Revista ARACÊ
ISSN: 2358-2472

KNOWLEDGE FAIR AS A STRATEGY FOR MEANINGFUL LEARNING IN THE SUBJECT OF MATHEMATICS

https://doi.org/10.56238/arev6n3-228

Submitted on: 18/10/2024 **Publication date:** 11/18/2024

Luísa Miranda Nunes da Costa Ignácio and Clara Romão Estaner

ABSTRACT

The article presented relates the elaboration and results achieved through a master's dissertation project regarding the realization of a Knowledge Fair, based on the normative documents that guide basic education in the country. The project was applied in a private educational institution and had the participation of students from the 9th grade of Elementary School II and High School. As a general objective, the project sought to bring students closer to the mathematical content learned through a project that enables its practical applications. And as specific objectives, to favor the development of student autonomy and teamwork through the creation of a company for the Knowledge Fair; improve the ability to seek in the acquired knowledge ways to solve problems and seek solutions; facilitate the development of the skills and competence described by the National Common Curricular Base (BNCC) and the appropriate theoretical content and use of these in a practical way in the daily lives of students. During the application of the project, the students developed the contents in practice as a tool for solving problems during the creation of a snack bar for the presentation on the day of the Knowledge Fair. After the application of the project, it was realized that through the experience in practice of the contents learned in the classroom, the students understood the importance of mathematics as a facilitating tool in everyday situations.

Keywords: Mathematics Teaching. Knowledge Fair. National Common Curricular Base.

Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

The teaching model currently applied in schools is a reflection of the various changes that have occurred in society over the years, so bringing new approaches to traditional methods of education is one of the great challenges faced by teachers in the classroom.

The teaching of mathematics, as far as it is concerned, presents technical and more systematic approaches, little diversified over the years with regard to the classroom. Bringing students closer to the experiences of the discipline is necessary so that the practical applications of the contents are known and experienced in schools.

Detaching pre-established concepts regarding the subject of mathematics is challenging for both teachers and students. From a very early age, in the early years of schooling, the discipline is seen as complex and difficult, this perception sometimes generates learning blocks and difficulties along the way.

Breaking with preconceived ideas that "mathematical content is treated in isolation and presented and exhausted in a single moment" (BRASIL, 1998, p. 22) and diversifying the traditional model of mathematics teaching become an important part of the process of making the discipline more accessible.

Conceiving that the accessibility of the discipline is important to generate the interest of students is the starting point to bring them closer to the contents presented in the classroom. This makes us think that education should not be a simple act of depositing information and concepts, but as described in the BNCC (BRASIL, 2018), it is to prepare the student for the world of work, providing opportunities to develop important skills and competencies for their growth as citizens.

Thus, understanding the students' difficulties and facilitating learning are the teacher's objectives when preparing activities that challenge them and bring them closer to the practical applications of concepts taught in the classroom. Involving them in situations in which they need to think critically and apply content from the discipline as a facilitating tool in problem solving becomes an active and meaningful learning strategy.

That said, how can we teachers challenge our students to use mathematics as a problem-solving tool? What strategies can we use to bring them closer to the discipline and the content taught in the classroom?

In order to answer these questions, this article has as a general objective to present how the development of a Knowledge Fair can facilitate the meaningful learning of mathematics. Such as the specific objectives:

Revista ARACÊ
ISSN: 2358-2472

- Provide opportunities for the development of skills and competencies described by the BNCC for the years of schooling;
- Favor students' perception of their role in the learning process and the development of autonomy;
- Bring students closer to the mathematical content learned, through practical experience.

After presenting the objectives of the article, a brief discussion will be held about the theoretical concepts guiding the development of the research.

DEVELOPMENT

MATHEMATICS TEACHING AND SKILLS DEVELOPMENT

According to the BNCC, the teaching of mathematics plays an important role in the development of skills and competencies necessary for the advancement of the student as a citizen, so that they are able to show themselves able to have "attitudes and values to solve complex demands of daily life, the full exercise of citizenship and the world of work (BRASIL, 2018, p. 8).

Thus, during the learning process, students need to break the concept of being mere spectators and become part of the process in order to develop skills, such as "investigation, reflection, critical analysis, imagination and creativity, to investigate causes, elaborate and test hypotheses, formulate and solve problems and create solutions" (BRASIL, 2018, p. 9).

