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THE INFLUENCE OF SELF-EFFICACY BELIEFS IN THE PERFORMANCE OF STUDENTS AT IFMG –BAMBUÍ

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ABSTRACT

Self-efficacy is a concept of Social Cognitive Theory that addresses one's ability to organize and take action to achieve goals. The research developed in this study intended to ascertain the reasons for poor student performance in disciplines such as Calculus. One of the hypotheses investigated deals with an assessment on the influence of self - efficacy beliefs. Relying on the students of IFMG – Campus Bambuí as a field of study, the research was based on the application of two distinct descriptive and qualitative steps that took into account the beginning and end of the disciplines. The results pointed at the existence of self-efficacy beliefs in beginner students and also at the fact that these beliefs became stronger in students in the end of the course. Thus, we can highlight the importance of teachers in the development of self-efficacy in students while promoting the development of new methodologies and the relevance of pedagogical and psychological support.

Keywords: Self-efficacy; academic performance; Social Cognitive Theory.

La influencia de la creencia de autoeficacia en el desempeño de los alumnos del IFMG –Bambuí

RESUMEN

Autoeficacia es un concepto de la Teoría Social Cognitiva que trata de la capacidad de la propia persona organizarse y ejecutar acciones para alcanzar objetivos. En este estudio se desarrolló una investigación que buscó averiguar los motivos que denotan bajo desempeño de alumnos cuando están cursando la asignatura de Calculus. Una de las hipótesis investigadas trata de la evaluación de la influencia de las creencias de autoeficacia utilizando como campo de estudio el equipo discente del IFMG – Campus Bambuí. La investigación se desarrolló con base en la aplicación de dos etapas distintas de cuño descriptivo y cualitativo que llevaron en cuenta el inicio y el final de las asignaturas. Los resultados apuntaron la existencia de creencias de autoeficacia en los alumnos iniciantes que se reforzaron en los alumnos concluyentes. Con base en eso, se puede destacar la importancia del profesor en el proceso de formación de la autoeficacia del alumno, la necesidad de desarrollarse nuevas metodologías y, también, la relevancia del soporte pedagógico y psicológico.

Palabras clave: Autoeficacia; rendimiento escolar; Teoría Social Cognitiva.

A influência da crença de autoeficácia no desempenho dos alunos do IFMG – Bambuí

RESUMO

Autoeficácia é um conceito da Teoria Social Cognitiva que trata da capacidade da própria pessoa se organizar e executar ações para atingir metas. Neste estudo foi desenvolvida uma pesquisa que procurou averiguar os motivos que denotam baixo desempenho de alunos quando cursando a disciplina de Calculus. Uma das hipóteses investigadas trata da avaliação da influência das crenças de autoeficácia utilizando como campo de estudo o corpo discente do IFMG – Campus Bambuí. A pesquisa foi desenvolvida com base na aplicação de duas etapas distintas de cunho descritivo e qualitativo que levaram em conta o início e o final das disciplinas. Os resultados apontaram a existência de crenças de autoeficácia nos alunos iniciantes que se fortaleceram nos alunos concluintes. Com base nisso, pode-se destacar a importância do professor no processo de formação da autoeficácia do aluno, a necessidade de se desenvolver novas metodologias e, também, a relevância do suporte pedagógico e psicológico.

Palavras-chave: Autoeficácia; rendimento escolar; Teoria Social Cognitiva.

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INTRODUCTION

Mathematical disciplines are generally considered difficult by most undergraduates. It is known that many students fail at these disciplines and that there are diverse factors, including psychological ones, that might contribute to poor performance and produce a direct influence on students' education. The Social Cognitive Theory (SCT), proposed by Albert Bandura, underlies concepts that provide us with the instruments to understand these possible psychological factors that might affect and/or influence the students' education.

According to Torisu (2010), students have difficulty in disciplines related to Calculus and that is not an exclusively Brazilian problem. Research studies show that the failure rates in Calculus disciplines are high in other countries as well (Torisu, 2010; Souza & Brito, 2008; Garzella, 2013; Rocha, 2011). Several factors might contribute to students' negative results. In this sense, it is observed that the self-efficacy belief that students construct in order to perform well in the discipline is a determining factor in the process of successful learning.

