduced to seek a certification, and it was observed in research carried out by Silva (2015) and Marcassa (2017).

A request was made to the direction board of the school the students attend to, for them to participate in the present study, for opening the school environment for the research. It was done to allow the writing of this manuscript, according to the current legislation. The school issued a document authorizing the study; it was sent to UFOP’s Research Ethics Committee along with the research project to be analyzed and it was approved and registered under CAAE n. 51673421.80000.515.

At first, it was necessary carrying out Preparation Meetings with 4 individuals, at the time. The summary of this process is shown in Chart 2.

Chart 2: Preparation Meetings

Meeting Activity	Goals
1st Meeting – Invitation	Introducing the project, inviting participants, distributing terms in the **Free and Informed Consent Form for students and parents**
2nd Meeting – Initial questionnaire	Drawing participants' socioeconomic profile
3rd Meeting – Diagnostic Activity	Assessing participants' knowledge about some Financial Mathematics contents
4th Meeting – Discussion about the diagnostic activity	Discussing the solution of activities carried out by participants and registering corrections in the chart for the whole class

Source: author

Based on the approach applied to qualitative-nature research - a natural environment (the classroom) and its context (practices by the professor-researcher) -, worker-students' personal experiences, family and personal experiences were data sources. This information was acquired through answers given to the Initial Questionnaire, which was handed out to participants, or collected from the available resources (MINAYO, 2016; BOGDAN, BIKLEN, 2010).

Fieldwork for methodology application demanded long-term contact with participants and the teacher-researcher was the key element for it. The natural environment (classroom) and interactive processes linked to straight contact with the assessed scenario were a direct information collection source for data production. The collected data were organized, analyzed and interpreted in an inductive way. Given the research's qualitative nature, data were described (elaborated and built) along with their analysis and interpretation, with the aid of instruments. It was necessary describing, analyzing and interpreting the followed stages, according to the selected GTERP methodology and to qualitative approach principles (MINAYO, 2016; BOGDAN, BIKLEN, 2010).

The teacher-researcher took notes in her field journal about her observations and participants made documental registers about the carried out assignments. The written word has outstanding position in the qualitative approach. Observation, field journal, students' documental records about the carried out assignments, and the initial and final questionnaires were the information-collection instruments adopted for data construction/elaboration.

Answers provided by the 20 worker-students in the Initial Questionnaire led to the following features: two students were 18 years old, nine were 17, four were 16 and five were in the age group 14-15 years. It was possible observing that many of them were in the right schooling age and that the class was small in comparison to demands for the night shift. It is important highlighting that the school management team offered this night-shift class because students had to work at day shifts to help family income (only three of them did not help their families' economic life, whereas other three, although working, also had financial support from someone; 14 students accounted for

their own survival). If they did not have the opportunity to attend the school's night shift, these students would not have the chance to attend school, and it justifies its management team concern with having a night-shift class available for the 1st year of high school.

In total, 50% (10) of worker-students' families lived with 1 ½ minimum wage - with 3 minimum wages, at most. Although 6 of them did not answer to this question, it is likely that their families' income would be too different from the aforementioned ones or that they did not have an income source, at all (assumingly they could be "Bolsa Familia" beneficiaries). Problems were elaborated according to participants' socioeconomic profile so that they could, actually, feel connected to them.

The Teaching-Learning-Evaluating Methodology proposed by GTERP was implemented based on two problem generators, after the target population was identified. This procedure aimed at research participants' Financial Education.

This featuring process was substantiated by answers in the Initial Questionnaire and developed to guide the elaboration of problems related to participants' daily lives, so that they could take them as of their own, as 'real' problems.

The first problem related to the financial planning of a low-income family. It was introduced through a text describing the scenario where Mr. Silva, a family father who yearned 1 ½ minimum wage, shows how to manage this amount in order to pay all the family's monthly expenses.

The second problem aimed this family's financial decision-making. The so-called "Bike Problem" aimed at giving participants the opportunity to join an informed decision-making process about consumption.

The approach adopted for both problems was linked to GTERP's proposition; i.e., to the Teaching-Learning-Evaluating Methodology based on Problem Solving.

At the end, questions forming the Final Questionnaire were introduced to participants. Questionnaire answers were turned into a data set that, after analyzed, provided evidences about this assignment's effect on School Financial Education, as long as GTERP's methodological proposition was adopted.