In line with what was previously portrayed, one should think about breaking pre-established concepts "that many subjects are restricted to the accumulation of information" (PAIVA, 2016, p. 17), in order to make meaningful learning possible and that offers importance to students.

In general, learning mathematics should be an act of learning to think and make oneself understood, visualize challenges and find ways to overcome them, develop hypotheses and solve problems that require critical thinking and creativity. Mathematics goes beyond purely systemic content, it behaves as a source of solutions to complex problems.

Revista ARACÊ
ISSN: 2358-2472

ACTIVE METHODOLOGIES AND THEIR PARTICIPATION IN THE CREATION OF MEANING

In line with what was previously discussed, the BNCC discusses the importance of a learning model that develops meaning to what students learn during the school period, allowing the contents to be absorbed and used later "to make their life project viable and continue learning, so as to be able to adapt flexibly to new conditions of occupation or subsequent improvement" (BRASIL, 2018, p. 465-466).

To this end, it is relevant that the activities designed and developed by the teacher at the time of learning are "centered on the student so that he learns the proposed knowledge through the interaction between him and other colleagues, stimulating critical thinking" (PAIVA, 2016, p. 15). Learning by doing is one of the strategies that can be addressed in this way of making learning important to the student.

Bacich and Moran (2018) expand this conception when they discuss the importance of exchanging knowledge and experiences during the learning process, also citing the importance of understanding and taking advantage of the student's experiences within their social environment for learning in the school environment.

In the process of creating meaning, the "teacher acts intentionally to change meanings of the student's experience, using educational materials from the curriculum" (MOREIRA, 2011, p. 39), and thus preparing the student for future challenges brought by the social environment in which they are inserted.

To this end, active methodologies contribute directly to the creation of meaning for students, contributing to their formative process and assisting in the development of citizens aware of their social and intellectual contribution.

REALISTIC MATHEMATICS AND PROBLEM SOLVING

The teaching of mathematics has tended over the years to be based on the conception that it is necessary to create "traditionalist or academic rationalist curricula, despite all the changes" (KRASILCHIK, 2000, p. 87), making the learning of the discipline by students a sometimes boring and complex process.

To present oneself against the idea that mathematics needs to be explained in a single way, contradicts many of the methodologies used to date for the teaching of the subject. Thinking about how to break this cycle is part of defending mathematics that is closer to the reality of students. To this end, it is necessary to promote moments in which

Revista ARACÊ
ISSN: 2358-2472

they can "work with issues that interest them and that are presented at the outset in a confusing way, but that we can clarify and study in an organized way" (PONTE et al., 2002, p. 1), making them think and collaborate with each other, facilitating the exchange of knowledge and experiences, in addition to provoking them to think and build hypotheses based on the knowledge acquired in the classroom.

Nevertheless, contributing to the use of mathematics as a facilitating tool for problem solving needs well-defined strategies by the teacher. It is understood that all proposed activities need to understand that "a problem is something that needs to be challenging, it needs to provide restlessness and make the one who will solve it look for various strategies that will culminate in the resolution" (MELO, 2020, p. 23).

This process of thinking critically, creating hypotheses and solving problems is an important step for realistic mathematics, since for this it is necessary that the student is able to mathematize a real problem, in order to solve it. Freudenthal (1973) describes the importance of having the ability to get involved in the problem and organize it within the experiences previously had, being able to "organize reality with mathematical methods" (FREUDENTHAL, 1973, p. 44).

Thus, conceiving that the student is a being capable of understanding mathematical concepts and using them in order to solve real problems becomes the starting point for a mathematics teaching based on the development of skills and competencies relevant to one's growth as a citizen.

PROBLEM-BASED LEARNING AND THE CREATION OF A KNOWLEDGE FAIR

Creating an attractive learning environment for the student, as well as conceiving meaning the discipline requires changes in the traditional model of teaching mathematics, it is necessary to have an environment that offers "more complex challenges, which develop a proactive posture of these students, both in individual tasks and in collaborative work, has become a pressing need" (GIORDANO; SILVA; 2017, p. 79).

Showing students their potential favors autonomy during decision-making, breaking the pre-established concept of a static teaching process where the student does not contribute and does not actively participate in their learning process. Relating creatively to the discipline develops critical thinking, in which students confront the reality in which they are inserted.