The self-efficacy concept lies at the heart of Social Cognitive Theory (SCT). According to this theory, self-efficacy is a determining factor in the behaviors individuals display for every situation. It directly influences the capacity for human agency, in which individuals choose their way of acting and intentionally affect their own performances and the circumstances of their lives (Pajares & Olaz, 2008).

Souza and Brito (2008) explain that all over the world research on the influence of self-efficacy in education is satisfactory and grows steadily. However, they also emphasize that, in Brazil, studies on the theme are still scarce. Such scarcity interferes in the construction of a diagnosis on the educational reality of students, especially the ones undergoing mathematical disciplines.

The IFMG is a federal educational institution that offers technical, graduation and post-graduation courses. In Bambuí/MG, the IFMG offers bachelor degrees in Administration and Computer, production, and food engineering. The institution also offers graduation courses in Physics, Agronomy, Zootechnics, various technical courses, and a master's degree for environmental protection professionals. Most of these university courses have Calculus in their curricula.

According to data obtained at the Academic Bureau at the IFMG – *Campus* Bambuí, students generally perform poorly in Calculus I and the failure rate was 72.69% in the second semester of 2015. Such performance might be due to the students' belief in their own potential and whether they performed well in the discipline or not. Considering this factor, the poor performance of IFMG – *Campus* Bambuí students in the Calculus disciplines, and the self-efficacy concept in the Social Cognitive Theory, the present article intends to demonstrate the results of a research developed on self-efficacy beliefs in students enrolled in Calculus disciplines at the IFMG – *Campus* Bambuí in the second semester of 2016.

According to Azzi and Polydoro (2006), in Albert Bandura's studies he emphasizes self-efficacy as an individual's own judgement concerning their capacity for organization and execution of actions in order to reach goals. Also according to the aforementioned authors, in 1977, Bandura was already proposing his self-efficacy theory while working on the treatment of phobias with modeling techniques for learning (Azzi & Polydoro, 2006). Thus, Bandura inferred that each person's belief led straight to psychological alterations (stress and depression) connected to threatening situations, which also influenced the level of motivation.

According to Azzi and Polydoro (2006), the concept of self-efficacy points at a phenomenon of subjective nature (beliefs) in which personal possibilities (capacity beliefs) produce personal trajectories in an agentic way (organization and execution) by connecting the self-efficacy conception to goals and objectives (producing accomplishments). Thus, the authors explain that there is an assessment focus that is restricted to a specific field in an individual's intention and action and there are perceptions of high self-efficacy for situations of control and low self-efficacy for other situations.

According to Bandura (1997), the adequate self-efficacy assessment, in view of different fields and contexts, involves a judgement on capacity by means of three dimensions: magnitude, power and generality. Magnitude involves three different levels of difficulty present in the field of activity. Power describes the intensity of an individual's belief in face of different aspects of the field. Generality refers to the amplitude of beliefs related to specific fields. Thus, self-efficacy beliefs refer to someone's judgement when dealing with certain situations (Azzi & Polydoro, 2006).

According to Azzi (2014), the perception of efficacy produces effects on human agency by means of four processes: cognitive, motivational and of choice. The cognitive process is regulated by proactive thought, in which anticipation formulates personal objectives and the stronger the perception of self-efficacy the harder the challenges chosen. The motivational process refers to the fact that people motivate themselves and guide their own actions while consolidating beliefs concerning what they are capable of doing.

The affection process, on the other hand, affects the amount of stress and depression that people experience in difficult and threatening situations as well as their motivational levels. And finally, there is the choice

process in which people avoid situations that they believe will overwhelm their capacity while choosing challenging activities and situations they believe they can handle (Boruchovitch & Bzuneck, 2009).

However, according to Torisu and Ferreira (2009), it is not correct to say that the mere possession of high self-efficacy beliefs is enough to ensure success in the realization of a particular activity. These beliefs, in combination with previous knowledge and suitable cognitive capacity, will be the basis for motivation and success.

According to Bandura (1986), individuals construct their own self-efficacy beliefs in different fields by means of the interpretation of information obtained from four sources that originate these beliefs and might act in collaboration or independently. The sources are: direct experience, vicarious experience, social persuasion, and physical and emotional state.

