ACTA SCIENTIAE

ISSN: 2178-7727
DOI: 10.17648/acta.scientiae.v21iss3id4763

Mathematics Self-Efficacy in the Education of Youngsters and Adults: Vanda's Case

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Received for publication on 29 Sep. 2018. Accepted, after revision, on 20 Oct. 2018.
Assigned editor: Claudia Lisete Oliveira Groenwald.

ABSTRACT

Literature has pointed out, for at least two decades, that the perceptions about one's own competency influence the motivation to learn and the school achievement. However, in the case of the Education for Youngsters and Adults (EJA), the beliefs and emotions related to the students' own self-perceptions as learners, especially as Mathematics learners, have not been given proper attention. In this article, we present a case study whose purpose was to investigate possible mobilizations of the Mathematics self-efficacy beliefs by an EJA student throughout the development of Mathematics tasks, which were created based on a theoretical framework. The research – from the development of the activities through the analysis – was based on Albert Bandura's Social Cognitive Theory, in particular, on the concept of self-efficacy. For seven months, we collected data through questionnaires, semi-structured interviews, the researchers' field journal, and video recordings of a few Mathematics class of a high school class at a public school, in Divinópolis, Minas Gerais, Brazil. The results showed strong evidence of mobilization of the self-efficacy beliefs on Vanda's behalf. However, albeit there has been observed more persistence by the student when carrying out her activities, her more active and autonomous participation, as well as her self-confidence and emotional well-being, it was also verified that the student's behaviour, feelings, and perceptions under evaluative situations evinced a slight change with regards to controlling negative emotions in those situations. In spite of being a single case, this work contributes to shed light on the Mathematics self-efficacy beliefs held by EJA students, as well as on the teacher's role in the process.

Keywords: Education for Youngsters and Adults. Mathematics Self-Efficacy. Social Cognitive Theory. Mathematics Learning.

Autoeficácia Matemática na Educação de Jovens e Adultos: o Caso de Vanda

RESUMO

A literatura ressalta, há pelo menos duas décadas, que as percepções sobre a própria competência influenciam, dentre outras coisas, a motivação para aprender e a realização escolar. No entanto, no caso da Educação de Jovens e Adultos, as crenças e as emoções relacionadas à percepção que o aluno tem de

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si como aprendiz e, em especial, como aprendiz de Matemática, não têm recebido a necessária atenção. Apresenta-se neste artigo um estudo de caso cujo propósito foi investigar possíveis mobilizações das crenças de autoeficácia matemática por uma estudante da EJA ao longo do desenvolvimento de tarefas de Matemática, construídas com base no referencial teórico. A pesquisa – da elaboração das atividades à análise – fundamentou-se na Teoria Social Cognitiva de Albert Bandura e, em especial, no conceito de autoeficácia. Ao longo de sete meses foram produzidos dados por meio de questionários, entrevistas semiestruturadas, diário de campo da pesquisadora e videogravação de algumas aulas de Matemática de uma turma do Ensino Médio de uma escola estadual de Divinópolis (MG). Os resultados evidenciaram indícios de mobilização das crenças de autoeficácia matemática por parte de Vanda. Contudo, embora nas aulas tenha sido observado mais persistência por parte da aluna na realização das tarefas propostas, participação mais ativa e autônoma, bem como maior autoconfiança e bem-estar emocional, também se verificou que os comportamentos, as sensações e as percepções da aluna em situações de avaliação evidenciaram mudança pouco significativa em relação ao controle de emoções negativas nessas ocasiões. Ainda que se trate de um único caso, dadas suas características, o presente estudo contribui para lançar luz sobre as crenças de autoeficácia matemática mantidas por estudantes de EJA, bem como sobre o papel do professor nesse processo.

Palavras-chave: Educação de jovens e adultos. Autoeficácia matemática. Teoria Social Cognitiva. Aprendizagem matemática.

INTRODUCTION

School – as a social space in which knowledge and thinking skills are tested, assessed, and socially compared – has great importance in the social validation of people's cognitive capacity (Bandura, 1997). Several factors in school episodes reflect on the development of one's own perception of their capacity to learn and, consequently, on their motivation to learn.

In this sense, the notion of self-efficacy – studied for decades by the Canadian psychologist, Albert Bandura, within the Social Cognitive Theory – has been drawing the attention of the academic community given its potential to comprehend and even influence the motivation to learn.