To this end, problem-based learning proves to be an advantageous tool in this

Revista ARACÊ
ISSN: 2358-2472

process of favoring the development of skills and competencies through the teaching of mathematics. In one of its contributions to this process, it seeks to "stimulate in the student the ability to learn how to learn, to work in a team, to listen to other opinions, inducing him to assume an active and responsible role in his learning" (MASSON et al.; 2012, p. 4).

In addition, according to the author, at this moment there is a change in the role of the teacher "who ceases to be the transmitter of knowledge and becomes a stimulator and partner of the student in the discovery of knowledge" (MASSON et al.; 2012, p. 4). In this sense, the development of a Knowledge Fair converges with the conceptions of problem-based learning, making the student an important part of all decision-making and solutions within the proposed activities.

METHODOLOGY

The research presents a qualitative approach, since it intends to determine the importance of making mathematics present in the students' experience as a tool for problem solving. It is classified as research of an applied nature, since it seeks to facilitate the learning process and solutions to problems presented during the elaboration.

As for the objectives, it is characterized as explanatory, as it investigates how the development of a Knowledge Fair can favor the learning of the discipline of mathematics.

The project was carried out with 28 volunteer students, from a private educational institution in the interior of the state of Rio de Janeiro, this number corresponds to 31% of the institution's students considering the grades of schooling. Table 1 shows the distribution of students according to the year of schooling.

Table 1: Number of students participating in the project.

	Grade 9	Year 1	Year 2	Year 3
Number of Students	12	6	5	5

Source: From the authors.

For the elaboration of the Knowledge Fair, some steps were determined, so that it would enable the creation of a path to achieve the results proposed at the beginning of the project. The stages of the project will be listed below.

Revista ARACÊ
ISSN: 2358-2472

LISTENING AND PROJECT PROPOSAL

Initially, a meeting was held with the participating students with the objective of presenting the project and listening to the conceptions that the students had regarding the learning of mathematics. Many of the opinions expressed by the students characterized mathematics as a complex discipline full of challenges. One of the students described mathematics as *"Very difficult teacher, I can't understand what I'm going to use it for in my life".*

After the exchange of ideas, the proposal to carry out the project was made, as well as the presentation of some of the activities to be developed by them during the development of the Knowledge Fair. Finally, the voluntary participation of students was requested, as a complementary activity to the activities carried out in the classroom.

DEFINITION OF THE CONTENTS TO BE WORKED ON DURING THE PROJECT

During this stage of the project, the results that the students obtained in the evaluation activities during the quarterly stage were considered. To this end, the contents in which the students encountered the greatest difficulties in assimilation during the work in the classroom were defined.

For each grade of schooling, specific contents were determined to be worked on, as well as contents that should be worked on collaboratively among all students participating in the project. All contents would converge with skills to be developed in each of the school grades. Chart 1 shows the contents selected in each of the school grades to carry out the activities during the development of the Knowledge Fair.

Chart 1: BNCC skills correlated to the contents listed for the project.

Series	Content	BNCC Skills
9th grade EFII	Ratio, Ratio and Units of Measurement	EF09MA06 EF09MA08 EF08MA20
Year 1 EM	Financial education (new high school)	EM13MAT203 EM13MAT510
Year 2 EM	Linear systems	EM13MAT301 EM13MAT302 EM13MAT501
3rd year EM	Areas of plane figures and geometric solids	EM13MAT201 EM13MAT307 EM13MAT504

Source: Brazil (2018, p. 315, 317, 534, 536, 541, 544 and 545).

Revista ARACÊ
ISSN: 2358-2472

Chart 2 describes the contents selected for collaborative use during the activities proposed for the elaboration of the Knowledge Fair. These contents were selected with the intention that the students could exchange knowledge not only with classmates from their own class, but also to contribute with classmates from other grades.

Chart 2: Contents for collaborative use.

Follow-up	Content	BNCC Skill
EFII (Grade 9)	Probability and Statistics	EF09MA21 EF09MA22 EF09MA23
EM (1st, 2nd and 3rd year)		EM13MAT102 EM13MAT202 EM13MAT316 EM13MAT407

Source: (BRASIL, 2018, p. 319, 533, 534, 537 and 539).

This stage was essential for the realization of the project, based on the knowledge of the contents to be worked on, it was possible to elaborate the activities to be proposed to the students, as well as determine the challenges that would be proposed to each of them.