The most efficient way to produce a strong sense of efficacy is by means of direct experience, which is related to past experiences (Azzi & Polydoro, 2006). Success episodes build up a positive opinion on personal efficacy. On the other hand, episodes of failure undermine that positive opinion, especially if there is no firmly established sense of self-efficacy (Bandura, 1994).

Another way to strengthen self-efficacy beliefs are the vicarious experiences provided by social models. According to Costa (2008), when observing other people's attitudes, individuals rely on an assessment that compares the characteristics of the model with their own. Thus, observing the consequences of actions, which can be positive or negative, individuals choose to adopt behaviors, when there is identification with the model, and take them as references.

Social persuasion is also one of the ways to strengthen people's beliefs in their capacity to accomplish certain tasks. Self-efficacy grows stronger when individuals somehow become acquainted with the fact that they are actually able to accomplish the task in question (Boruchovitch & Bzuneck, 2009). Pajares and Olaz (2008) reinforce the idea that social persuasion is a means to strengthen self-efficacy beliefs and propose that the development of self-efficacy beliefs actively depends on persuasion agents. These authors believe that when persuasion is positive, individuals feel encouraged whereas negative persuasion de-energize individuals and drains their self-efficacy belief. People also take their physical and emotional states into consideration when judging their capacities. Poy et al. (2004) emphasize that part of an individual's judgement on their capacities is sustained by their emotional states.

According to Bandura (1994), individuals consider poor performance as a reaction to stress and tension. Thus, sheer intensity of physical and emotional reactions do not matter. What really matters is the way such intensity is perceived and interpreted (Barros & Santos, 2010). People with a high self-efficacy sense consider their excitement as performance facilitators. However, people who doubt themselves see their own excitement as an obstacle to development (Barros & Santos, 2010).

Several mentioned authors (Azzi & Polydoro, 2006; Pajares & Olaz, 2008; Barros & Santos, 2010; Poy et al., 2004) agree with Bandura in the perception that direct experiences, vicarious experiences, verbal/social persuasions and physical/emotional states are fundamental for the strengthening as well as for the sabotage of an individual's belief in personal capacities and the process of self-efficacy buildup.

Concerning education, numerous research studies point at the fact that a student's persistence is a consequence of positive self-perception. Students with stronger beliefs in their capacities are more persistent in the face of difficulty, take on challenging tasks, do not limit their choices too much, and suffer from lower levels of anxiety (Pajares, 1996).

Pajares and Schunk (2004) explain that these research studies demonstrate that self-efficacy is highly applicable to the educational context, which produces significant influence on the thoughts and actions of students and teachers as well as on the students' education, motivation and sense of accomplishment.

When it comes to Mathematics, self-efficacy beliefs have been studied generally in the context of problem solution, anxiety concerning math tests, and the choice of careers related to this area (Azzi & Polydoro, 2006). The authors also explained that self-efficacy beliefs are an important mediator in the solution of mathematical problems. In other words, students that believe they can accomplish a task will keep on persisting in their objective even though they come up against difficulties, using a variety of different strategies until they can find a solution to the problem (Shih & Alexander, 2000).

METHOD

The present study is a cutout from a research realized as Scientific Initiation at the IFMG *Campus* Bambuí – MG, in the years 2016 and 2017. The objective of the research was to assess the influence of self-efficacy beliefs in students' performances in the Calculus disciplines at the IFMG – *Campus* Bambuí in the second semester of 2016. A qualitative and descriptive case study was realized at two different moments in the discipline. The intention was to outline a profile of the students and describe self-efficacy beliefs in the beginning and in the end of the disciplines as well as the influence of self-efficacy beliefs on the performance of students.

Concerning technical procedures, the research employed questionnaires, which were regulated by

the instruments developed by Pires (2008) and Torisu (2010), who also researched self-efficacy beliefs regarding school performance.

The questionnaires consisted of ten questions divided into four categories according to the following objectives: identification, perception of overall performance, perception of performance in the Calculus discipline and the influence of the student/teacher relationship on performance in the discipline. In the questionnaires, the answers were provided by means of a Likert 1 to 5 mode and multiple choice questions. In questions related to perception of performance and the teacher/student relation, there was space for justification.

