

**Positive effects of an intervention program to strengthen the learning strategies of Brazilian High School teachers**<sup>1 2 3 4</sup>

*Efeitos positivos de um programa de intervenção para o fortalecimento das estratégias de aprendizagem de professores do Ensino Médio brasileiro*

*Efectos positivos de un programa de intervención para el fortalecimiento de las estrategias de aprendizaje de profesores del ensino médio brasileiro*

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**Abstract**

This study aims to design and to evaluate the effectiveness of a theoretical/self-reflective intervention to strengthen teachers' learning strategies in a double perspective: as a student and as a teacher. The sample was composed of three High School teachers. Data were collected using four qualitative instruments. The results showed that the intervention had positive effects. As students, teachers began to reflect more on their own learning and the strategies they use to learn. As teachers, they felt more capable and motivated to teach learning strategies to their students. We hope that this intervention can be reapplied in a higher number of teachers, so that more students can learn strategically.

**Keywords:** Teacher education, cognitive and metacognitive strategies, self-reflection, High school.

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## **Resumo**

*O objetivo deste estudo foi construir e avaliar a eficácia de uma intervenção teórica/autorreflexiva para o fortalecimento das estratégias de aprendizagem de professores em dupla vertente: a de estudante e a de professor. Participaram da pesquisa três professores do Ensino Médio. Os dados foram coletados por quatro instrumentos qualitativos. Os resultados mostraram que a intervenção gerou efeitos positivos. Como estudantes, os professores passaram a refletir mais sobre a própria aprendizagem e as estratégias que utilizam para aprender. Como professores, sentiram-se mais capazes e motivados para ensinar as estratégias de aprendizagem aos alunos. Espera-se que a intervenção seja utilizada com um número maior de professores para que mais estudantes possam aprender de forma estratégica.*

**Palavras-chave:** formação de professores, estratégias cognitivas e metacognitivas, autorreflexão, Ensino Médio.

## **Resumen**

*El objetivo de este estudio fue construir y evaluar la eficacia de una intervención teórica y autorreflexiva para el fortalecimiento de las estrategias de aprendizaje de profesores por medio de un doble abordaje: el profesor como el estudiante y el profesor como el profesor. Participaron de la investigación tres profesores del Ensino Médio. Los datos fueron recolectados a través de cuatro instrumentos cualitativos. Los resultados mostraron que la intervención generó efectos positivos. Como estudiantes, los profesores empezaron a reflexionar más acerca del propio aprendizaje y de las estrategias que utilizan para aprender. Como profesores, se sintieron más capaces y motivados para enseñar las estrategias de aprendizaje a los alumnos. Se desea que la intervención sea utilizada con un número más grande de profesores para que más estudiantes puedan aprender de manera estratégica.*

**Palabras clave:** formación de profesores, estrategias cognitivas y metacognitivas, autorreflexión, Ensino Médio.

## **Introduction**

Society nowadays increasingly requires students who are active, self-reflective and aware of their own learning. Such social requirements are associated with the characteristics of self-regulated students. Self-regulated students have a vast repertoire of cognitive and metacognitive learning strategies, and are able to adapt their goals and persist in their efforts to achieve them. They are proficient at monitoring the comprehension of what they study and modifying strategies to learn more and better. They have high self-efficacy beliefs, which helps them remain

motivated even with complex tasks (Veiga Simão, 2004; Wang & Sperling, 2020; Weinstein & Acee, 2018; Zimmerman, 2002).

Self-regulation of learning can be defined as an individual's ability to regulate his/her own cognition, metacognition, motivation, and behavior, in order to achieve a specific educational/academic goal (Zimmerman, 2002). One of the key variables of self-regulated of learning is learning strategies, defined as procedures to facilitate the acquisition, storage and retrieval of information (Dembo, 2001; Weinstein & Acee, 2018). As the ability to self-regulate learning and the use of learning strategies are not innate skills, efforts should be made to encourage them in students (Kramarski & Kohen, 2016; Zimmerman, 2002). Teachers are essential in this process. However, they rarely promote self-regulatory skills and self-reflective practices in their students (Ávila et al., 2018; Cleary & Platten, 2013; Ganda & Boruchovitch, 2018; Kramaski & Kohen, 2016; Vosniadou et al., 2020; Santos & Boruchovitch, 2011). For teachers to teach self-regulatory processes to their students, they need to become self-regulated students and learn how to teach these skills (Dembo, 2001; Kramaski & Kohen, 2016; Staley & Dubois, 1996; Xu & Ko, 2019).

As there are few subjects in academic curricula focused on the development of self-regulatory skills of future teachers, teachers hardly teach such skills to their students in the Brazilian context (Ganda & Boruchovitch, 2019; Machado & Boruchovitch, 2018; Marini & Boruchovitch, 2014). Interventions have been carried out to encourage self-regulation of learning of future teachers and fill this gap (Boruchovitch & Machado, 2017; Frison, 2017; Ganda & Boruchovitch, 2018); however, interventions with Brazilian high school teachers, focus of the present study, have been rarely reported (Finsterwald et al., 2013; Klug et al., 2018; Lau, 2013; Rosa & Rosa, 2016).