If we take this notion into the Mathematics Education of Youngsters and Adults, we will verify that, although some studies have been enhancing the difficulties related to the learning of that audience, as well as their perceptions of themselves, of their school and its subjects, little has been investigated about their beliefs toward Mathematics self-efficacy, their motivation to learn, and mainly, how to contribute to overcome the obstacles identified.

This study approaches the self-efficacy beliefs in the journey of a student from the Education for Youngsters and Adults (EJA) program, during an intervention in the Mathematics class. The data come from a Mater's research (Rodrigues, 2015)[1] carried out with an EJA group of high school students. The research investigated possible

[1] In this paper, we use both the theoretical-methodological framework and the data collected for the research mentioned, analyzing, therefore, a student's experience throughout the field work. Thus, such analysis is not part of the Thesis. The project was approved by the Federal University of Ouro Preto's Committee on Ethics in Research (CAAE 19212913.0.0000.5150).

mobilizations of the self-efficacy beliefs, based on Albert Bandura's Social Cognitive Theory.

After a brief introduction to the notion of self-efficacy and Mathematics self-efficacy, we will describe the methodology adopted, and move on to the data analysis. The paper is concluded with some thoughts on the process experienced by Vanda.

SELF-EFFICACY BELIEFS AND MATHEMATICS SELF-EFFICACY

The study of self-efficacy by Bandura started from his investigations on how domain experiences – the ones in which people exert control over threats, cultivating competences, confrontation styles, and personal beliefs – can contribute to foster psychosocial changes, as in the treatment of phobias and, in those investigations, self-efficacy beliefs proved to be an important element of human agency (Bandura, 2008).

The self-efficacy beliefs refer to the judgment of one's own capacity of carrying out certain tasks (Bandura, 1982). It is, therefore, a self-assessment of the capacities to carry out further actions, involving personal perceptions about one's own skills, knowledge, and intelligence (Bzuneck, 2001). These beliefs influence the way each person goes through tough situations, how they struggle and persist, what paths they choose, and what emotional arousals they experience (Bandura, 1982).

People of strong self-efficacy beliefs, that is, those who are more confident about their capacities, face tough situations as challenges to be overcome, and not as threats to be avoided; they set goals that, even being difficult, are kept with commitment and interest; in face of failure, they recover confidence more quickly and heighten their efforts (Pajares & Olaz, 2008).

In addition to that, such beliefs influence the choices made by subjects, who tend to avoid doing the activities they judge to be beyond their capacity, and to select the situations they judge to be capable of doing what is necessary to accomplish the result (Bandura, 1982). These beliefs can also affect significantly people's motivation, actions, and emotional states:

> […] they influence the amount of *stress* and *anxiety* that the subjects feel, as they are involved in an activity. High self-efficacy beliefs help create feelings of serenity when approaching difficult tasks and activities. On the contrary, people with low self-efficacy may believe things are more difficult than they really are, and such belief induces stress, anxiety, depression, and a limited view on the best way of solving a problem. (Pajares & Olaz, 2008, 106)

Self-efficacy beliefs are not permanent or fixed, but they vary in accordance with the activities to be carried out and the situational context. Self-efficacy may vary in relation to its magnitude (once the tasks to be carried out have different degrees of difficulty),

its generality (one may regard him/herself as effective in just some situations or in various contexts), and its strength (the stronger the belief in one's own capacity, the most persevering the subject will be when carrying out his/her tasks) (Bandura, 1977).

The upbringing and modification of the self-efficacy beliefs depend on four sources: enactive mastery experience, vicarious experience, verbal persuasion, and affective states.

Enactive mastery experiences are the most important source because they involve people's individual experiences. When observing success or failure patterns present in their actions, these experiences may speculate about possible future results (Bandura, 1977). In doing so, several successes tend to heighten the expectation of succeeding again, depending on how they are interpreted, considering mainly the causal attribution (effort, capacity, external help) and the difficulty level of the task (Bandura, 1997).

Vicarious experiences refer to the observation of similar models. The inferences from what is observed in other people depend on the similarities between the observer and the model (Bzuneck, 2001), and constitute a source more likely to undergo changes (Bandura, 1977).

