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Academic Performance in Differential and Integral Calculus: a Case Study

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ABSTRACT

This paper is part of an investigation that aims to know the history of the set of disciplines that study the contents of Differential and Integral Calculus taught at the Federal University of Goiás. This article analyzes the academic performance of students in the discipline Calculus 1A of said institution, the first semester of 2010 to the second semester of 2016, corresponding to 14 academic semesters, checking aspects such as: students enrolled, approval and disapproval and final averages. A case study based on qualitative-quantitative research is therefore carried out. To do so, it relies on administrative, pedagogical and academic data obtained in the Integrated System of Management of Academic Activities of the university. The quantitative data collected are analyzed mainly in the light of descriptive statistics. In addition, the qualitative analysis is developed with the support of a bibliographic study, based on authors who discuss topics such as: teaching and learning of mathematics, learning difficulties in Calculus and reprobation in higher education. The results show an unsatisfactory performance in the discipline Calculus 1A, manifested in high reprobation and in low end averages. The study also shows that the number of students per classroom does not cause greater disapproval. In light of the above, there is a need to problematize the teaching and learning processes, as well as thinking about proposing educational actions that may alter this framework, leading students to an effective learning of the contents of these disciplines.

KEYWORDS

Differential and integral calculus. Calculus. Academic achievement.

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Desempenho Acadêmico em Cálculo Diferencial e Integral: um Estudo de Caso

RESUMO

Este trabalho é parte de uma investigação que objetiva conhecer a história do conjunto de disciplinas que estudam os conteúdos de Cálculo Diferencial e Integral ministradas na Universidade Federal de Goiás. Este artigo analisa o rendimento acadêmico dos alunos na disciplina Cálculo 1A da referida instituição, do primeiro semestre de 2010 ao segundo semestre de 2016, o que corresponde a 14 semestres letivos, verificando aspectos como: alunos matriculados, aprovação e reprovação e médias finais. Realiza-se, pois, um estudo de caso, com base em pesquisa com abordagem quali-quantitativa. Para tanto, respalda-se em dados administrativos, pedagógicos e acadêmicos obtidos no Sistema Integrado de Gestão de Atividades Acadêmicas da universidade. Os dados quantitativos coletados são analisados principalmente à luz da estatística descritiva. Além disso, a análise qualitativa é desenvolvida tendo como respaldado um estudo bibliográfico, fundamentado em autores que discutem temas como: ensino e aprendizagem de matemática, dificuldades de aprendizagem em Cálculo e reprovação na educação superior. Os resultados evidenciam um desempenho insatisfatório na disciplina Cálculo 1A, manifesto em elevada reprovação e em médias finais baixas. O estudo ainda mostra que a quantidade de estudantes por sala de aula não provoca maior reprovação. Diante do exposto, emerge a necessidade de se problematizar os processos de ensino e de aprendizagem, bem como pensar na propositura de ações educativas que possam vir a alterar esse quadro, levando os alunos a uma aprendizagem efetiva dos conteúdos dessas disciplinas.

PALAVRAS-CHAVE

Cálculo diferencial e integral. Cálculo. Desempenho acadêmico.

Desempeño Académico en Cálculo Diferencial y Integral: um Estudio de Caso

RESUMEN

Este trabajo es parte de una investigación que tiene como objetivo conocer la historia del conjunto de disciplinas que estudian los contenidos de Cálculo Diferencial e Integral enseñado en la Universidad Federal de Goiás. Este artículo analiza el rendimiento académico de los alumnos en la disciplina Cálculo 1A de dicha institución, del primer semestre de 2010 al segundo semestre de 2016, lo que corresponde a 14 semestres lectivos, verificando aspectos como: alumnos matriculados, aprobación y reprobación y medias finales. Se realiza un estudio de caso, con base en investigación con abordaje cualitativo cuantitativo. Para ello, se respalda en datos administrativos, pedagógicos y académicos obtenidos en el Sistema Integrado de Gestión de Actividades Académicas de la universidad. Los datos cuantitativos recogidos son analizados principalmente a la luz de la estadística descriptiva. Además, el análisis cualitativo se desarrolla teniendo como respaldo un estudio bibliográfico, fundamentado en autores que discuten temas como: enseñanza y aprendizaje de matemáticas, dificultades de aprendizaje en Cálculo y reprobación en la educación superior. El estudio todavía muestra que la cantidad de estudiantes por aula no provoca mayor reprobación. En vista de lo expuesto, surge la necesidad de problematizar los procesos de enseñanza y de aprendizaje, así como pensar en la proposición de acciones educativas que puedan venir a alterar ese cuadro, llevando a los alumnos a un aprendizaje efectivo de los contenidos de esas disciplinas.