The applied questionnaires had the four mentioned categories. However, their objectives were distinct: the first questionnaire focused on the students expectations at the beginning of the discipline. The questionnaire taken by the students in the end contained questions regarding students' success, what contributed to their satisfactory performance and how they felt by reaching the conclusion of the discipline.

Initially, in order to read data obtained at the Academic Bureau of the IFMG- *Campus* Bambuí, four courses including the Calculus discipline in the first semester of 2016 were identified. The courses were: Food Engineering, Computer Engineering, Physics and Zootechnics. Respectively, the courses had 41, 33, 54 and 47 enrolled students. However, in the first part of the research, the participating students were taking the Calculus discipline for the first time. There were 16 from Food Engineering, 21 from Computer Engineering, 7 from physics, and 28 from Zootechnics. The total sum was 72 students. In the second stage, students were in the end of the Calculus discipline.

It is important to emphasize that the fact that the students were in the end of the course does not mean they passed the course. 26 students remained in the discipline until the last examination: 11 Food Engineering students, 10 Computer Engineering students, 3 Physics students and 2 Zootechnics students.

17 students passed the discipline. 3 from Food Engineering, 8 from Computer Engineering, 5 from Physics and 1 from Zootechnics. Thus, concerning the students who participated in the research in that semester, 23.16% passed the Calculus discipline. 19.44% of the participating students dropped out of the research. Therefore, 80.56% of the participating students were engaged in all stages of the research.

Concerning the application of questionnaires, the first stage took place in August 2016, the beginning of the academic semester. The objective was to assess the students' sense of self-efficacy in the beginning of the Calculus discipline. The students were initially made acquainted with the general objective of the study, with the confidential nature and anonymousness of all data supplied and with the importance of their collaboration and of honesty in their answers. In order to clarify any doubt concerning the questionnaire, explanations were provided whenever necessary. The stage involving students finishing the course took place in the months of December 2016 and January 2017.

All data collected was processed by Google Forms. Questions with incomplete answers were labeled as unanswered and questionnaires were categorized by means of initials referring to the name of the course and the student's number (e.g.: Z1 – participant number 1 from the Zootechnics course, and so on). After producing a worksheet, it was time to start process of data tabulation and grouping up, in which there was an initial assessment of the students' profile for details concerning the predominance of students from a particular course, gender, or age.

There were assessments on the self-perception of individuals as students, their school performance, how often they studied at home and how they felt about taking tests. In addition to these tests, the analysis was based on students' perception of Calculus as well as their difficulties and expectations concerning the discipline. Finally, there was an analysis of the students' thoughts concerning the teacher/student relationship and how it might influence performance. Results were interpreted by means of the studied theory already presented in the theoretical referential.

RESULTS AND DISCUSSIONS

Questionnaire – beginners in the Calculus discipline

Concerning the researched students' profile, it was possible to observe that 57.40% were male, ages between 18 and 20 (65%), who considered themselves good at exact sciences (53.60%). It was also observed that most of the participating students were in the second semester of Zootechnics (34.78%) and Computer Engineering (30.43%).

When it comes to self-perception as a student, 95.6% described themselves as good or average while only 4.40% affirmed that they were not very good students. This positive rate might be connected to the frequency of studies at home. Most of the students reported that they studied at home. 73.09% did not study only right before tests. Only 1.50% reported that they did not study at home at all. Concerning their feelings about taking tests, 63.8 % believed that tests made them feel good. Only 36.20% felt nervous and feared such nervousness could get them confused. These data demonstrate that the students, in the beginning of the discipline, present a positive perception of their performance, which might be the foundation and support for their sense of self-efficacy.

Concerning the discipline, it was possible to notice that, although students consider Calculus disciplines difficult, they presented a positive sense of self-efficacy in this context. Most of the students believed themselves capable of learning the contents (78.30%) and of passing the discipline (81.20%). The students represented their positive sense of self-efficacy at this initial moment by their belief in their own capacity to get good grades in the discipline (59%). (15%) emphasized that, despite the difficulty of the content, they believed in their capacity to understand it, do the assignments, and get good grades.