Verbal persuasion (or social persuasion), another source for self-efficacy beliefs, is related with the idea that people can be influenced in their own self-perceptions by what others communicate about them (Bandura, 1977). However, to be convincing, the communicator needs to have credibility and to provide information compatible with the subject's experience (Bzuneck, 2001).

The affective states (or physiological indicators or psychological states) are cognitively processed to be incorporated to the sense of self-efficacy, considering factors such as source, intensity, and the circumstances in which they happened (Bandura, 1997). Experimenting negative emotions when carrying out a task can be understood as lack of capacity damaging, therefore, the notion of self-efficacy (Bzuneck, 2001). Besides that, humour studies, mainly the intense ones, can affect attention, learning, and memory recall (Bandura, 1997). This way, we can positively affect self-efficacy by promoting emotional well-being and reducing negative emotional states (Pajares & Olaz, 2008).

The information obtained by a subject stemming from those sources pass through personal interpretation, that is, a cognitive process, and then they are incorporated to the subject's self-efficacy beliefs (Bandura, 1997). In this process there are several factors, namely: previous conceptions on one's own capacity; considerations on the level of difficulty of the task; causal attribution of the success or failure and the time pattern of when they happened; presence or absence of external aid; self-assessments (according to personal patterns) and assessments performed by others; personal significance of the task (importance to satisfaction, self-esteem) (Bandura, 1997; Bzuneck, 2001; Pajares & Olaz, 2008).

Another important aspect is the relation between the self-efficacy beliefs and motivation (Bandura, 1977). A subject with strong self-efficacy beliefs strives more to carry out tasks, albeit they are difficult and it is necessary to heighten the efforts. Therefore, this is one of the factors that influences motivation, along with the appreciation of the results and the incentives to act (Amaral, 1993; Bzuneck, 2001).

The studies on self-efficacy can contribute to understanding the relation of the student with Mathematics learning, which many times is fulfilled with negative feelings, like unsatisfying performance, anxiety, and demotivation.

We understand that Mathematics self-efficacy involves the subject's self-percept about his/her own capacity/competency to deal with situations (school or extracurricular ones) that s/he understands as mathematical. That perception differs, in general, from the academic self-efficacy, once Mathematics involves knowledge and specific skills that are particular and different from other school subjects. In addition, even within Mathematics, there can be difference in the student's self-efficacy perception in relation to certain themes, for instance, numerical operations, algebraic calculations, plane geometry, functions, analytic geometry, probability etc.

METHODOLOGY

We sought to investigate possible mobilizations that occurred in an EJA student's self-efficacy beliefs from the accomplishment of the activities that were developed based on the main aspects mentioned in the literature studied.

In view of the nature of the object of study and the investigation question, a qualitative research approach seemed to be more appropriate.

Data were generated from questionnaires, semi-structured interviews, the researcher's field journal, registers produced by students, and video recording of some classes. In this article, we will present the process experienced by Vanda. Therefore, as the work encompassed the whole class, we will mention it in the description of the process.

In the first place, we followed Vanda's class for four months, attending the Mathematics class and observing the students. During this period, we developed a pilot activity with the class and applied a diagnostic test and a questionnaire. We also carried out a semi-structured interview, and requested the students to answer some questions after an assessment (which we called "strips").

The next term, we taught lessons on Geometry for two months in the same class, with themes defined by the class's Mathematics teacher. We could count on the teacher's monitoring throughout the whole process. In the second stage, we generated data from the researcher's field notes, 'strips' with questions, and a semi-structured interview after concluding the work.

Chart 1
Schedule and brief description of the activities' development stages.

Themes approached in the activities	Period
Geometric solids – classification and elements: differentiation of two-dimensional and three-dimensional figures, characterization and classification of the solids as prisms, cylinders, pyramids, cones, spheres.	1st week Feb 3 to Feb 7
Polyhedron elements: vertices, faces, edges. Planning of solids. Some plane figures and their elements: angles, vertices, and sides of a polygon.	2nd week Feb 10 to Feb 14
Resuming the previous week. Angles, perimeter, area. The area was calculated in rectangles.	3rd week Feb 17 to Feb 21
Resuming the previous week: perimeter and area.	4th week Feb 24 to Feb 28
Resuming the previous week: perimeter and area. An activity on the right triangle's area.	5th week Mar 3 to Mar 7
Pythagoras' theorem: discussion of property (to which the Pythagorean theorem refers to) verified in right triangles and, later on, the formalization of the rule, with denominations and use of equation that expresses such relation. Applying the theorem to problem solving.	6th week Mar 10 to Mar 14
Review of the topics studied.	7th week Mar 17 to Mar 21
Assessment. Beginning the study on the volume of parallelepiped.	8th week Mar 24 to Mar 28

Rodrigues (2015).