PALABRAS CLAVE

Cálculo diferencial e integral. Cálculo. Rendimiento académico.

Introduction

This study is part of a project developed at the Institute of Mathematics and Statistics (IME) of the Regional Goiânia of the Federal University of Goiás (UFG), on the history of Differential and Integral Calculus (CDI) in the institution. It has as its main goal to subsidize actions that can improve the teaching and learning of the content taught, reducing average disapproval and, consequently, student retention.

It is necessary to say that the terminology variations of the disciplines that compose the CDI are related to the quantity of content, besides the own demands of some courses in the area of
Exact Sciences. As an example of the disciplines that make up the CDI and which are distinct, we have Calculus 1A and Calculus for Electrical Engineering 1. The contents that make up the Calculus 1A, a discipline with a workload of 96 hours, are: real numbers; real functions of a real variable and its inverse; notions about conics; limit and continuity; derivatives and applications; Taylor's polynomial; integrative techniques; improper integrals; and applications. The table of the discipline Calculus for Electrical Engineering 1, which has an hourly load of 60 hours, is the following: intervals and inequalities; real functions; limits; continuity; derivative and differential with a variable; theorems about derivable functions; maximum and minimum; integral with a variable; defined integral; and integration techniques.

The unsatisfactory income in CDI, manifest in failure, is a reality in several educational institutions, both in Brazil and abroad. The study by Barufi (1999) shows that, at the University of São Paulo (USP) from 1990 to 1995, the average CDI failure rate was 43.8%. Likewise, Rezende (2003) shows that, in the universities of Rio de Janeiro, the average failure in the same discipline ranged from 45% to 95%, according to the course for which it was offered. In addition to these, other authors (TALL, 1993; FRAGOSO, 2011; DONEL, 2015; GARZELLA, 2011, RASMUSSEN; MARRONGELLE; BORBA, 2014) have already indicated that failure in this discipline is high.

Considering these variations of terminologies and in view of the high reproducibility in CDI, it was decided to specifically analyze the academic performance of students in Calculus 1A, because it is a subject offered in the first period for undergraduate courses, and that requires a mathematical background of basic education. In addition, this was the specific discipline that offered most of the classes (see Table 01). In addition, it aims to contextualize and connect with the contents that will be taught, forming a continuous chain of ideas. In general, the discipline in question contemplates seven main topics, which are: 1) Real numbers: Properties; Breaks; Absolute value; Equations and Inequalities; Sets of points in the plane: Semi plane and Conics; 2) Functions: Function definition; Operations with functions; Graphics; Elementary and Transcendent Functions; Compound, Inverse and Implicit Functions; 3) Limits and Continuity of Functions: Notions of Limit; Lateral Limits; Limit of a function at a point; Operative properties of limits; Continuity; fundamental limits; Infinite limits; Limits in infinity and asymptotes; 4) Derivative: Concept; Geometric Interpretation; A Derivative as a function; Derivation rules; Derivatives of higher order; Chain Rule; Implicit derivation and Derivative of the inverse function; 5) Derivative Applications: Rate of Change; Maximum and Minimum Value, Theorem of the mean value; Study of the variation of the functions, Sketch of graphs of functions; Rule of L'Hospital; Taylor's polynomial; 6) Integration: Primitives of real functions; Properties; Immediate primitives; Integral Undefined; concept of defined Integral; Fundamental Theorem of Calculus; Change of variable in Integration and Inertial Integrals. Integration Techniques: Integral by parts; Integrals by trigonometric substitutions; Integration of Rational Functions by Partial Fractions; Inertial Integrals; and 7) Integration Applications: Areas between Curves; volumes of solids of revolution; volumes of solids by sections of areas; arc length; areas of a surface of revolution; average value of a function.