One of the problem generators applied to financial planning was selected and data were analyzed based on the herein adopted theoretical reference.

5 Data Analysis

Data were gathered (elaborated, constructed), simultaneously analyzed and interpreted, with the aid of an instrument given the qualitative nature of the present research. It was done to describe, analyze and interpret the followed stages, based on the adopted GTERP's methodology.

5.1 The Financial Planning Problem of a low-income family

A text (Chart 3) describing a scenario about Mr. Silva, who yearns 1 ½ minimum wage, was introduced. Mr. Silva had to manage this amount to pay all the family's expenses. The worker-students should feel connected to them in order to solve the problem. They had to get involved in the matter and to get the will to solve it (ONUCHIC, 1999; ONUCHIC, ALLEVATO, 2011).

Chart 3: Mr. Silva's family overview

Mr. Silva's Family comprises 4 people: Mr. Silva, himself, his wife and two kids, at the age of 12 and 14 years, respectively. They live in a house inherited from his grandmother: two bedrooms, the kitchen and one bathroom. He has a formal job, with social security number, and earns 1 ½ minimum wage a month. He has the right to access the Unified Health System (SUS) and his kids study in a public school. If one considers the register in the Federal Governments' Unified Register (CadÚNICO), and family income up to ½ minimum wage, the family must pay a social fee in its light bill. The family lives in the periphery and pays the housing tax. Assumingly, he also pays water social fee. It is important knowing how much will be left of his salary after all taxes are subtracted from it, as well as all fees and what he pays for gas canister. It is known that he gets the 13th salary and 1/3 of his salary as vacation bonus.

Source: author

5.2 The First Meeting for the Planning Problem Applied to Family Finances

Two paper sheets were handed out to participants, one of them described the situation-problem and the other was blank for them to write down the solution. They could use an electronic calculator.

Individual reading was performed. Participants started reading about the problem in silence. Next, they asked the teacher-researcher about the meaning of CadÚNICO and the reason why the family had the right to benefit from social fee, since none of them knew about it. It was explained to them that, because Mr. Silva earned 1 ½ minimum wage to be split among 4 people, the total result would be less than ½ minimum wage for each family member.

They also wanted to know how to calculate social-fee value and the 13th salary value, as well as if there was social fee for water bill. They asked what housing tax was.

According to Dutra (2011), dialogue evidences an alternative to build new knowledge and interaction among research participants.

The teacher-researcher took participants to the school computer lab, where they could access the internet to make consultations about the addressed topics and to get data related to the problem to be solved. Some websites were suggested to be googled:

https://salario2022.com.br/salario-minimo-liquido-2022/

https://www.gov.br/pt-br/servicos/inscrever-se-no-cadastro-unico-para-programas-sociais-do-governo-federal/

https://www.valadares.mg.gov.br/detalhe-da-materia/info/prefeitura-prorroga-prazo-para-pagamento-do-iptu-2022/169509 https://www.guiatrabalhista.com.br/guia/salario_minimo.htm

They were expected to get answers to the aforementioned enquires. However, some of them did not know how to turn the computer on. Given their difficulties, the teacher-researcher provided the necessary orientations and students helped each other to complete the task.

Each group used a computer after they were back on, students were asked by the teacher-researcher to name a team leader. The contents were read in groups. This was the assignment for the 1st Meeting.

5.3 Second Meeting for Planning Problem applied to Family Finances

Participants got a paper sheet describing the problem: find out what is left of the salary after subtracting the taxes, fees and the value paid for gas canister, the housing tax, and the light and water bills, from it. How much will be left for the remaining expenses, if the family spends 90 Kwh/month, on average?