BRAINSTORMING

The brainstorming stage was designed so that students, through collaborative interaction, could expose their ideas and develop proposals together with their colleagues for the development of the Knowledge Fair, all students were encouraged to express their opinions and actively participate in the decision-making process.

At this time, many details of the development of the project were discussed, how the results would be presented on the day of the Knowledge Fair and what activities would be carried out in each of the teams. It is relevant to mention that throughout the discussion the teacher participated as a mediator in the dialogues and favoring the participation and active listening of the students.

Many of the development details were defined during the meeting to carry out the brainstorm, in addition to being a moment that provides the opportunity to develop skills necessary for social interaction and teamwork. Moreover, this achievement was important to guide the subsequent stages.

Revista ARACÊ
ISSN: 2358-2472

OPINION POLL

The BNCC (BRASIL, 2018) discusses which skills should be developed during the basic education process. Within the mathematics curriculum and its technologies, it is common to observe that many contents are listed in more than one grade of schooling and correspond to a skill to be developed at that moment of learning.

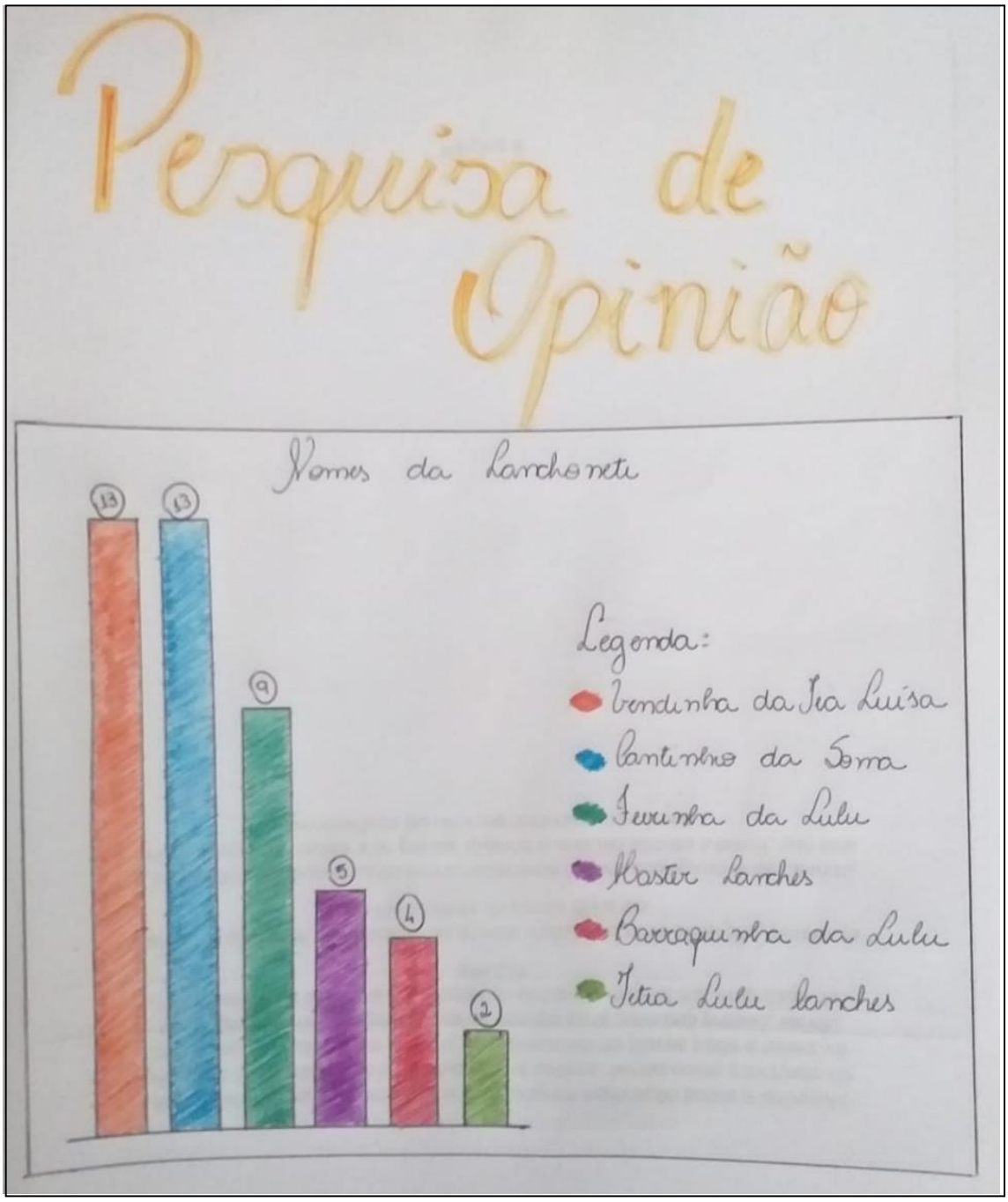
At this stage of the project, the probability and statistics content was chosen to be worked on by the students during the activity, since it is one of those contents that permeate more than one grade of schooling, in order to provide an opportunity for an exchange of knowledge between students from different grades of schooling, as well as collaborative work.