The recognition that it is possible to teach self-regulatory skills at different levels of education; the need for teachers to be self-regulated before promoting these skills in their students; the few subjects in initial and continuing teacher education programs focused on developing self-regulation of learning, and the positive impact of such skills on learning – all these factors justified this study. Our study aimed to design and assess the effectiveness of a theoretical/self-reflective intervention program to strengthen learning strategies in teachers acting both as students and as teachers. More precisely, this study sought to answer the following question: 'Is a theoretical/self-reflective course about learning strategies, in double perspective,

able to strengthen self-regulatory skills and promote changes in the pedagogical practices of high school teachers?

The following hypotheses were proposed:

H1 – Teachers as students will expand the repertoire of learning strategies, recognize the importance of using study and learning strategies and of self-regulation of motivation, and enhance self-reflection on their own learning.

H2 – Teachers as teachers, after participating in the intervention, will present a better definition of the concept of learning strategies, recognize the relevance of learning strategies and self-regulation of motivation for strategic and deep learning of their students, and therefore, will teach them how to use learning and motivation regulation strategies.

## **Method**

### **Participants**

This study included three female teachers from a group of 20 high school teachers, who taught Mathematics, Arts, and English in a public school, located in the state of Paraná, aged 47 to 51 years, mean age of 49 years. All teachers reported as their maximum level of education the attendance of the Programa de Desenvolvimento Educacional (PDE). The length of service in the teaching profession ranged from 18 to 29 years, mean of 25 years.

### **Intervention developed with teachers**

The intervention program ‘Theoretical and self-reflective course: learning strategies and their application in the educational context’ was developed by the authors of this study based on the literature in this field (Andrzejewski et al., 2016; Boruchovitch & Ganda, 2013; Dembo & Seli, 2008). This intervention was defined as a theoretical and self-reflective course, whose main objective was to teach teachers how to use cognitive and metacognitive learning strategies, so they could first use them as students and then start teaching them to their students. The

intervention was designed with a focus on a double perspective: the teacher as a student, and the teacher as a teacher (Boruchovitch & Ganda, 2013; Boruchovitch & Machado, 2017).

The intervention consisted of seven meetings, each meeting lasted 3 hours. It was performed in the 2nd half of 2017 and, at the end of the course, the teachers received a certificate of participation. The first author taught a different learning strategy at each meeting (Mccombs, 2017; Weinstein & Acee, 2018; Weinstein & Mayer, 1985). The seven intervention meetings had the same dynamics. First, they reviewed the content taught in the previous meeting through ‘remembrance technique,’ which consisted of having one of the teacher write a short text about the content of the previous meeting and read it to the others. Then, a self-reflective activity was proposed regarding the content (learning strategy) that would be assessed in that meeting. After discussing the self-reflective activity with the group, the theoretical framework was presented for each strategy taught. At this moment, the learning strategy to be taught at that meeting was defined, describing its benefits, how to use it, and the possibilities of teaching them to students. The next moment was focused on the application of the learning strategy to teachers as students. This activity and related discussion were followed by a presentation to teachers of examples of activities about how to teach each of the learning strategies discussed in the course to their students. Initially, the intention was for teachers to use all of these activities with their students. However, as they had some issues like short time and a lot of content to teach the students, only activities related to metacognitive strategies were implemented by the teachers in their classroom lessons. Finally, the teachers reported, in a structured learning diary, what they had learned at each of the meetings. Appendix A shows the organization of the intervention, its objectives, content, and the activities done by the teachers and their students.

## **Data collection instruments**

Data collection took place in five distinct moments: pre-test, during intervention, post-test, late post-test 1, and late post-test 2. Data collection instruments used in each of these moments are described next.

## **Instrument applied in pre-test**

### **- Protocol of activation of metacognition and self-reflection of future teacher learning (Boruchovitch, 2009) – Adapted version for working teachers**

After adaptation for use with high school working teachers, this instrument was used in the present study to identify which learning strategies teachers use to learn contents and assess their knowledge regarding the concept of learning strategies. This instrument included questions such as ‘When you have a task or want to better study and learn about a given content, what do you do? Describe in detail.’ and ‘In your opinion, what are learning strategies?’

## **Instruments applied during the intervention**

### **- Structured learning diary**

The structured learning diary aimed to promote reflection of teachers on their learning at each meeting. It had three questions, two addressing the teacher as a student and one addressing the teacher as a teacher. Due to space limitations, four randomly selected diaries were analyzed in the present study: two regarding meetings about metacognitive strategies and two about cognitive strategies. ‘What did I learn today?’ is one example of a question from the structured learning diary.

### **- Diary of teacher experience to report about their application of activities with students**

This diary was used to evaluate the experiences of teachers regarding the application of activities to promote and strengthen the metacognitive strategies of students. It had five subjective questions asking the teachers to describe their experience when applying the activity proposed by the researcher to encourage the use of metacognitive learning strategies with their students. The question ‘Describe your experience of setting goals with the students. How did the students react to the activity?’ is one example.