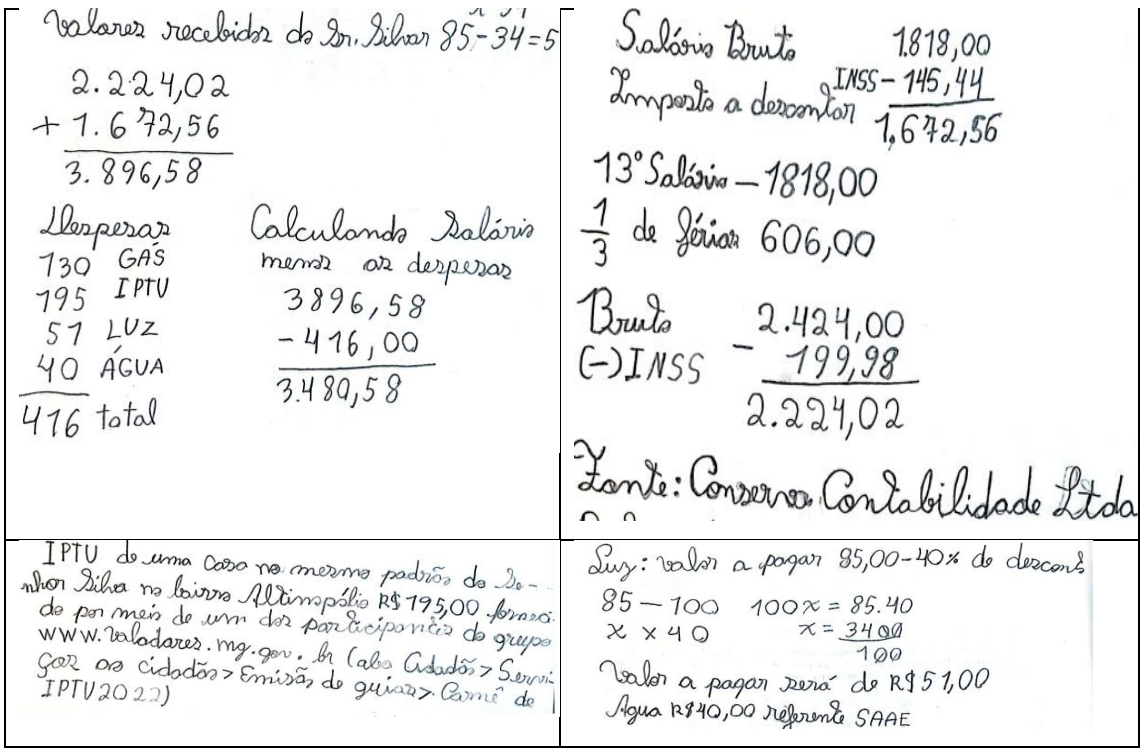
Participant A1, from Group A, was chosen as group leader; right after start reading the text, he informed that he did not understand the proposed assignment. He was asked to search for the minimum wage value and the total paid for the collected taxes and fees. A new reading was carried out and the search for the mentioned terms was performed; values were hidden on purpose. A1 started solving the problem and found the answer. Participant A2 informed that he worked delivering furniture and that he also earned 1 ½ minimum wage, but he did not have a social security number. A4 searched the region's gas deposit; he found the price paid for a gas canister (R$130.00) and that power consumption added with the charged taxes could reach R$1.10/hour, based on the aforementioned scenario. With respect to housing tax, A1 got in contact with his family to search information about how much is paid in his region, but he confessed to not have had the interest of knowing about costs with these taxes and fees.

According to Dutra (2011), there are problems that trigger important discussions for the learning process, although they seem simple. It is so, because they start from participants' interest. Participant A4 got in contact with an accounting office and checked the values regarding minimum wage, 13th salary, vacations and discounts. Participants in Group A, besides getting involved in problem solving during two 50-minute classes, also worked on it after school.

Because the text regarding the first problem mentioned that Mr. Silva earned a 1 ½ minimum wage, plus 13th salary and 1/3 vacation salary, groups understood that they had to sum all these values (R$3,896.58) to make calculations about expenses. They needed mediation by the teacher-researcher to explain that these values were only received once a year. Sometimes, data that did not influence problem solution would come out in some problems. It is essential analyzing the reality or making interpretations; in this case, it was not necessary using all data provided in the text.

Pironel (2019) shows how teachers can interfere with students' knowledge construction without providing elements that could disclose a problem solution. We believe that mediation, at the right time, is essential for learning and for getting interested in finding solutions. Solution four by Group A is shown below, in Chart 4.