The tasks were developed from the theory studied, the class's characteristics, and the researcher's teaching experience, seeking to construe a more amicable relation with Mathematics and to strengthen the self-efficacy beliefs and motivation.

We sought to propose accessible tasks, so that all students would be able to solve them, even partially. In addition, the activities had an increasing level of difficulty to be more challenging. In all lessons, we used questions, problems, situations that would arouse curiosity, avoiding to simply giving away information. The activities would happen in short stages and they were followed by the discussions of the students' problem solving. Whenever possible, the problems would approach everyday situations, considering the students' knowledge and encouraging them to expose it in the lessons. Besides that, we endorsed them to carry out the activities in pairs or groups. We sought to develop the actions in a way to provide situations in which the students could obtain satisfying performance in the tasks and domain experiences like, for example, going to the board and explaining how an activity should be solved. In general, we tried to create a pleasant environment in the lessons, aiming to broaden the positive emotions. For more information on the activities, see Rodrigues (2015).

ANALYSIS OF THE PROCESS EXPERIENCED BY VANDA

In this article, we present a cut from a broader study focusing on the experience of a student, henceforth referred to as Vanda (alias).

When this study was being carried out, Vanda was 43 years old and worked as an industrial assistant of electrostatic painting. Married, with children, she went back to school against her husband's will. As a child, she had studied up until the old fourth grade (currently the third year of elementary school).

The analysis was organized according to five thematic axes, defined through the cluster of elements from the theory, which are related to self-efficacy and the data collected: (1) previous experiences and new school perceptions; (2) experiences acquired in the project and personal interpretation; (3) persisting and overcoming obstacles; (4) affective relation established with school Mathematics during the project; (5) self-assessment for the learning results.

PREVIOUS EXPERIENCES AND NEW SCHOOL PERCEPTIONS

In this axis, we approach school experiences (previous and current ones), seeking to identify their relations with possible mobilizations of the Mathematics self-efficacy beliefs because, just like did Bandura (1977), we understand that previous conceptions about one's own capacity constitute a self-scheme which influences the interpretation of the information that can or cannot be incorporated into the self-efficacy beliefs, affecting what is recovered from memory to make judgments.

The data suggest that Vanda established a relation with Mathematics learning filled with both the feeling of difficulty and the desire of overcoming that difficulty. Her perception about her own capacity to learn Mathematics, being developed ever since her childhood, had a negative connotation. In the initial interview about school back in her childhood time, she stated, "*I was always a good student at many subjects, but Mathematics always got me unsteady. I've always had like... a certain aversion to Mathematics, even though, today, I want to overcome it. Today I understand that this can be overcome, can't it?"*.

In the initial stage of the research, we noticed that the Mathematics class were basically taught following this sequence: explanation of the content with notes on the board, resolution of exercises (which were copied from the board), correction of the exercises by the teacher. The teacher seemed to be patient; he would explain calmly, waiting the necessary time so that all students followed the class, respecting the students' different paces. Some students seemed to have a lot of difficulty. They would ask for the teacher's help and, at times, they would give up on doing the activity and would wait to copy from the correction.

When asked about how she felt during the Mathematics class, Vanda answered: *"Well, I wait, this is me, I'm the one lying in wait, you know? Waiting for him to correct*

that exercise. [...] he has to give me the exercise at least three times, so that I can learn it. [...] Am I a slow Mathematics learner, very slow" (initial interview).

In the class observed, there were rare moments in which students would discuss an activity collectively, moving efforts and curiosity to find out the result. They would usually participate doing the activities and, sometimes, answering questions at correction time. The teacher-students' relationship was respectful and the environment during the lesson was peaceful. According to Vanda: *"he is great. And he helps us a lot, not only me, but many students say he is a great teacher"* (initial interview).