### **Instrument applied in post-test and late post-test 1**

The ‘Protocol of activation of metacognition and self-reflection of future teacher learning’ used in pre-test was applied again in two different moments.

### **Instrument applied in late post-test 2**

#### **- Semi-structured interview based on the interview script to assess the impact of an intervention on the participant’s learning and life (Boruchovitch, 2010, revised in 2019)**

The purpose of the interview was to assess whether the course offered to teachers helped them change their attitudes, as students and as teachers. The interview had seven questions, four questioning the professors as students, for example: ‘Was the course content useful for you to improve as a student?’ and three addressing teachers as teachers, for example: ‘Was the content developed in the course useful for you to improve as a teacher?’

## **Data collection procedure**

The project was initially submitted to the ethics committee and was approved by document n°. 64526117.3.0000.5404. After the project was approved, at the end of the first half of 2017, contact was made with the teachers to explain about the research objectives and invite them to participate in the intervention. A few weeks before starting the intervention, signs were spread around the school to remind the teachers of the beginning of the course. The school’s pedagogues also helped with course dissemination, reminding the teachers about the course daily.

The pre-test with the teachers took place in September 2017, on the first day of the intervention, and the post-test was conducted on the last day of the course, in November 2017. At the time of the pre-test and post-test, first, the teachers signed an informed consent form and then answered the data collection instruments. The first late post-test took place in February 2018 and the second in February 2019. All data collection occurred with no problems or doubts from the teachers.

## Data analysis procedures

Data were analyzed by content analysis (Bardin, 2004). The answers to open questions were grouped according to their content, through the creation of categories of response. The consistency of the categorization process was assessed by three independent judges: a master and a doctoral student in Education with solid knowledge of the theoretical framework adopted in this study and by a doctoral student in Chemistry. The three judges analyzed 30% of randomly selected answers of teachers to open questions. The percentage of agreement between the analysis of judges and those of the researchers ranged from 84% to 100%.

## Results

### Protocol of activation of metacognition and self-reflection of future teacher learning (Boruchovitch, 2009)

Table 1 shows the categories created according to the answers provided by teachers for question 1, at the three times of the research (pre-test, post-test, and late post-test 1).

**Table 1: Attitudes reported by teachers when they need to perform a task, study and learn a given content.**

Attitudes	Question 1 – When you have a task or want to better study and learn about a given content, what do you do? Describe in detail.					
	N=3					
	Pre-test		Post-test		Late post-test 1	
	N	%	N	%	N	%
Search different sources	2	40	1	9,09	0	0
Take notes	2	40	2	18,18	0	0
Look for pleasant quiet places	1	20	2	18,18	2	40
Organize time to study	0	0	2	18,18	1	20
Read	0	0	2	18,18	1	20
Underline	0	0	1	9,09	0	0
Write summaries	0	0	1	9,09	0	0
Reread the materials	0	0	0	0	1	20
<b>Total</b>	<b>5</b>	<b>100%</b>	<b>11</b>	<b>100%</b>	<b>5</b>	<b>100%</b>

Note: In this table, the value of N can be greater than 3, because in some cases the teachers provided more than one answer.

The answers of teachers in the pre-test showed that, despite using learning strategies to learn, they showed a very restricted repertoire. In the post-test, they presented expanded repertoire of learning strategies, as they mentioned having organized the time to study, performed readings, underlined, and written summaries. These strategies were all practiced during the intervention. However, the analysis of the answers provided by the teachers in late post-test showed that the following four learning strategies were not maintained after the post-test: search different sources, take notes, underline, and write summaries. However, a new strategy was reported in late post-test 1: reread the materials. When asked if they had already heard about learning strategies, all teachers said yes and knew how to conceptualize the construct, as indicated in Table 2.

**Table 2: Definitions of learning strategies of teachers in pre-test, post-test, and late post-test 1.**

Question 3 – In your opinion, what are learning strategies?						
N=3						
Definitions	Pre-test		Post-test		Late post-test 1	
	N	%	N	%	N	%
Different ways to learn content	1	33,33	0	0	0	0
Methods that help learn	1	33,33	1	20	1	25
Ways that an individual uses to study and learn	1	33,33	1	20	1	25
Best way to learn	0	0	1	20	0	0
Techniques that facilitate learning	0	0	1	20	0	0
Ways that help perform learning tasks	0	0	1	20	2	50
<b>Total</b>	<b>3</b>	<b>100%</b>	<b>5</b>	<b>100%</b>	<b>4</b>	<b>100%</b>

Note: In this table, the value of N can be greater than 3, because in some cases the teachers provided more than one answer.

The answers of the three teachers provided at different times of the study indicated that, since the beginning in the pre-test, they correctly defined learning strategies. In addition, a refined concept was observed in the post-test. In late post-test 1, they maintained the concept of learning strategy as the method that helps learn and as ways that an individual uses to study and learn, a concept used by them in the post-test. They also recognized that learning strategies help perform tasks.