Chart 4: Group A's solution



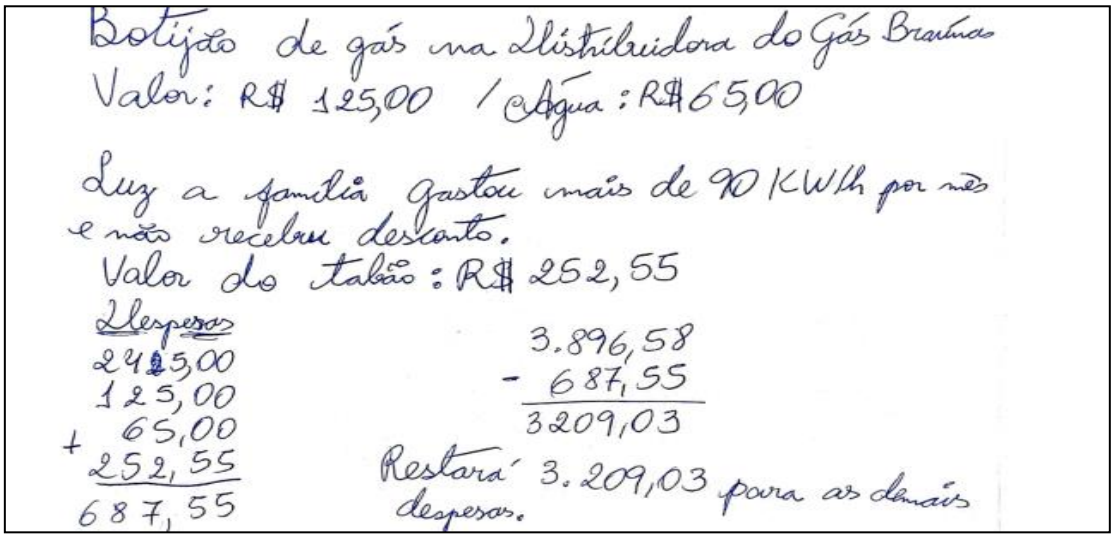
Source: author

The text did not mention the 13th salary or the 1/3 vacation salary. On the other hand, Group A searched the prices paid for gas canister, housing tax, light and water, based on rules shown in Chart 4.

The other groups followed the same path. They took into account that Mr. Silva's monthly income was R$3,896.58. Expenses varied, but it was natural, because groups made searches in different sources. Expense variations were recorded among Group A - R$416.00; Group B - R$ 687.55; Group C - R$326.55; Group D – 753.77 and Group E - R$783.25.

Participant B1 was Group B leader; he lived in a peripheral location and set housing tax at R$245.00. Initially, Group B had a hard time finding the total value of 1 ½ minimum wage, but, after reconfiguring the search, based on other meshes, it got to find the total, without trouble. The other school mattes went on with the research without impairments, but B3 was surprised with the price paid for a gas canister; this group mentioned that it costed R$99.00. B4 informed to have bought a gas canister for R$125.00. After searching in the internet, they found out that this value changes depending on inflation, as informed in Braúnas distribution center. Problem solution found by Group B is shown in Chart 5.

Chart 5: Group B's Solution



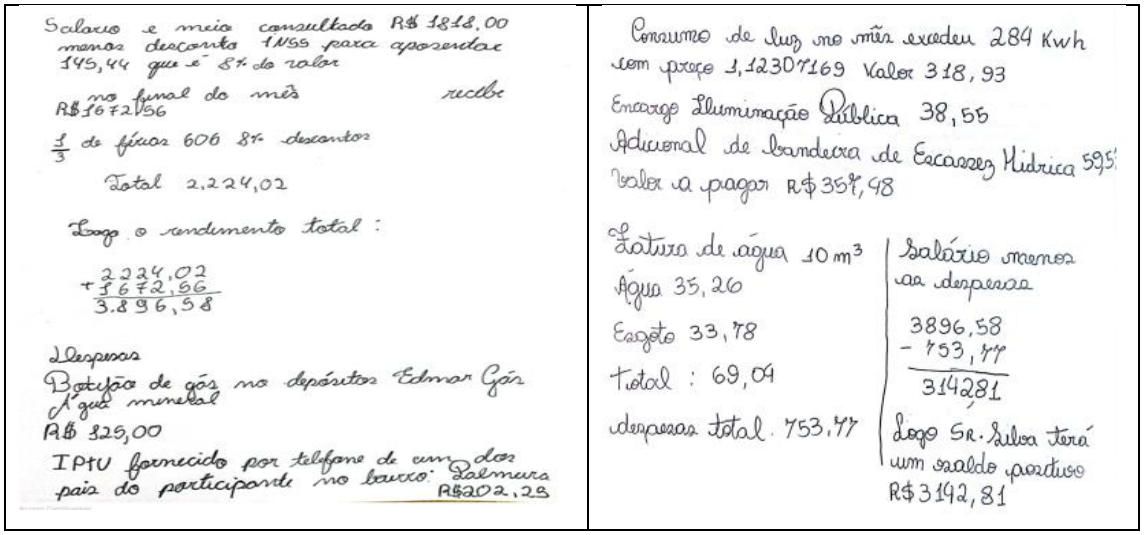
Source: author

Participants in Group C easily found the necesary data, because they have already helped with family budget.