For this activity, students were asked to conduct an opinion survey considering the decisions made in the previous stage (brainstorming), so that they could know the opinion of other colleagues in the school and the school community. This survey was carried out by students in the 2nd and 3rd year of high school and disseminated through the official channels of the educational institution. After the research was carried out, the data treatment was carried out by students from the 9th year of Elementary School II and 1st year of High School, who were also responsible for the construction of graphs that clearly showed the research data.

Figure 1 presents one of the graphs constructed by students of the 9th grade of Elementary School based on the treatment of data from the opinion survey.

Revista ARACÊ
ISSN: 2358-2472

Figure 1: Bar graph produced by the students with the data from the opinion survey.



Source: 2nd year EM students (2022).

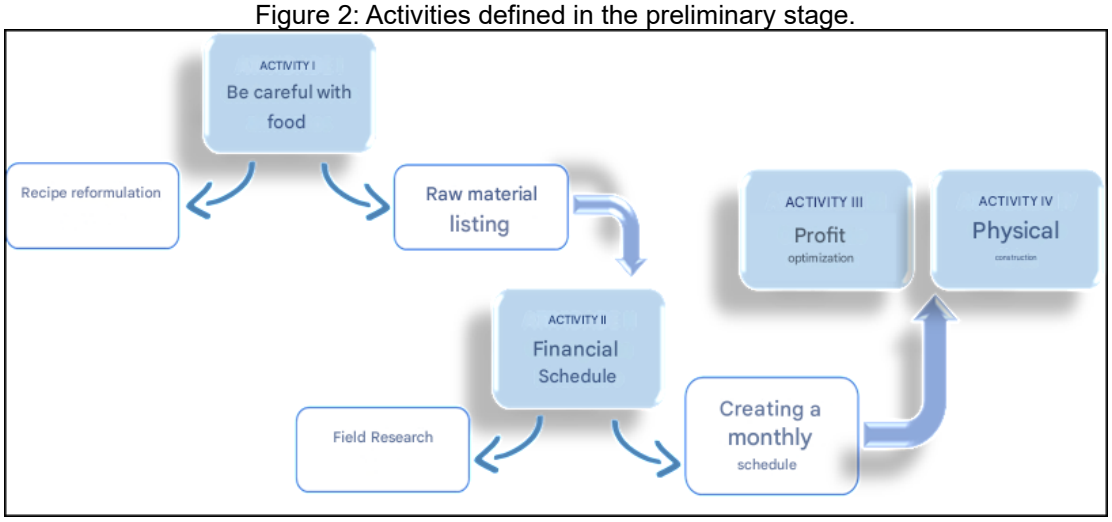
As mentioned above, the entire activity was based on the skills of the BNCC, which discusses the need to work on the ability to "(EM13MAT202) plan and execute sample research on relevant issues, using data collected directly or from different sources" (BRASIL, 2018, p. 534).

Revista ARACÊ
ISSN: 2358-2472

PRELIMINARY TASKS

After the opinion survey was conducted, the students were divided according to the level of schooling so that they could work based on the contents previously defined and listed in Chart 1. Thus, each team received a task to be performed during the development of the Knowledge Fair. Figure 2 highlights how the activities were defined.

Figure 2: Activities defined in the preliminary stage.



Source: From the authors.

All activities (didactic sequence), as mentioned above, were designed with the objective of providing opportunities for the development of skills and competencies contemplated by the BNCC, with the purpose of "developing logical reasoning, the spirit of investigation and the ability to produce convincing arguments, using mathematical knowledge to understand and act in the world" (BRASIL, 2018, p. 267). Details of the didactic sequence adopted in this research can be found in Ignácio and Romão (2024).