## Structured learning diary

The results of diaries are presented in the chronological order of the meetings. Chart 1 shows the diaries of the meetings about metacognitive strategies and Chart 2 shows the diaries of the meetings about cognitive strategies.

**Chart 1: Answers of teachers about metacognitive strategies in structured learning diaries**

Questions	<b>Meeting 2 - Metacognitive strategy and self-regulation of learning</b>
What did I learn?	- Concept of self-regulation of learning and metacognition (P1); - What can I do to improve my learning process (P1); - Everyone learns in a different way (P2); - Everyone should know his/her best way to learn (P3).
What part of the content would be interesting to apply to myself?	- Learn more about metacognition (P1); - Be aware of how I learn (P2); - Apply more study and learning strategies (P3).
How would I offer what I learned at these meetings to my students?	- Provide guidance about self-regulation of learning and metacognition (P1); - Inform about the importance of awareness for learning (P2); - Present learning strategies that can help learn (P3).
Questions	<b>Meeting 4 – Metacognitive monitoring strategy: self-questioning and metacognitive regulation strategy: self-regulation of motivation</b>
What did I learn?	- Be more patient while performing the tasks and not repeat them so many times (P1); - The importance of monitoring learning during the tasks (P2); - Regulation strategies can generate superficial or deep processing of information (P3).
What part of the content would be interesting to apply to myself?	- Monitor while a task is performed to avoid wasting time in redoing it (P1); - Set goals and monitor to achieve them (P2); - Self-regulate emotion, especially anxiety (P3).
How would I offer what I learned at these meetings to my students?	- Assist in organizing the activities they have to do (P1); - Present available strategies to monitor learning (P1) (P2); - Explain what monitoring and regulation of emotion and motivation are (P3).

Source: Developed by the authors.

Chart 1 shows the answers of teachers for what they learned at the second meeting of the intervention, focused on metacognitive strategies and self-regulation of learning. They all pointed out the importance of metacognition for learning. This idea is clear when they reported they should know the best way to learn, that each individual learns in a different way and that, from then on, they were aware of what they could do to improve their own learning.

When the teachers were asked about what part of the content would be interesting to apply to themselves, one of them answered that she would like to learn a little more about metacognition and that she believed she was a self-regulated person in relation to learning. Another teacher said it would be important for her to consciously use study and learning strategies. Finally, Teacher 3 indicated that it would be interesting to apply study and learning practices and attitudes learned at the meeting.

When asked how they would offer what they learned at Meeting 2 to their students, the teachers said they would discuss, in a simple manner, the importance of metacognition, self-regulation of learning, and the different learning strategies.

Meeting 4 addressed the metacognitive strategy of monitoring: self-questioning and the metacognitive strategy of regulation: self-regulation of motivation. When asked about what they had learned at the meeting, two teachers (Teachers 1 and 2) focused on monitoring strategies; and one (Teacher 3) was focused on the regulation strategy. About monitoring, Teacher 1 highlighted the need to be more patient while performing the tasks, to avoid redoing them many times. Teacher 2 was more generic and highlighted the value of monitoring at the moment of learning. Teacher 3 mentioned the importance of motivational self-regulation strategies for deep information processing.

In the question about what part of the content would be interesting to apply to themselves, the three teachers gave very interesting answers, described next.

**Teacher 1** - Monitor while the proposed activities are performed so that I will not waste my time redoing what was already good.

**Teacher 2** - Know how to set goals and monitor to achieve them.

**Teacher 3** - Regulate my emotions, particularly anxiety, which I believe impairs my performance in tasks.

The answers of teachers showed, in general, that all of them would start to monitor more their own learning, as well as their goals and emotions.

The actions mentioned by the teachers about how they would teach what they learned at Meeting 4 to their students referred to showing students the relevance of monitoring, of

identifying which strategies they would use to facilitate learning and help them organize their school tasks.

In summary, the assessment of the answers of teachers regarding the meetings about metacognitive strategies indicated that they had expressive gains in terms of theoretical framework of metacognition and self-regulation of learning; they reflected on their own learning and how the metacognitive strategies could make them more competent students; they were able to recognize their strengths and weaknesses in order to learn; and they felt more motivated to teach their students how to use metacognitive strategies.

Chart 2 next shows the answers provided by teachers in diaries of the two meetings about cognitive strategies.