The Geometry lessons in the 3rd year showed, since their start, some novelties in relation to what was previously observed. The explanatory explanations of the contents lessened, and there was more incentive to collective discussions, questionings, moments in which the students could express their ideas about the problems proposed, stimulating curiosity and discovery. We also sought to offer more successful experiences within the activities, encouraging collaborative work in which the students would help each other.

In the final interview, the student stated that her way of seeing Mathematics "*is gradually changing. [...] Well, I think that now I am starting to understand it better"*. When asked about what provoked such change, she addressed the importance of the lessons' support, because *"I don't know, I think it was a complement that was lacking, to help"*.

All the facts exposed above suggest that the new experiences in the Mathematics class enabled Vanda to have more pleasant experiences in those lessons.

EXPERIENCES ACQUIRED IN THE PROJECT AND PERSONAL INTERPRETATION

The second axis of analysis regards the experiences acquired by Vanda, specifically during the work with Geometry, and how they were interpreted by her. This is an axis that presents vital aspects to analyse self-efficacy beliefs, such as: successful or failure experiences and time pattern of when they happened; difficulty in carrying out and understanding the activities; situations in which the student showed understanding of Mathematics; personal interpretation of the task difficulty; causal attribution of success or failure (causes directed to capacities, efforts, or external aspects).

The most present element in the initial data related to this student is her difficulty in learning Mathematics. She would often make comments about that, many times looking discouraged. In spite of that, she was excited and optimistic before the situations, willing to strive. Sometimes she seemed to realize her effort as a compensation for her low capacity, mas she would also see that effort as a possibility to improve her capacity, a path to overcoming difficulty.

In one of the lessons, the teacher resolved a question on the board, and Vanda said she had not understood it. He explained it again and she replied (in a low voice), *"Why does Mathematics have to be so complicated?"*. In her answers to the questionnaire,

Vanda cited in three of them that she had difficulty in learning Mathematics, but she said she liked the subject.

Difficulty is related with the personal interpretation of successes and failures, and in Vanda's case, the idea of attributing success to external aid was expressed, and this is another indicator for frail self-efficacy beliefs. In response to one item of the questionnaire, she addressed the importance of being helped by her teacher, writing: *"For many times I can understand what the teacher is explaining, poor me if it weren't for the teacher"*, but she seems to consider that that is insufficient, given her personal capacity: *"Even though he explains it slowly, I'm afraid I have a bit of difficulty"*. In the interview, she also mentioned something in that sense: *"His explanation isn't incomplete; he is GREAT at explaining things. The students even finish the activities quickly in his lessons. I am the one with difficulty"*.

Successful experiences, main source of self-efficacy, did not seem to be frequent in Vanda's school routine. The observation of the class indicated that several of the tasks were not accessible to her. She seemed, indeed, to have lots of difficulty to do the activities. She remained diligent and, at many times, she would ask her teacher for help. In general, she would take more time to carry out the activities than her classmates did, and sometimes, she would not do them.

In another question, she comments: *"I must overcome my difficulty, but this, this isn't easy, you know. If I say it's easy, I'm gonna be lying"*. However, she checks in the questionnaire the option *"I don't think so"* to the affirmation: *"I think Mathematics is very difficult and I can't learn it well, even if I strive*, what suggests her efforts may take her to learn it, albeit she thinks it is difficult.

The observations and data obtained during the intervention pointed out some changes in the student's successful and failure experiences. The first episode related to that was a Vanda's action that occurred on the project's first week. At the discussion/correction of an activity, in face of the question of whom would like to go to the board, after two classmates volunteered to do so, Vanda also decided to go. As she had previously confirmed that her resolution was correct, she seemed to be satisfied and confident. According to what had been observed in her behaviour in the previous year, that attitude could be taken as unexpected, once she would often show difficulty, and sometimes, she would not do the exercises.

Other situations related to successful experiences were observed. Her frequency increased quickly. She was able to do more activities, and she probably understood the contents better.

Another important episode happened on the 7th week: Vanda and Meire paired up to carry out review activities. Vanda asked me if the resolution to question 1 was correct: *"Is that so? I'm teaching her like I did"* and I confirmed. She looked satisfied and said (laughing, as in a joke) that she had gotten a headache because it was the first time she did an activity by herself. I commented: *"and it is working out!"*.

This episode was a successful experience and it also showed a possibility of improvement in the student's self-confidence. Vanda said that, for the first time, she resolved exercises without any help, and she was teaching her classmate how to do so. When she was told, her answer was correct, she looked excited.