This perception gets confirmation by the fact that most of the students, 52.20%, felt confident or very confident in the beginning of the Calculus discipline. Also, students reported that they believed that the way they studied influenced their performance in the discipline (97.10%). 36.11% manifested the belief that if they studied hard, they would get better grades.

Concerning the teacher/student relationship, (65.20%) of the respondents mentioned that the relationship was good and positively influenced their academic performance. In these answers, it is possible to observe the importance of teachers in the development of a sense of self-efficacy in the students.

Questionnaire II – students in the end of the Calculus discipline

Here, we will analyze data from students who did all assignments and took all tests proposed by the Calculus discipline, that is, the ones who persisted until the end. It does not matter if they passed or not. They were 27 students, which corresponds to 39.13% of the students who started the research (69 students).

Concerning the profile of interviewed students, we noticed that most of the respondents were male (67%). In questionnaire I (beginners), the percentage difference between men and women was only 14.8%, and now it was 34%. This difference might be due to gender issues in the choice of professions in the area of Exact Sciences (Azzi & Polydoro, 2006). Most of the respondents were between 19 and 20 years of age (48 %) and were enrolled in the courses of food and computer engineering (37% each).

The researched students considered themselves good or average (92.60%) and believed themselves capable of successfully finishing the Calculus discipline (85.20%). Although they had a positive self-perception regarding their academic performance and apparently developed a positive sense of self-efficacy for Calculus, it is important to highlight the fact that 55.60% felt apprehension when taking tests for the discipline although they believed they would make it to the end. Nonetheless, approximately one third of the students (29.60%) felt calm because they knew they had studied for the test.

It is possible to observe that when there is too much effort in order to overcome a challenge, self-efficacy beliefs grow weak. The students' apprehension about taking the tests seems to demonstrate that. On the other hand, successful experiences motivate students and empower their sense of self-efficacy. Thus, they can self-regulate in order to improve their study routines. The students pointed out that they actually took the time several times a week to study for the discipline (96.70%) and affirmed that the study influenced their performance (92.60%) and that the more they studied the better they performed in the discipline (65.40%).

Analysis of the results points at the fact that students developed a positive sense of self-efficacy regarding the discipline (85.20%) and that they believed they would pass the discipline. However, direct experience is not enough to sustain self-efficacy for further Calculus disciplines. 46.70% lack the confidence to start another Calculus semester.

Respondents mentioned that the most influential factors in their performance in the Calculus discipline was the teacher's pedagogical skills, their perception of the possibility for success (Direct experience) and the observation of the students who did well in the discipline (vicarious experience).

Just like in questionnaires I and II (beginners and dropouts), participating students mentioned that the teacher/student relationship directly influences performance in the discipline. They believe that when a relationship is good, it contributes to performance and to the will to study (92.60%). Another very relevant point for students refers to the pedagogical techniques employed by the teacher.

Final analysis – Comparison of results from the two groups of students (beginners and finishers)

At this stage, there was a comparison of results obtained with the application of two questionnaires for Calculus beginners (questionnaire 1) and students in the end of the discipline (questionnaire 2) in the graduation courses at the IFMG – *Campus* Bambuí. In order to do this analysis, the research specific objectives were used as references. They were: identify the presence of a sense of self-efficacy in the students of the Calculus disciplines; investigate the different ways students study for the Calculus disciplines; analyze the influence of pedagogical methodologies for the teaching of Calculus on performance and on the development of self-efficacy in the students; describe the teacher/student relationship in the Calculus discipline and its influence on the students' performance; propose strategies for the development of self-efficacy in students of the Calculus discipline at IFMG – *Campus* Bambuí.

Only 17 students participating in the research

passed the Calculus discipline. Thus, concerning the students participating in the research, 23.16% of the students passed the Calculus discipline in this semester. Concerning the profile of the researched students, the questions asked referred to course, gender, and age.

Concerning the course, it was observed that the one with the greatest number of beginners was Zootechnics. For students in the end of the course, Engineering (Food and Computer Engineering) was the area with the most representation.

Most of the students beginning the discipline were male and, consequently so were the students in the end. According to Pinto, Carvalho and Rabay (2012), gender relations influence and limit the professional choices and aspirations of the young students.