**Chart 2: Answers of teachers about cognitive strategies in structured learning diaries**

Questions	<b>Meeting 5 – How to motivate students to learn, and the cognitive rehearsal strategy: Underline.</b>
What did I learn?	- The underline strategy is a starting point for a deeper study (P2); - How to give feedback to students, aiming to motivate them (P2); - How do learning goals influence student motivation (P3); - What are rehearsal learning strategies and their importance (P3).
What part of the content would be interesting to apply to myself?	- Try to give feedback to myself, relating it to the content (P2); - Put the rehearsal strategies into practice (P3).
How would I offer what I learned at these meetings to my students?	- Teach test strategies in a simple way (P2); - Develop activities for students to apply and practice the underline strategy in the real context (P3).
Questions	<b>Meeting 6 – Cognitive elaboration strategy: summarize, and cognitive organization strategy: concept maps.</b>
What did I learn?	- Importance of concept maps for better content learning (P1); - Difference between organizational chart and concept maps (P1); - How to organize and make concept maps (P2) (P3).
What part of the content would be interesting to apply to myself?	- Use concept maps in the next courses to better understand the content (P1) (P2) (P3).
How would I offer what I learned at these meetings to my students?	- Start to use and encourage the development of concept maps with high school students (P1); - Offer examples of concept maps and address what they are made of (P2); - Encourage the use of concept maps for the introduction of new content, such as review and as a form of evaluation (P3).

Source: Developed by the authors.

At meeting 5, guidelines were provided about how to motivate students to learn. This content was included in the course, as the teachers were interested in this topic. The cognitive strategy of underlining was also addressed. At this meeting, Teacher 1 was not present, so her report was not available. When asked about what they learned at the meeting, Teacher 2 was able to define underlining as a primary strategy that is a starting point for other strategies to be used along with it and highlighted the importance of both positive and negative feedback for student motivation. Teacher 3, on the other hand, was more objective and mentioned having learned about how learning goals influence student motivation and about cognitive rehearsal strategies. The teachers generally stated they would try to use the content learned in their lives as students, and with their students. They would approach the content learned in a simple way with their students and propose activities to facilitate the comprehension of cognitive rehearsal strategies.

At meeting 6, they discussed cognitive elaboration strategies: summarize and cognitive organization strategies: concept maps. The three teachers, when asked about what they learned at the meeting, focused their answers on concept map. They said they learned how to build concept maps and use them to enhance learning. Teacher 1 said that, with the content discussed at the meeting, she began to differentiate an organizational chart from a concept map, which, for her, were the same.

The teachers unanimously highlighted that it would be interesting to apply concept maps when they need to learn some content or perform some task. With regard to teaching what they learned at the meeting, they were willing to teach their students how to build concept maps and seemed to consider relating concept maps to the subjects they teach.

In summary, the answers of teachers in the diaries of the meetings about cognitive strategies suggest they not only learned how to teach their students how to use cognitive strategies, but were also sure of the importance of these strategies for their own learning. In addition, they expanded their knowledge about the theoretical framework supporting the cognitive strategies addressed at the meetings and about motivational theories. They were also willing to motivate their students and teach them how to use cognitive strategies.

## **Experience diary reporting the application of activities with students**

The results from the experience diary reporting the application of activities with the students were presented as these activities happened. Then, the planning activity diary is presented first, followed by the monitoring activity diary and, finally, the regulation activity diary.

The planning activity applied by the teachers basically required the students to set a weekly goal for the subject taught by the teacher and report what they would do each day of the week to achieve such goal. In the week following the activity was proposed, the students would have to report whether or not they had achieved the goal and present the reasons for not achieving it, in case it happened.

According to Teacher 1, the students reacted well to the proposed activity, which was also highlighted by Teacher 2. Teacher 1 also explained that, at the time the activity was done, the students were focused on the university admission exam, which made them set goals for that. Teacher 3 reported that, at first, the students complained about having to write, but later they understood the proposal, although some were immature about its planning.

The positive aspects observed by the teachers when conducting the activity suggested the students reflected on the way they study (Teacher 1), recognized the importance of creating plans to achieve their goals (Teacher 2), and took the activity seriously, as a commitment to be fulfilled (Teacher 3). On the other hand, the negative aspects were: Teacher 1 reported it would be interesting to apply the activity in the first quarter to set goals for the entire school year. Teachers 2 and 3 highlighted the lack of interest of some students in the proposed activity.

When asked if the students were able to achieve their goals during the week, they all said yes. Teacher 1 reported that a student looked for private lessons to better understand the content. Teacher 2 said that when students were unable to meet the goal of a specific day, they autonomously changed the day, and Teacher 3 stated students managed their time, thus realizing the importance of planning.

Finally, all teachers answered they would continue with the goal-setting activities with their students. Teacher 1 said she would conduct this activity in the first half of the following year, as she believed it would promote good results in student learning. Teacher 2 said she would

use this type of activity because setting goals helps an individual organize life. Teacher 3 answered she would use this practice so that students could better organize their time.

In summary, regarding the experience of applying the goal-setting strategy with students, the teachers reported that most students were interested in this activity and were motivated to achieve the goals, although some students were immature while setting goals. In addition, another interesting aspect was that teachers were willing to keep using this activity with their students.

The activity for comprehension monitoring strategy basically consisted in teachers defining a challenge that could or could not be related to the subject they teach. During challenge resolution, the students should make notes of all thoughts they had to solve it. This way, students practiced monitoring while performing the task. The teachers chose to apply to students the same logic challenge answered by them at the intervention meeting about monitoring strategies. When asked how the activity had been performed, all of them reported that it was something new for the students, especially conscious monitoring. For this reason, they had many doubts about how to monitor their own learning, which were clarified by the teachers.