In the final interview, about the question related to whether she was feeling excited with the proposed activities, she answered: *Always! [...] Because some activities I got to work out on my own, and to me, that was glorious!".* The idea of achieving success without external help was interpreted in a favourable way, what may raise questionings in relation to the negative self-perceptions previously identified, and with that, instigate changes.

Vanda's perception about the difficulty in learning Mathematics was still there, but it seemed to be softened, and she started to comment less about that during the class. On the third week, Vanda said the lessons were interesting and easy, and she felt excited and capable of doing the tasks proposed. In the final interview, when asked about what she thought of an activity proposed, she answered: *"Well, I, like, I was hoping I could do it, you know, because, as I've got this, this difficulty in Mathematics, I have to do it, otherwise what I'm studying won't be worth it, will it?".*

The situation of doing the exam did not seem to be pleasant, but it was certainly better than Vanda's prediction during the initial interview in the previous year, when she had affirmed that *she wasn't going to score much.* In a given moment, Vanda lowered her head on the desk, and stayed like that for about seven minutes. This situation was similar to the one that happened during an exam in the previous year. Again, this can indicate she did not know what to do, or that she was extremely tired. Vanda said the level of the exam was "medium', adding that at the beginning she was calm, thinking she would resolve all the questions by herself. These answers are significantly different from those given in the previous year, even though the situation of individual exam without consultation was less comfortable than the evaluative exercise in pairs with consultation allowed. The student seemed more confident at the beginning her exam considering that the questions had a lower level of difficulty (she used to think the exam was difficult, and, in this moment, she said it was medium).

In the final interview, in face of the question: "Do you think that, this year, you got to overcome some difficulties?", she answered: *"Yes, some. Not all, but some.* Moreover, she justified, *"Well, I think that, that my thoughts were clearer, you know. But in the beginning of the year, my development, I felt it was dropping, I'd been very tired".*

Vanda seemed to be aware of her learning process, observing her performance, her progress, her feelings before all of that, focusing more on internal than on external aspects (paying more attention, having clearer thoughts and better understanding). This could have increased her self-efficacy beliefs at interpreting the causes to success by looking to herself, and not to an external aid or other environmental factors. Besides that, she commented that her performance was lower because of her being tired and work conditions, something related to an external situation, and not to one's own capacity. Such interpretation suggests that the low performance did not affect negatively her self-efficacy.

PERSISTING AND OVERCOMING OBSTACLES

The third thematic axis of this analysis approaches persistence and the overcoming of obstacles during the several tasks, observing the student's behaviour under situations in which she needed to persevere to face tough moments, increasing her efforts and keeping motivation to act. These aspects bring indications of mobilization of the self-efficacy beliefs and motivation (Bandura, 1977; Pajares & Olaz, 2008).

In Vanda's case, personal satisfaction is an important aspect to her persistence toward learning Mathematics, what could be observed before and during the project. In the initial interview, she mentioned her childhood journey and the difficulties to continue studying. About her difficulty in Mathematics, she affirmed: *"[...] I know that is a barrier to be overcome. I put in my head that it is a barrier to be overcome, so I must strive. If I don't, who will do that for me?* In general, Vanda showed motivation, interest, and persistence toward her studies, including Mathematics learning.

On the other hand, her low frequency of successful experiences was related with her way of persisting or not in each of the class's tasks. In the initial interview, she said that, during the lessons, she would ask for help when she had difficulty: *"I talk to the teacher, he knows about my difficulty, doesn't he? Or sometimes I wait for him to correct the activity on the board, and then I do it, too"*.

The observation of similar models (classmates) can contribute to the student's persistence before obstacles, if s/he considers that there are similarities between his/her capacity and the capacity of his/her classmates: if the others are getting to do it, there are chances of him/herself getting to do it as well. However, in Vanda's case, that idea seemed to have had a negative effect, as suggested by her line: *The students even finish the activities quickly in his lessons. I am the one with difficulty" (initial interview)*. She seems to feel belittled when she realizes that her classmates would learn from the teacher's explanation and she would not.

During the project, the development and application of the activities in the lessons relied on the idea of encouraging persistence in the resolution of the activities. The assistance to the students' questions happened through suggestions and clues, leaving every student in charge of resolving the most part of the problem. It is of utmost importance that the students realize that at persevering in a task, their chances to get it right get bigger, and there is a greater satisfaction in recognizing the result from their own endeavour, instead of getting external aid to accomplish the task.