At last, concerning age, a similarity was observed between beginners and students in the end of the course. Most of them were young students ages 19 to 20.

Before moving on to the identification of self-efficacy beliefs in the participating students, it is important to take a look at how they develop. Apparently, it is a simple process but it is very inferential and subjective. An individual (student) engages in an action, interprets its results and, based on perception, develops a sense of personal capacity in a particular field. The whole process is permeated by internal (physical and emotional states) and external influences (direct experiences, vicarious experiences and verbal persuasions). Thus, it is possible to affirm that self-efficacy, in a certain field, is a shifting phenomenon that suffers direct influence by the environment, according to the results of the present research.

Concerning the identification of self-efficacy beliefs in the researched students, they can be observed in beginners as well as in students in the end of the course. The students present a positive sense of self-efficacy concerning the Calculus field although they recognize the discipline is difficult. However, constructed self-efficacy changes and sometimes grows weak, especially in the group of students in the end of the course, who do not seem confident about taking further disciplines in the same area. It is possible to observe that they do not think they have enough self-efficacy to engage in another Calculus discipline despite that fact that they have built a positive self-concept regarding the area of Exact Sciences.

Social cognitive theory points at the fact that when success is obtained by means of too much effort, it does not contribute much to the strengthening of self-efficacy. Students tend to jump to the conclusion that they do not possess the necessary skills to deal with the challenges of the field in view of how much effort they had to put out in order to be successful. It is possible to infer that this is what happened to the students in the end of the course. It is also worth it to mention the fact that self-efficacy beliefs are not the same as result expectations. Although students might have a sense of self-efficacy regarding a particular field, they can have negative result expectations, which can be connected to context elements (environment, class schedules, students, pedagogical techniques and strategies employed by the teacher, etc.) that they know are out of their control (Boruchovitch & Bzuneck, 2009).

In the correlation between self-efficacy beliefs and their influence on the studies, it was observed that self-efficacy beliefs had a direct influence on the effort put out by the researched students and on the strategies used. It is known that self-efficacy interferes in the students' motivation. Thus, it was observed that the students, in the two phases of the research (beginners and finishers), emphasized the influence and the importance of studying for success in the discipline and pointed at the development of a study routine as conducive to success. It was observed that study time dedication was the same for beginners and for students in the end of the course as well. 73.09% of the beginners and 96.70% of the students in the end of the course affirm that they study at home at least twice a week. 36.11% of the beginners and 65.40% of the students in the end of the course also reported that success in the discipline is closely connected to extended study time.

It was possible to perceive a percentage elevation in study time for students in the end of the course, which is in accordance with the SCT theory that the more positive the self-efficacy belief the greater the self-regulation, which is something necessary for students to plan more efficient courses of action and display more perseverance towards the overcoming of their own challenges.

The research has revealed that the most common study time tools for all students were exercises and video tutorials. They also highlighted that fact that the right way to study is of vital importance for success in the discipline. Some participants point out that studying the wrong way might undermine performance but they did not provide any definition for studying the wrong way. They did not report any participation in on-site, study or tutorial groups.

It was possible to observe that the frequency and the style of study routines are connected to the students' feelings about taking tests in the discipline. We noticed a positive sense of self-efficacy concerning the examinations in beginners as well as in students in the end of the course. 63.80% of the beginners believed tests were good for them. 55.60% of the students in the end of the course felt apprehensive about taking

tests but believed they would pass. One third of the students in the end of the course felt confident about the exams because they knew they had studied hard enough to pass.

The choice of methodologies in the teaching of Calculus really influences performance and the formation of self-efficacy in students. Such influence can be detected unanimously in the study. The students in the end of the course considered the pedagogical approach used by the teacher in the classroom to be counterproductive for learners in the discipline. Thus, it was possible to prove that the teaching techniques used in the classroom are fundamental for the construction and maintenance of self-efficacy beliefs.