In addition to converging with the skills listed in the BNCC, the activities were elaborated with attention to the contents previously studied in the classroom, given that to complete the task the students needed to define hypotheses based on mathematical contents, using them as a tool for problem solving.

THE KNOWLEDGE FAIR

Once the tasks were carried out, the students were responsible for thinking about how the results achieved by them during the development of the project would be presented to other colleagues in the institution and the school community. At this moment,

Revista ARACÊ
ISSN: 2358-2472

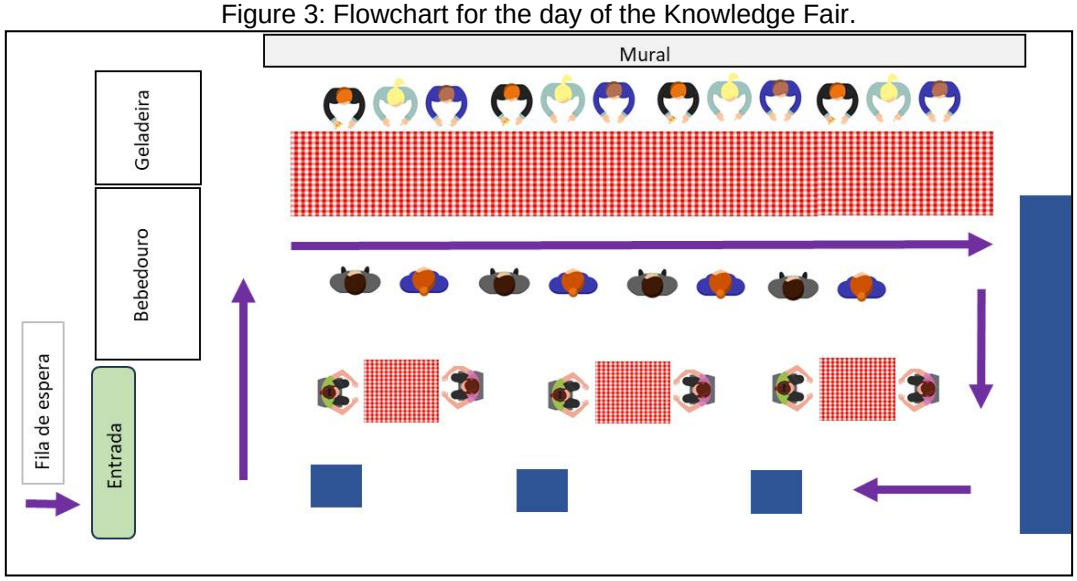
the teacher took on a helping role, favoring and encouraging discussions and decision-making.

The first concern at the time of presentation was with the layout of the physical space where the Knowledge Fair took place. All the tasks should be presented, as well as the results achieved, it is relevant to state that the students chose to receive the visitors of the Knowledge Fair in a personalized environment to reproduce a snack bar.

To this end, the students defined a flowchart so that all the stages of presentation were respected and so that all participants watched all the presentations and, at the end, participated in the mathematical challenge developed by them, with the objective of providing an active participation to the visitors.

Figure 3 shows the flowchart created by the students so that the activities could be carried out in a rhythmic and organized way.

Figure 3: Flowchart for the day of the Knowledge Fair.



Source: 1st year EM students.

The acceptance of the visitors surprised the students who presented many positive reports to the realization of the Knowledge Fair, many exposed their opinions, such as *"I didn't know that at school you learned to calculate sales prices, this was not seen in my time", "in the past mathematics was only about solving problems in the classroom with the teacher", "who would have thought that you could use mathematics for that".*

Throughout the project, observations were made regarding the growth of students in relation to the development of important skills and competencies for the formation as citizens. These observations will be discussed in the following chapter.

Revista ARACÊ
ISSN: 2358-2472

FINAL CONCLUSIONS

In order to start the discussion about the results achieved with the application of the project, it will be necessary to return to the objective intended at the beginning of this research, to present how the development of a Knowledge Fair can facilitate the meaningful learning of mathematics.

All the activities and tasks developed by the students during the preparation of the project were discussed by the BNCC regarding the development of skills and competencies during basic education. It is possible to affirm that the conceptions previously presented by the students about the learning of mathematics were not the most favorable to achieve the objectives initially proposed.