When asked if the students considered that monitoring their own thinking facilitated the performance of the task, the students of Teachers 2 and 3 answered 'no' as they found it difficult to report everything they thought to complete the activity. On the other hand, the students of Teacher 1 mentioned that, with monitoring and making notes, they were able to understand the challenge with more clarity and objectiveness. Teacher 3 gave an additional report about the experience of applying the activity, as described next.

**Teacher 3** - Even performing the activity in a group, the students acted as in other activities, only one group reported everything, but with great difficulty. It must be applied more often so they can adapt to the activity.

This teacher's report shows it was difficult for students to complete the logic challenge and monitor their thoughts, which may be explained by the lack of conscious monitoring among

them, which strengthens the need to apply these activities more often, as suggested by the teacher.

In summary, the results obtained with the application of the thought monitoring activity showed that it was not very common for students to monitor their own thoughts and, when encouraged to perform this practice, they faced considerable difficulties. Although problems were observed among students who managed to put monitoring into practice, they recognized the activity was clearer and more objective, which facilitated its performance.

The last activity performed by the teachers with the students was the metacognitive strategy of self-regulation of motivation. They were asked to make the following initial question to the students: 'What do you do when you need to perform a school activity, but do not feel like doing it?' Then, there was an oral discussion led by the teacher to show that it is possible to exercise intentional control over motivation and emotion. After this first moment, the teachers were instructed to select two or three strategies for self-regulation of motivation from a list to teach and encourage students to use the selected strategies.

The speeches of teachers about the guiding question of the activity showed the students were interested in the discussion and, most of the time, they were motivated to perform the activities because they had to do them and because of the grade they needed. The report of Teacher 2 about a student highlights this situation.

**Teacher 2** - Only one student reported that she seeks a compensation for performing the activities. She said that, when reading a book, for example, she puts a candy between the pages.

In general, all teachers reported the students were surprised to learn that they could regulate their own motivation. The strategies selected by the teachers for the students were related to autoconsequence. They said the students showed interest in learning about the strategies presented.

Overall, the answers of teachers suggest the students did not know they could intentionally control their own motivation to perform their school activities. Even not knowing about this possibility, the students reported that, when they did not want to do a school assignment, they thought about how their grade and school performance could be affected with

completing such task. The results of the interview with the teachers in late post-test 2 are presented next.

### **Interview to assess the intervention impact on participant's learning and life**

In the interview with the teachers, they also answered some questions that assessed the teachers as students and as teachers. Table 2 shows the questions and answers of teachers as students.

**Table 2: Answers to questions assessing teachers as students**

<b>Question – Did the course help me to further develop my ability to learn? Justify.</b>	<b>N</b>	<b>%</b>
Expanded my repertoire of learning strategies	2	66,67
Enhanced reflection on how I learn	1	33,33
<b>Total</b>	<b>3</b>	<b>100%</b>
<b>Question – Did you find the content useful to improve as a student?</b>	<b>N</b>	<b>%</b>
Reflection on my own learning	1	25,00
Reflection on the learning strategies normally used	1	25,00
Possibility of learning the contents discussed in the course	1	25,00
Importance of planning as a teacher and as a student	1	25,00
<b>Total</b>	<b>4</b>	<b>100%</b>
<b>Question – Did the course help me change my behavior as a student? If yes, assess whether it was a positive gain and give an example of what has changed.</b>	<b>N</b>	<b>%</b>
Expanded my repertoire of learning strategies	3	50,00
Started thinking about the best way to learn and focus on content	2	33,33
Monitored comprehension and learning	1	16,67
<b>Total</b>	<b>6</b>	<b>100%</b>
<b>Question – Did the course help me become more aware of the aspects that I still need to change in my behavior as a student to benefit from the classes more and learn better?</b>	<b>N</b>	<b>%</b>
Have more confidence in myself	1	33,33
Improve planning to achieve my goals	1	33,33
Apply the learning strategy to myself, relating it to the subject I teach	1	33,33
<b>Total</b>	<b>3</b>	<b>100%</b>

Note: In this table above, the value of N can be greater than 3, because in some cases the teachers provided more than one answer.

The answers of teachers regarding their learning as students showed interesting changes. After the course, they started to diversify their repertoire of learning strategies; reflect on how they study, how they learn, and strategies they use to learn. They also started to recognize the importance of planning; monitor learning better; and develop more confidence in their abilities.

Table 3 shows the questions and answers of the teachers regarding their learning, as teachers.