Participants D, D1, D3 and D4 had some doubts about water fees and had a hard time getting to the mean consumption to use in problem solving. D2 informed the mean cost based on his family's consumption and his group worked with this value. Only D2 knew water mean consumption value recorded for his house (10m3), plus sewage fees. D2 accessed CEMIG webpage and got informed that water

shortage band must be added to the bill, depending on power consumption. They used all these data in their calculations. Solution is available in Chart 6, below.

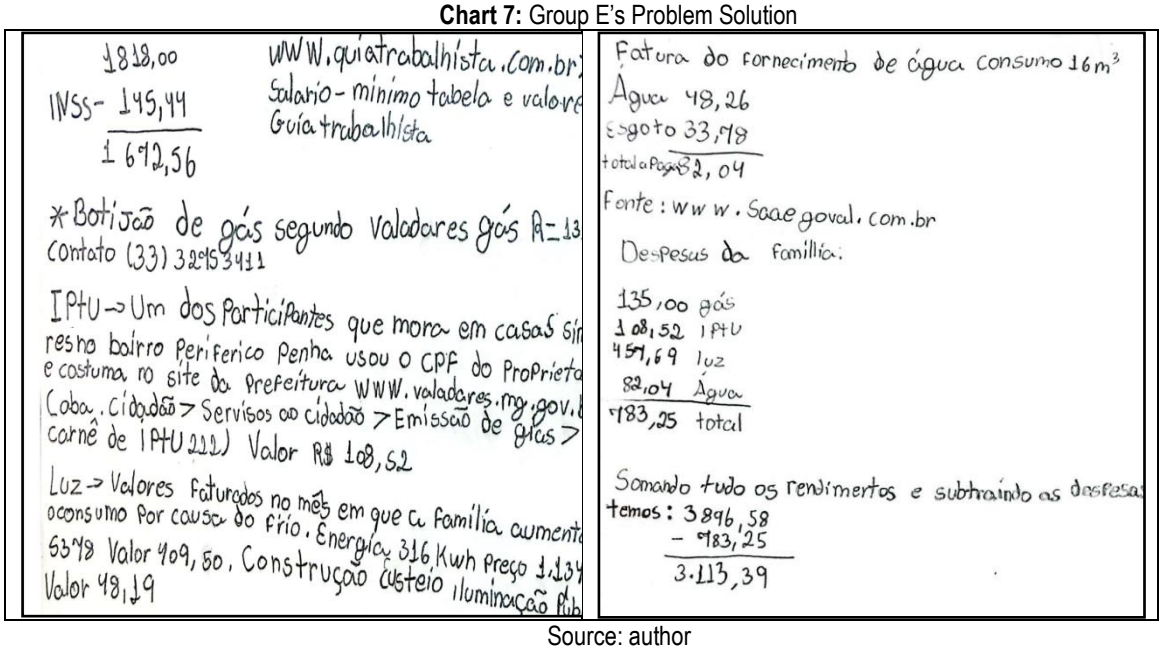
Chart 6: Group D's Problem Solution



Source: author

After some time searching, E3, Group E's leader, informed that only with the monthly income it would not be possible paying for all the expenses, if one had in mind that food was not included in subtractions made from the total salary. In order not to have a negative result, the 13th salary and the 1/3 vacation salary should be added to the cash flow available. Group 7's solution is shown in Chart 7, below.

Chart 7: Group E's Problem Solution



Source: author

The plenary discussed that they had to subtract these fixed expenses from the total monthly income to find how much would be left: R$1,672.56.

Conclusion: in order to solve a problem one must read the text with close attention, and not to create information about what is not clear in it. A problem can have different answers, depending on the data available and on the situation; sometimes, there is no solution. The Mathematics Teaching-Learning-Evaluating Methodology based on Problem Solving provides the possibility of having several learning paths, including Financial Education, as long as the stages are followed, as suggested. Students must dialogue, discuss, conclude and share their results (DUTRA, 2011).