We noticed that persistence and the overcoming of obstacles are aspects that, during the class in general, were more explored and improved, whereas in the evaluative activities there are not any indications of significant improvement in that sense. Preparation for the evaluative situation is an aspect that could have been more explored, so that the exam application could be seen more naturally and the students would have had a performance closer to that of the lessons. According to Bandura (1977), self-efficacy can vary in relation to generality, once the subject may consider him/herself efficient in just some situations, or in various contexts.

AFFECTIVE RELATION ESTABLISHED WITH SCHOOL MATHEMATICS DURING THE PROJECT

This axis focuses on emotional aspects and their relation with self-efficacy, considering, more broadly, the student's affective relation established with Mathematics. To do so, we considered behaviours and verbal and non-verbal expressions as indicators of the emotions being experienced.

Seeking to cultivate emotional welfare during the lessons and a pleasant affective relation with Mathematics can contribute positively to the strengthening of the students' Mathematics self-efficacy. Thus, the strengthening of self-efficacy will operate an important role in the self-regulation of emotional states, acting upon the control of disturbing thoughts from the emotional standpoint (Bandura, 1977).

Vanda's affective relation with Mathematics had positive and negative aspects. In the initial interview, she mentioned that she did not like the Mathematics class when she was a child, but she was a good student. She also said she used to like her teachers back then, *"Although I'm, like, I'm not very good at it, I used to have some enthusiasm..."*.

In the EJA Mathematics class, prior to the project, Vanda demonstrated to enjoy the lesson mainly because of the teacher. When asked about a situation in which someone asks her for help in a Mathematics task, she said, *"Oh, I get embarrassed because sometimes it is the type of help I can't provide. Even my children, they don't ask me because they know about my difficulty in Mathematics. They don't ask me anything about Mathematics"* (initial interview).

Considering Vanda's participation in the project, the positive emotions became more frequent in the lessons. In the last interview, Vanda answered: *"To be honest, I felt way more comfortable than last year. Last year, I was kinda stuck. I don't have a good relationship with Mathematics, you know. I can't let myself go; it seems I get stuck. This year was way more... more relaxing"*.

About her affective relation with Mathematics, there are important indicators of improvement. The student seemed to be more excited with the contents studied and enjoying more the lesson. For many times, she would talk to the researcher with a smiley face. She would also show satisfaction for getting to carry out part of the tasks.

Regarding the emotions experienced at the moment of the exam, as well as happened to the majority of the students in class, Vanda did not show significant improvements. Answering to how she felt while responding the questions, she wrote, *"I felt confident, but my mind went blank"; "because things aren't always the way they seem to be"*. She seemed well when the exam started, but as time went by, she could not keep her emotional balance because of the difficulty in resolving the questions. Regarding how she felt when the exam ended, she checked the option "dissatisfied with my performance", and she wrote, *"Because even though I gave my best, I left a lot to be desired"*. This shows she strived to reach her personal performance pattern, mas she reckoned she was not able to accomplish it.

Regarding the emotional aspects related to the evaluative moments, we have a point that requires more attention and guidance to the students, as pointed out in the previous item, with regards to persistence.

SELF-ASSESSMENT FOR LEARNING

This last axis analyses how the student reflected on her own Mathematics learning, considering the personal patterns established. Through personal reflections and the comparison of their own behaviour with the personal patterns established to themselves, the students act like self-regulators when it comes to their own learning. This self-assessment provides information to direct future actions, according to one's motivation and beliefs about one's own capacity. According to the Social Cognitive Theory, people's actions take into account their personal patterns and self-assessments, and not only probable rewards or external punishments (Bandura, 2008).

In the initial interview, when asked about why the difficulties reported would happen, she answered:

> *Oh my! I don't know. I've tried; I've put this 'why' in my mind, too. I say to myself, I don't know why I can't. It seems like a block, you know, my mind goes blank, even if he might have explained the topic on the board. When he explains, it all seems very easy, but when I try to put it into practice...*

It was perceptible that the self-assessment Vanda used to do showed an unsatisfying Mathematics learning for her personal patterns. When asked, in the initial interview, about what she would do when she could not resolve or understand an activity, she said, *"Well, I could understand all of them, you know? Resolving them, that was the heart of the matter. Sometimes we understand in theory, but can't put into practice, you know"*. Also, an important positive aspect was identified, which is closely related to the strengthening of self-efficacy. It is the self-motivation (also approached previously). The student made it clear that studying is important to her life, as well as overcoming her difficulty in Mathematics. That is, considering tough situations as challenges to be overcome, not as threats to be avoided.