**Table 3: Answers to questions assessing teachers as teachers**

<b>Question – The content developed in the course was useful for me to improve as a teacher</b>	<b>N</b>	<b>%</b>
Teach the learning strategies learned in the course	3	50,00
Show that there are different ways and strategies to learn	2	33,33
Motivate students to learn	1	16,66
<b>Total</b>	<b>6</b>	<b>100%</b>
<b>Question – Based on what was developed in the course, how could I improve the ability to learn of my students?</b>	<b>N</b>	<b>%</b>
Review the course content with students	2	40,00
Explain learning strategies in the classroom	1	20,00
Do not give up looking for the best for students	1	20,00
Show that everyone learns in a different way	1	20,00
<b>Total</b>	<b>5</b>	<b>100%</b>
<b>Question – Were you able to use the course content in your classes? Give examples.</b>	<b>N</b>	<b>%</b>
Concept maps as a resource for learning	2	28,57
Self-reflection on how students learn	1	14,28
Setting goals for learning	1	14,28
Strategies for regulation of motivation	1	14,28
Informal conversations about learning strategies	1	14,28
Activity of comprehension monitoring	1	14,28
<b>Total</b>	<b>7</b>	<b>100%</b>

Note: In this table, the value of N can be greater than 3, because in some cases the teachers provided more than one answer.

In summary, the answers of teachers suggest the content of the intervention program was very useful to drive changes in their pedagogical practices and promote efforts to insert learning strategies in their classes.

## Discussion

### Effects of the intervention program on teachers as students

The hypotheses for results obtained in the intervention from teachers as students were that teachers would be able to expand the repertoire of study and learning strategies, recognize the importance of using these strategies and self-regulation of motivation, and enhance self-reflection on their own learning.

The results revealed interesting changes in the teachers as students. Application and diversification of learning strategies were observed in the post-test, but a reduction in these strategies was seen in late post-test 1. Such reduction may be a consequence of self-reflection on their own learning if the strategies they reported in the post-test really helped them learn. Also, if the intervention had more meetings and more moments of practical application of learning strategies, perhaps these strategies could be maintained in late post-test 1. Another hypothesis that could explain reduced learning strategies reported in late post-test 1 is that teachers may have become so proficient with some strategies that others were unnecessary. The results of our study reinforce the importance of stronger support so that teachers can continue using study and learning strategies taught in the courses/interventions and such use can become a habit among them, since the maintenance of interventions effects seems to be difficult (Boruchovitch & Ganda, 2013, Dembo & Seli, 2008).

Authors like Dembo (2001), Góes (2020), and Xu and Ko (2019) report that, first, teachers must be convinced of the importance and benefits of learning strategies, and then start teaching them to their students. The answers of teachers showed that, at the end of the intervention, they seemed convinced of the value of learning strategies and strategies for self-regulation of motivation. This result reiterates the importance of developing interventions, based on the theoretical framework of self-regulated learning, stating how to use learning strategies (Andrzejewski et al., 2016; Ganda & Boruchovitch, 2018).

Finally, the teachers showed an increase in self-reflection on their own learning, started to reflect on whether the learning strategies they used were adequate and monitor how they learned. These data are consistent with the literature that supports self-reflective practices as resources to strengthen self-regulatory skills (Ávila et al., 2018; Cleary & Platten, 2013; Ganda & Boruchovitch, 2018; Rosa & Rosa, 2016).

The results of the teachers as students confirmed all the study hypotheses and showed positive effects of the intervention program. Future studies could assess how teachers learn and how interventions can ensure a more sustained effect on the study and learning strategies of teachers. The results of teachers as teachers are discussed next.

## **Effects of the intervention program on teachers as teachers**

The initial hypotheses of intervention effects on teachers as teachers were that they would present a better definition of the concept of learning strategies, recognize the importance of using learning and motivation regulation strategies with their students, and start teaching students how to use these strategies.

The findings of this study not only showed that all teachers correctly conceptualized the learning strategies in the three stages of the study, but also showed refinement of this concept, when they participated in the intervention. This conceptual refinement may be a result of the intervention with the teachers, since the definition of learning strategies was discussed in practically all meetings. In a different way, Santos and Boruchovitch (2011), when investigating elementary school teachers, and Marini and Boruchovitch (2014), when assessing Pedagogy students, found wrong concepts of learning strategies, showing that teachers and students considered it difficult to distinguish learning strategies from teaching strategies and mixed both constructs.

The teachers mentioned the course helped them improve as professionals, allowing them to teach the contents learned to the students and recognize the different ways of learning. They also sought to motivate students to learn using different strategies, and reported putting into practice the contents learned in the course. The teachers felt motivated to teach and apply the activities to promote learning strategies use to students. In addition, when applying them, they saw the students had problems to perform them, which highlighted the urgency of addressing these strategies more often in their classrooms. The fact that teachers felt motivated to teach the learning strategies and had changed their pedagogical practices for this reason suggests the intervention achieved its objectives. The results achieved are consistent with those obtained by Finsterwald et al. (2013), Klug et al. (2018), Lau (2013), Rosa and Rosa (2016) with high school teachers, revealing that teachers, even finding it difficult to change their pedagogical practice when taught about learning strategies, incorporated them into their classes and started to recognize the benefits of this practice. These findings reinforce the fact that more interventions should be developed addressing this theme with teachers. On the other hand, they indicate these interventions should not be necessary, given that this content, due to its importance, should be taught in teacher education programs (Bembenutty, 2015; Dembo, 2001; Weinstein & Acee, 2018; Zimmerman, 2013). In addition, the low adherence of teachers to the

intervention program shows that the lack of motivation of teachers to participate in continuing education courses is an issue that must be investigated.