5.4 Third Meeting about the Problem concerning Family Finances Planning

The following situation was introduced for this meeting:

It is known that Mr. Silva earns 13th salary and 1/3 vacation salary. Students must search in the internet about what is a healthy and economic diet to feed four people, as well as the amount and prices paid for the suggested food types.

Participants did not get information about what would be a healthy and economic diet to feed four people in order to solve this problem. They searched for a list of grocery shopping in the internet. They also did not observe that there was too much data that did not help finding the solution. Group E's solution is shown in Chart 8, below.

Chart 8: Group E's Solution for Problem 2

2- Sabe-se que o Sr. Silva recebe o 13º salário e 1/3 do salário de férias. Pesquise na internet para saber qual deve ser uma dieta saudável e econômica para alimentar as quatro pessoas. Também as quantidades e preços dos alimentos sugeridos.	AS DESPESAS com alimentação seria de 468,20
3- Agora que vocês já conhecem os alimentos necessários e preços. Qual seria a despesa da família com esta alimentação? DESPESAS FIXAS 735,30 ALIMENTAÇÃO +463,20 1.203,50 biscoito : 3,35 cloro : 14,90 Tempero : 10,59 Papel higienico : 12,80 amaciante : 25,90 Sabão em Pó : 10,88 molho de tomate : 6,99 frango congelado : 10,49 carne 10Kg : 200,00 Presunto : 15,50 ARROZ = 20,00 FEIJÃO = 10,00 CAFÉ = 16,30 LEITE = 4,69 REPOLHO = 2,99 ALHO = 11,99 OVOS = 12,00	alface = 2,00 banana = 2,99 Tomate = 3,99 batata = 2,99 manga = 2,47 iogurte = 1,09 manteiga = 15,90 azeitona = 46,90 biscoito = 3,35 cloro = 14,90 Tempero = 10,59 Papel higienico = 12,80 amaciante = 25,90 Sabão em Pó = 10,88 molho de tomate = 6,99 frango congelado = 10,49 carne 10Kg = 200,00 Presunto = 15,50

Source: author

Observe that the Group did not understand the question. They summed the fixed expenses to expenses with food. Besides not searching for healthy diet, participants did not observe that they were supposed to feed four people. Then, the teacher-researcher informed about the diet and suggested that they should visit : https://www.cienciainforma. m.br/index.php

https://www.cfn.org.br/

https://www.agenciaminas.mg.gov.br/noticia/minas-atualiza-cardapios-da-alimentacao-escola https://www.nutricaoempauta.com.br/ and tables with school food menus in Minas Gerais State.

In order to get the most economic diet possible, she asked them to select food with lower nutrition value and, consequently, the cheapest ones. She suggested a search in the School Food Program, which provides healthy food menus and the amounts necessary for the research.

Based on the research by Milani (2011), groups presented wrong answers, and it demanded intervention by the teacher. Doubts were discussed in the Fourth Meeting about the Problem about Family Financial Planning.

After having all the necessary material in hands, the groups developed a healthy menu and described the amounts needed for four people, for a month. They searched for the prices and made suggestions for healthy and economic meals, to answer the question.

All groups made detailed suggestions in table presenting portions and calories. Group A suggested breakfast, lunch, small meals and supper. It did not suggest dinner. For breakfast: fruit salad (based on amounts and values per person, and for the family as a whole).

Group B suggested the same meals with different ingredients. It also did not suggest dinner. Group C's suggestion did not mention supper or dinner. Group D did not specify the daily meals (how many and which ones). It just presented a list of food for four people to eat within a month (R$1,180.11 for 1,903.32 KCAL). The group explained that they thought about a varied, nurturing and economic diet that could provide a different menu every week. The consultation to the school food menu, which provided information on amounts and calories, according to this Group, allowed making a list for breakfast, lunch, afternoon snack and supper. It was the only group including supper in its list.

5.5 Fifth Meeting about the Problem referring to Family Finances Planning

The following question was asked: now that you already know the necessary food and its prices, what would be Silva's family expense with it? Because this question was already discussed and answered in the previous Meeting, when each group had formulated a healthy and economic diet, they just had to present their results.

Participants were interested and concerned with presenting them, but they kept on arguing about the sum of expenses, which they thought was too high, in comparison to Mr. Silva's salary - it represented the families of each participant.