Understanding the student's performance in Calculus 1A is fundamental, since it is one of the curricular components in which the students present greater difficulties. And the constant disapproval ends up leading the student to evade the institution, because when he fails several times, he has the feeling that he is unable to learn the contents, and then he gives up the course. Students enter university with high expectations in terms of learning, and when they cannot achieve satisfactory academic performance, they feel lost, unmotivated. In addition, it is considerable to collect and analyze more refined data, since they may reveal aspects that are implicit or unclear about the context of these disciplines. Furthermore, it is believed that the results of this investigation favor the understanding of the reprocessing problem in DIC, besides being able to guide future actions, based on scientifically proven results.

In this work, a case study is carried out, which is not a specific technique, but a method directed to the organization of social data, preserving the unitary character of the researched object (GOODE and HATT, 1969). According to Gil (1991), the case study consists of an exhaustive and deep study of few objects, which allows a broad and specific knowledge of the same. The author understands that: "[...] the design is based on the idea that the analysis of a unit of a given universe makes it possible to understand the generality of the universe or, at least, to establish the basis for an investigation" (GIL, 1991, p. 79).

For the accomplishment of this study, a research with qualitative-quantitative approach is developed. Godoy (1995, p. 58) explains that qualitative research: “It is concerned with objective measurement and quantification of results. It seeks precision, avoiding distortions in the analysis and interpretation of data, thus ensuring a margin of safety in relation to the inferences obtained”. The qualitative research “[...] does not seek to enumerate and/or measure the events studied, nor does it employ statistical instruments in data analysis. Part of broad questions or focus of interests, which are being defined as the study develops” (GODOY, 1995, p. 58). According to Giddens (2012), the qualitative-quantitative research is a mixed method that can lead to a broader understanding and explanation of the studied content. Minayo and Sanches (1993) affirm that the quantitative study can promote the deepening of qualitative aspects, and vice versa.

Here, we analyze the academic performance of UFG students in the discipline Calculus 1A from the first half of 2010 to the second half of 2016, which corresponds to 14 academic semesters. Aspects such as: students enrolled, approval and disapproval and final averages are verified. To that end, it is supported by administrative, pedagogical and academic data obtained in the Integrated System of Management of Academic Activities (SIGAA) of UFG. The quantitative data collected are analyzed mainly in the light of descriptive statistics. In addition, the qualitative analysis is developed with the support of a bibliographic study, based on authors who discuss topics such as: teaching and learning of mathematics, learning difficulties in Calculus and reprobation in higher education.

Results and Discussion

In the regional Goiânia of the UFG, in April 2016, there were 20.531 students regularly enrolled. In the second half of 2016, the following classes of CDI were offered by the IME/UFG, for a total of 51, serving 2.090 students. Therefore, about 10% of university students attended these subjects.

Table 1. Classes of Differential and Integral Calculus offered by IME/UFG - 2016/02[1]

Denomination	Amount of classes
Calculus 1	1
Calculus 1A	10
Calculus 1B	4
Calculus 1C	4
Calculus 2	1
Calculus 2A	8
Calculus 2B	6
Calculus 3A	6
Calculus 3B	2
Differential and Integral Calculus and Analytical Geometry II	2
Calculus I	3
Calculus II	1
Calculation for Electrical Engineering 1	1
Calculation for Electrical Engineering 2	1
Calculation for Electrical Engineering 3	1
TOTAL	51