The importance of the teacher's support was the focus when students described the teacher-student relationship in the Calculus discipline as a direct influence on performance. Such perception was also unanimous in the two groups of students. The students reported that when the teacher provides them with good support they do better. Such influence is described by 65.20% of the beginners and 92.60% of the students in the end of the course. We may also emphasize the increase in the percentage for students in the end of the course. It is also important to question ourselves whether students are not mixing their personal feelings regarding a teacher and the pedagogical techniques used in the classroom. But we already know that learning is made easier when there are positive emotional components underlying the teacher/student relationship. So it is important to pay special attention to this detail of the research and recognize that it has an implicit relation with the formation and the maintenance of self-efficacy in students concerning this particular field.

The SCT points at how beneficial it is when teachers help students realize they are making progress. The feedbacks given by the teachers prove fundamental in the process of formation and maintenance of self-efficacy. We know that verbal persuasion is one of the components in the formation of self-efficacy but persuasion by itself does not have a long-lasting effect. Therefore, the teacher must be perfectly aware that proper feedback has great relevance in the formation of self-efficacy. It must be provided the right way and in combination with the successful experiences that every teacher is supposed to help students have by regulating the level of difficulty and the specificity of tasks.

The present research has verified the SCT notion that direct experience (going through success or failure), vicarious experience (observing the success or failure of classmates), and emotional and physiological aspects (the students' anxiety sometimes is perceived as a sign of vulnerability, which makes students believe they are not good enough to handle the challenges of a particular field) influence the construction of self-efficacy. There was a fourth factor that was also very relevant. It was the teacher's pedagogical skills. It is fundamental to emphasize the importance of the role the teacher plays for these students.

Concerning the students in the end of the course, it was verified that the same factors are considered positive. They are: pedagogical techniques used by the teacher, perception of the possibility of success (direct experience) and the observation of students that did well in the discipline (vicarious experience).

In a nutshell, it was observed that some factors became important elements to be processed by pedagogues, educational psychologists, and teachers of the institution so that students can have better chances for success. Among such factors, two of the most important are: the pedagogical techniques and strategies used in the classroom by the teacher (which might include direct and vicarious success experiences as well as some factors of verbal persuasion – a feedback by the teacher, for example) and the students' emotions concerning the discipline (anxiety).

FINAL CONSIDERATIONS

The challenges and discoveries presented by the research led us to produce the following reflections:

1 – The importance of studies on self-efficacy for the formation of new teachers. The Social Cognitive Theory is still little known in Brazil but there are some studies on its influence on school performance and on teachers' practice. These studies have a lot to contribute to the improvement of teaching.

2 – In the results, we found very robust self-efficacy expectations in the beginners of the discipline and a changing sense of self-efficacy in the group of students in the end of the discipline. We might attribute such fragile self-efficacy to environmental factors out of their control (demanding teachers, classmates, level of support, etc.).

3 – It was observed that most of the students self-regulated in order to realize the tasks in the discipline. They regularly studied at home rather than just right before tests. They used the Internet for support (video tutorials) and did not mention any participation in on-site tutorial activities.

4 – In the results, the importance of the positive or negative role played by the teacher became evident in the formation and maintenance of self-efficacy in the students of the Calculus disciplines. Their intervention has great relevance on the construction of self-efficacy by means of verbal persuasion (the best way to provide feedback on students' performances) as well as pedagogical methods and strategies in the classroom.

5 – The relevance the students see in the pedagogical

techniques used by the teacher in the classroom demonstrates a necessity faced by the pedagogical team and the teachers to develop new methodologies for the discipline in order to provide support for the construction of self-efficacy. Thus we recommend the works of Schunk (1989, 1991) and of Boruchovitch and Bzuneck, (2009), which suggest that the activities must have three characteristics: they must be brief so they can be completed in a short time; they must be specific, that is, they must be well defined and not too generic or vague; and, at last, their level of difficulty must be in accordance with the students skills, which implies the need to work with diverse activities.

6 – Another highlight is the importance of the work of professionals from the Educational Psychology department of the institution in order to mitigate the influence of emotional factors as obstacles to the success of students in the discipline. This factor came up in different parts of the research. The Social Cognitive Theory establishes that physiological and emotional factors influence the formation of self-efficacy beliefs.

We believe that it is a very important theme and these issues still present several aspects to be studied. We recommend the production of new studies using specific scales for the measurement of self-efficacy and statistical resources. These tools were not used in the present research in view of its scope. Not using such instruments was a limitation in our study.

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