Situations were elaborated to reach this very point, on purpose, because the idea was to build the profile of research participants, so that the introduced situation was actually embodied as their own problem. It was assumed to make them prone to solve the problem, based on the definition of problem by Onuchic (1999).

Participants were willing to choose the items and were concerned about providing breakfast, lunch and snacks. However, they observed the prices and learned that, based on the minimum wage, it would be unfeasible to buy all the food they had suggested.

Silva's family expenses with the suggested food were

Group A = R$1,779.09; Group B= R$1,764.39; Group C= R$827.86

Group D=R$1,180.11; Group E=R$1,305.41.

The expenses led to values considered high by the participants. When they presented the results, they kept on arguing that the totals and the salary did not match. According to OCDE (2005), this understanding process is essential for individuals to make financial choices. In this case, it was a tough choice: some groups ruled out the meals as an attempt to pay for the other expenses.

Still, in the Fifth Meeting, another provocative question was asked: now that you know all fixed expenses and the total spent with food, how much would be left for the other expenses?

Leader in Group A used a calculator while commenting that affording a house implied paying several bills and that the salary was not enough, because there would be monthly negative balance of R$513.73.

Group B considered that the family should prioritize its needs, but it would remain in debit, because the salary was not enough, it would have monthly debit of R$867.07. Participants

suggested paying it in installments, but it would not solve the problem. How could they pay the debit? According to Rosetti Júnior (2010), the need of a critical reading of the experienced situation helps to achieve citizenship and to encourage one to struggle to accomplish the necessary changes to reach a dignifying life.

Participants had shown to understand the need of planning in order to do not experience financial squeeze at the time to pay for their expenses. On the other hand, they have confirmed that the salary they were dealing with was not enough to do so. School Financial Education, in this sense, as proposed by Silva and Powel (2013), is important for students to learn how to make financial decisions substantiated by Mathematics Financial Education.

Interestingly, during the discussion, Group C stated to depend on a family agreement and they even presented the possibility of saving R$518.15 if they replaced meat for eggs in the meals. Group E, in its turn, took supper and dinner out of the list, so that it would not have all daily meals.

According to Pironel (2019), learning evaluation takes place at all moments, at each feedback, and it shows the need of clarifying about citizens' rights. As President Luís Inácio Lula da Silva uses to say: citizens have the right to breakfast, lunch and supper.

Group D also took dinner and supper out of the list and showed that, this way, they could save even more, just by replacing some items for cheaper ones, as suggested by the teacher-researcher, before. However, the family lacks R$ 320.93, yet; and it still has other expenses to pay.

Participant E1 justified saying that there were too much bills to pay and that minimum wage value did not allow affording them all. Well, if Group E was aware of its rights, it would likely not take supper out of the daily meals list. A School Financial Education approach could take care of this subject. BNCC (Brasil, 2018) recommends to have Financial Education in the discipline matrix, even if as Cross-sectional topic.

Based on their calculations, participants have proven to have a hard time living with a salary similar to that of Mr. Silva, because it is not enough to pay for all the expenses. Food expenses exceed the minimum wage. How could he pay for the fixed expenses? Just to make it clear, according to the Federal Constitution, worker-students could think about struggling for their rights, rather than accepting the situation and do not have supper, and live with insufficient nutrition. School Financial Education could also approach such a viewpoint.

Another provocative question was made: how can the family split the saved fraction? And, if there is nothing left, how to solve the problem?

Group A suggested that the younger kids could get a job to help the family budget. Group B said that they should have an extra economic activity to complete the monthly budget, such as selling candies and working with house cleaning. Miraculously, Group C found a way to save money and even split the saved money for other items they considered essential for the family. They assumingly did not calculate the necessary total for the whole month or did not provide the family with essential items. Group D observed Silva's family financial difficulty. Participants suggested to use its saving, if it had any, or to increase Mr. Silva's workload with a second job. Well, if they do not have money to afford monthly expenses, how could they have savings? Would it be more interesting to have a minimum wage capable of affording the expenses? They lack knowledge about their constitutional rights, which is another item that can be approached by School Financial Education.

After this debate, Group E suggested that all family members should get a job, even the underage ones, as the way to help with the family's expenses. Just as the other groups, the solution was to increase the workload. They did not think about struggling for a fairer minimum wage, because they certainly did not know their labor and constitutional rights. Once again, this is an approach that could be addressed by School Financial Education.