Therefore, all hypotheses initially formulated were confirmed. Data showed the relevance of the intervention to drive changes in the pedagogical practice of these teachers. These positive results are largely due to the fact that the proposed course assesses the teachers as students and as teachers, and helps them develop self-reflection on their own learning, a proposal widely supported by national and international literature (Boruchovitch & Machado, 2017; Dembo, 2001; Kramarski & Kohen, 2016; Staley & Dubois, 1996; Veiga Simão, 2004).

## **Final considerations**

The effectiveness of the intervention program can be measured by the gains for teachers both as students and as teachers. They became more strategic and self-regulated students and, as teachers, they were capable and motivated to strengthen the self-regulatory processes of their students.

Despite its important contributions, our study has several limitations, including the reduced number of teachers who participated in it; the study applied self-report instruments, which may have generated social desirability; the intervention program was conducted in the fourth two-month school term, when the teachers were already tired with many end-of-year tasks to perform. We hope our study inspires further assessments with larger samples, using self-report instruments complemented with behavioral observations; and that the intervention programs of this nature can be carried out in the beginning of the school year, in order to ensure full benefits and higher adhesion of the teachers. Also, future studies should estimate the impact of interventions with teachers on student learning. Due to its thematic relevance, we hope teaching of learning strategies and the self-regulated learning framework be inserted in teacher education and continuing education programs for teachers, so that more students and more future teachers can benefit from learning in a strategic and self-regulated way.

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**Appendix A - Intervention meetings: objectives, contents, activities performed by teachers and applied to students**

Meetings and contents – learning strategies	Objectives	Activities performed by teachers	Activities developed by authors and used by teachers with their students while teaching learning strategies
1 - Introduction to learning strategies	<ul style="list-style-type: none"> <li>- Explain the objective of the course;</li> <li>- Conduct the pre-test;</li> <li>- Introduce learning strategies.</li> </ul>	<ul style="list-style-type: none"> <li>- Pre-test.</li> <li>- Structured learning diary<sup>5</sup>.</li> </ul>	-
2 – Metacognitive strategy and self-regulation of learning	<ul style="list-style-type: none"> <li>- Review the content of the previous meeting<sup>6</sup>;</li> <li>- Teach about metacognition and self-regulated learning.</li> </ul>	<ul style="list-style-type: none"> <li>- Activity of self-reflection on learning itself.</li> </ul>	-
3 – Planning: setting goals	<ul style="list-style-type: none"> <li>- Encourage self-reflection on planning;</li> <li>- Teach metacognitive strategy of planning focusing on goal setting strategy.</li> </ul>	<ul style="list-style-type: none"> <li>- Activity of self-reflection - setting goals;</li> <li>- Activity of setting goals.</li> </ul>	<ul style="list-style-type: none"> <li>- Teach about the importance of setting goals and creating a weekly goal;</li> <li>- Report about the experience to teach students about goal setting in the experience diary.</li> </ul>
4 – Monitoring: self-questioning; - Regulation: self-regulation of motivation	<ul style="list-style-type: none"> <li>- Encourage self-reflection on monitoring of comprehension;</li> <li>- Teach monitoring strategies: self-questioning and regulation: self-regulation of motivation.</li> </ul>	<ul style="list-style-type: none"> <li>- Activity of self-reflection - self-questioning and self-regulation of motivation;</li> <li>- Protocol of Self-reflection on behavior;</li> <li>- Activity of setting goals;</li> <li>- Activity of learning monitoring;</li> <li>- Activity on the self-regulation of motivation.</li> </ul>	<ul style="list-style-type: none"> <li>- Perform the activity of challenges and the activity of self-regulation of motivation with the students, making them reflect on these processes.</li> <li>- Report about the experiences of conducting these two</li> </ul>

<sup>5</sup> Learning diaries were filled at all meetings.

<sup>6</sup> The content discussed in previous classes was reviewed at all meetings.

			activities in the experience diary.
5 – Motivation to learn: theoretical and practical guidelines - Rehearsal: Underline	- Provide guidance on how to motivate students to learn; - Encourage self-reflection on underlining; - Teach the underline strategy.	- Activity of self-reflection - underline; - Activity of setting goals and behavior monitoring; - Underline activity: read a short text in the beginning of the meeting and analyze how you underlined it at the end of the meeting; - Reading and summary of a text about motivation.	-
6 – Elaboration: Summarize; - Organization: concept maps	- Teach the summarize strategy and concept map.	- Activity of self-reflection: summarize and concept maps; - Activity of setting goals and behavior monitoring; - Analysis of developed summaries; - Construction of a concept map.	-
7 – End of course	- End concept maps and daily activities; - Conduct the post-test.	- Presentation of concept maps; - Discussion of planning and behavior monitoring activities; - Post-test.	-

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