Regarding the discussion, it is relevant to present that the first challenge encountered during the realization of the project was the rupture of thought regarding the conception that mathematics is not a facilitator of the decision-making and problem-solving process, but rather a complicator during the learning process.

Demystifying the learning of mathematics and presenting it as a problem-solving tool was the starting point for the development of the project. When students began to perceive mathematics as a facilitating agent in the process of learning mathematics, it became a pleasurable process full of discoveries.

Approaching mathematical concepts in a practical way and learning to use them outside the classroom environment, in real problems, proved to be a great ally during the development of the project. Bringing students to think about mathematics as a facilitating tool converges with the objective proposed at the beginning of the project.

In addition to bringing students closer to the content learned during the learning of mathematics, the project enabled a rupture of thinking and a new perception of students about studying mathematics.

It is evident that the path to mathematical learning through skills and competencies still has a long way to go to be in line with what is discussed by the BNCC, but we as teachers need to understand that having active listening, understanding the difficulties and challenges that our students go through in this process is relevant to shape our way of presenting content in a lively and attractive way.

In addition, the project facilitated the teaching of mathematics in the educational institution and even more, it changed the way mathematics was seen by students, the

Revista ARACÊ
ISSN: 2358-2472

school community and the school. Showing us that mathematics is not a seven-headed beast, but an ally in the face of problem situations from the simplest to the most complex.

Revista ARACÊ
ISSN: 2358-2472

REFERENCES

1. Bacich, L., & Moran, J. (2018). *Metodologias ativas para uma educação inovadora: Uma abordagem teórico-prática*. Porto Alegre, Brazil: Penso.

2. Brasil, Ministério da Educação. (2018). *Base Nacional Comum Curricular*. Brasília, Brazil: MEC.

3. Brasil, Secretaria de Educação Fundamental. (1998). *Parâmetros curriculares nacionais: Matemática*. Brasília, Brazil: MEC/SEF.

4. Freudenthal, H. (1973). *Mathematics as an educational task*. Dordrecht, Netherlands: Reidel.

5. Giordano, C. C., & Silva, D. S. C. (2017). Metodologias ativas em Educação Matemática: A abordagem por meio de projetos na Educação Estatística. *Revista Produção Discente em Educação Matemática, 6*(2), 78–89.

6. Ignacio, L. M. N. C., & Romão, E. C. (2024). *A matemática na prática: Manual prático para a elaboração de Feiras da Matemática* (1st ed., Vol. 1). Curitiba, Brazil: Seven Editoras. Retrieved November 6, 2024, from https://www.sevenpubli.com/_files/ugd/3efb3f_986819b7cf054a959a6a78526e47c4db.pdf

7. Krasilchik, M. (2000). Reformas e realidade: O caso do ensino das ciências. *São Paulo em Perspectiva, 14*(1), 85–93. https://doi.org/10.1590/S0102-88392000000100010

8. Masson, T. J., Miranda, L. F., Munhoz Junior, A. H., & Castanheira, A. M. P. (2012). Metodologia de ensino: Aprendizagem Baseada em Projetos (PBL). In *Congresso Brasileiro de Educação em Engenharia*, São Paulo, Brazil.

9. Melo, M. C. P. (2020). *A resolução de problemas: Uma metodologia ativa no ensino de matemática para a construção dos conteúdos de “potenciação e radiciação” com alunos do ensino fundamental* (Unpublished master’s dissertation). Universidade Tecnológica Federal do Paraná, Londrina, Brazil.

10. Moreira, M. A. (2011). Aprendizagem significativa: Um conceito subjacente. *Aprendizagem Significativa em Revista, 1*(3), 25–46.

11. Paiva, T. Y. (2016). *Aprendizagem ativa e colaborativa: Uma proposta de uso de metodologias ativas no ensino da matemática* (Unpublished master’s dissertation). Universidade de Brasília, Brasília, Brazil.

12. Ponte, J. P., Costa, C., Rosendo, A. I., Maia, E., Figueiredo, N., & Dionísio, A. F. (2002). Actividades de investigação na aprendizagem da matemática e na formação de professores. In *Sociedade Portuguesa de Ciências da Educação – Secção de Educação e Matemática*, Coimbra, Portugal.