Based on the questions placed to Silva's family, the worker-students could link their financial difficulties to those of their own families. Since many of them worked to help with their families' expenses, even the underage ones, they likely assumed that it would be the natural solution.

5.6 Consideration about the Financial Planning Problem of a low-income family

Participants in the present research would get to school tired from the daily work, but even thought, they were interested in talking with the teacher-researcher, even during mediation, to reach a solution. They did not know what a healthy and economic diet was. That is why they did not take the healthy-diet expression seriously. Teacher-researcher's mediation was necessary to suggest the material to be consulted. She suggested a search in the School Food Program, which provides a healthy-food menu and the necessary daily calories. She also explained that they needed to seek similar food at lower prices so the diet could also be economic, and it was important for all groups to be able to find the solution.

Participants also did not know how to calculate the family's monthly income, because they did not know their labor rights, such as 13th salary and 1/3 vacation salary. One of them said that

he had a social insurance number in his “Carteira de Trabalho” [Work card]. The teacher-researcher explained it and participants could solve the question linked to these terms.

They had the opportunity to observe mistakes in several solutions, because each group found a different solution. They could also observe the relevance of carefully reading the assignment, because there could be unnecessary data in it that would not influence problem solution.

Participants considered that the solution for lack of money to afford the expenses lied on working more and on increasing income. It was necessary clarifying about their rights for complete meals. They understood that the salary was obsolete and one participant also explained that the gas canister price was higher because of inflation. Thus, the salary was unfair, because it did not ensure a healthy diet.

6 Considerações Finais

The aim of the present research was to disclose contributions from Problem Solving based on the Problem Solving methodology applied to Financial Education provided to a class of worker-students enrolled in the 1st year of a public night-shift high school. The study was guided by the following question: “what are the likely contributions of Problem Solving to the Financial Education of worker-students enrolled in a public night-shift high school?

The assignments were planned and conducted based on the specific goal of solving the research question.

- Developing assignments related to Financial Mathematics contents based on the Teaching-Learning-Evaluating Methodology substantiated by Problem Solving, in the Financial Education approach, which is entangled to participants’ labor and social realities.

- Valuing their experiences with money to help informed and planned decision making based on financial problem solving, according to families’ financial situation.

- Contributing to these participants’ citizenship formation through Financial Problem Solving, so that they can struggle for changes in their social context, based on information critically supported by reality.

The Teaching-Learning-Evaluating Methodology proposed by GTERP was implemented to aim at research participants’ Financial Education. It was done through two problem generators elaborated after the target population was set. Answers in the Initial Questionnaire were used to

guide the elaboration of problems related to participants' daily lives, so that they could embody them as of their own, as real problems.

Questions in the Final Questionnaire were introduced to the participants, and their answers formed a data set that was analyzed and allowed finding evidences about the effects of these assignments on School Financial Education. It was followed by the methodology proposed by GTERP.

Based on data and on the use of some tools (questionnaires, observations, field journal and documental records), it was possible creating categories that dialogued with previous categories, based on the School Financial Education proposition by Silva and Powell (2013), which was herein adopted. The new categories pointed out that assignments' results, based on the Mathematics Teaching-Learning-Evaluating Methodology proposed by GTERP, helped the (Mathematical) School Financial Education proposed by Silva and Powell (2013): critical reading of financial information; analyzing and assessing the situation in an informed way; elaborating a financial planning to guide consumption actions; making informed decisions.

They also led to participants' broader participation and involvement in the carried out assignments. They did not skip classes regarding the Research Meetings.

There were positive changes in their attention to the accurate reading of assignments, which led to mathematical understanding of the introduced mathematical problem-situation, because participants engaged in them. Real situations embodied by them became real problems (ONUCHIC, 1999, 2003, 2008; ALLEVATO, ONUCHIC, 2014; ALLEVATO, 2016; LAMBDIN, 2003), and they regarded financial decisions related to daily issues.

Problem Solving favorably contributed to the Financial Education of worker-students enrolled in the 1st year of a public night-shift high school.

The investigation question was answered, i.e., it was possible finding the contribution from the Problem Solving Methodology to the Financial Education of worker-students enrolled in the 1st year of a night-shift high school.

It is recommended to develop further studies to make investigations related to public polices, labor rights and Financial Education provided to worker-students.

It is also possible carrying out a research in the Youth and Adult Education (EJA) environment, focused on problems elaborated by worker-students for a population different from the one targeted in the present study.

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