After participating in the project, there were some changes in Vanda's self-assessment. In spite of her dissatisfaction at the exam, she seems to have considered the lessons' experiences as important elements to her self-assessment, pointing out to a good learning.

In the initial interview, when asked whether she was having a good Mathematics learning in that term, Vanda answered: *"I believe so... I think I'm a bit better"*. In the final interview, her answers were different, indicating that there were perceptions of improvement in her personal self-assessment, albeit those changes were not as significant

as she had wished. To the question "At the end of the lessons this year, did you get satisfied with your participation or did you feel misplaced?", she answered: *"Yes, I did get satisfied. [...] Because, for example, Mathematics, as I've said before, is one of the most difficult subjects to me, you know. But it is... for example, I've always paid attention to the school subjects, and I feel my performance is better. So, I was always satisfied because I could see I was making progress".* Regarding her own learning's assessment, with the question: "In your opinion, did you learn Geometry from the activities proposed?", the answer was more exciting than in the previous year: *"Like, I didn't learn EVERYTHING about Geometry as it was proposed, you know, but some things I really did learn, it was very important to me learning that".*

The experiences acquired by the students during the lessons go through self-assessment to be incorporated into their perceptions. Thinking about her school journey in the medium term and realizing there have been improvements, had Vanda satisfied and this is a positive point for the mobilization of self-efficacy beliefs.

FINAL CONSIDERATIONS

The analysis of Vanda's experience evinces that before the intervention performed her relation with Mathematics learning had positive and negative elements. She was willing to learn because she considered it as important knowledge. She enjoyed the teacher's methodology and strived to have good performance. Nevertheless, such relation was marked by difficulty and an unsatisfying performance, in her opinion. In addition to that, Vanda used to give great importance to external aid in the successful experiences, which were not frequent in the lessons. This way, it was possible to identify that the student's self-efficacy beliefs were, in general, frail, despite of her significant motivation to learn. Even with the intention of looking for changes, the perceptions seemed to be deeply rooted, hindering the process.

Throughout the Geometry Project, Vanda's experiences in the Mathematics class became more pleasant, and the successful experiences in the activities slowly became more frequent. The student noticed herself carrying out activities without aid and helping her classmates. Her participation in class became more autonomous, more persistent and with more positive emotions, albeit her learning difficulties were still there. Her self-assessing expressions showed more satisfaction with her own performance when she noticed her improvements throughout the lessons. However, the evaluative moment was still seen as an uncomfortable moment, in which personal perceptions and performance were less satisfying than during the lessons.

In summary, from certain elements which relate to the self-efficacy perception and according to the theoretical framework adopted, it was possible to identify change indicators in a positive sense related to some strengthening of Vanda's self-efficacy beliefs. These elements refer to the student's expressions with regards to her: difficulty in learning Mathematics; affective reaction toward the school subject; interpretation of

the successes, failures, and efforts moved; successful experiences; persistence before the obstacles; emotions acquired; notion of self-confidence, self-motivation, and self-regulation of learning.

In this sense, this article contributes to the field of Mathematics Education by offering a look to a relatively under-researched area. It highlights the importance of the Mathematics self-efficacy beliefs for EJA students (and other students as well) upon their own Mathematics learning, and, especially, the role of the Mathematics teacher in this context. An environment for Mathematics learning can facilitate or hinder the development of such beliefs, and, consequently, the motivation to learn Mathematics.

The case hereby presented brings clear indicators in that direction and, even though it is one single case, given its characteristics, it is similar to several situations experienced by countless EJA students.

AUTHORS CONTRIBUTIONS STATEMENTS

A.C.F. oversaw the project. C.S.R. and A.C.F. conceived the idea presented. C.S.R. developed the theory, performed the fieldwork, collected and analysed the data. C.S.R. and A.C.F. discussed the process of data collection and analysis, as well as the results and contributed to the final version of the manuscript.

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