Source: Authors

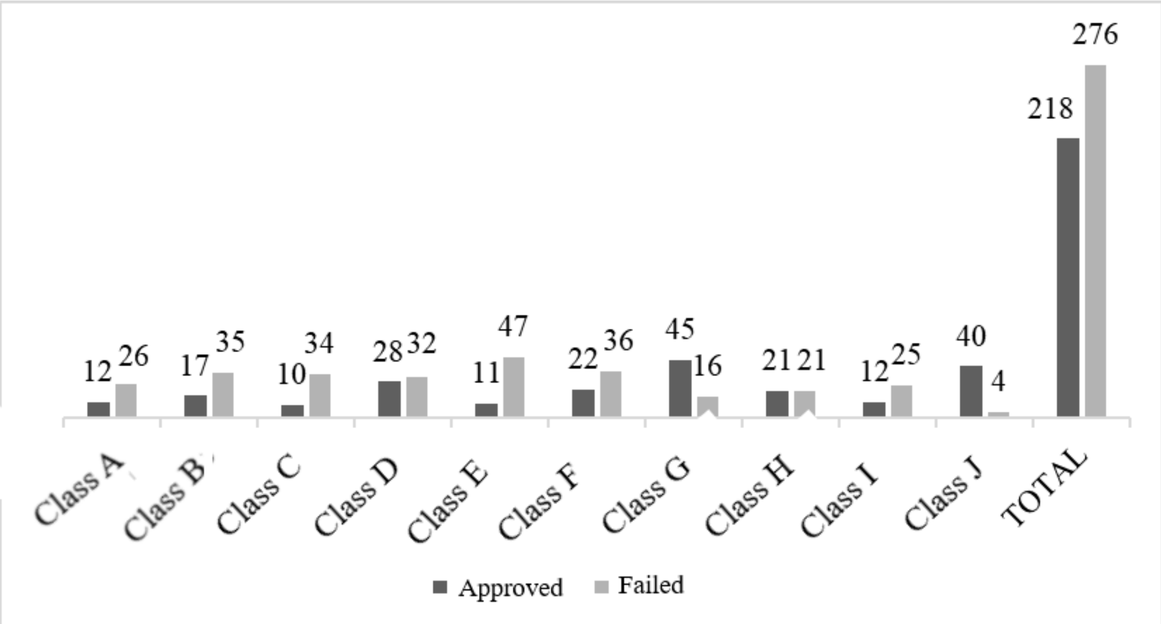
Of the total number of students who studied these subjects, 1.163 (55.65%) were disapproved and 927 (44.34%) were approved. Diverse studies deal with learning difficulties in CDI, and, despite the differences in the nature of these obstacles, they are related with the high failure rates. This picture is so common historically, and so recurrent in institutions of

[1] In addition to these CDI disciplines offered in the second half of 2016, IME/UFG offers other disciplines of the same group, such as Differential and Integral Calculus and Analytical Geometry I.

higher education in general, that students end up believing it normal to fail in that discipline. And, in the same way, teachers end up accepting high reprobation as something natural (OLIVEIRA; RAAD, 2012).

In dealing specifically with Calculus 1A, in the second semester of 2016, IME/UFG offered ten classes, attending 494 students regularly enrolled in eleven undergraduate courses, namely: Environmental and Sanitary Engineering, Civil Engineering, Computer Engineering, Engineering Transportation, Physical Engineering, Chemical Engineering, Physics (undergraduate and baccalaureate), Medical Physics, Geology, Mathematics (undergraduate and baccalaureate) and Chemistry (baccalaureate). Of this group, 276 were disapproved (56%) and 218 were approved (44%).

Graph 1. Approved and failed in Calculation 1A - 2016/02

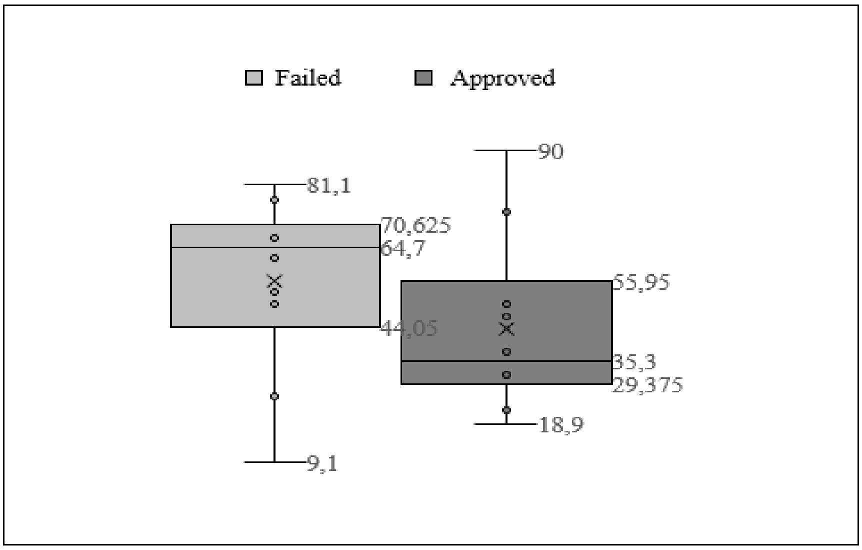


Source: Authors.

Graph 1 shows that the number of failures greater than that of approval occurred in seven of the ten classes surveyed, varying from 53.3% to 81.1%. Only in two classes (G and J) did the approval pass higher than that of failure, reaching 90.9% and 73.8%, and in one class (H) the number of approved and failed was the same. In the period in question, the average percentage of failed and approved was, respectively, 56.24% and 43.76%. Therefore, analyzing the classes specifically, and the general data, there is a very expressive disapproval frame.

Graph 2 analyzes the median of the presented data.

Graph 2. Percentage of students approved and failed in Calculus 1A - 2016/02



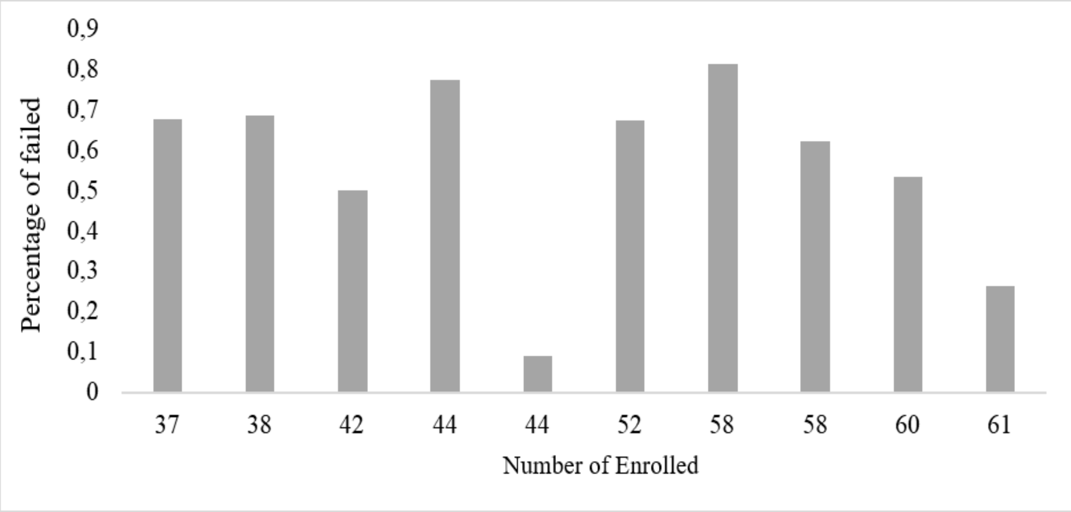
Source: Authors.

As shown in the Box Plot[2] above, it can be seen that, in the total of Calculation 1A classes offered in the second half of 2016, 75% had 70.6% of failed and 55.9% of approved; 50% of the classes had 64.7% of failed and 35.3% of approved; and 25% had 44.05% of failed and 29.37% of approved ones. It is worth mentioning that the lowest percentage of students who failed a class was 9.1%, and the highest was 81.1%. Otherwise, the lowest percentage of approval in a class was 18.9% and the highest of 90%. Data sets do not have outliers. In addition, the two sets show asymmetry in the distribution of approved and disapproved. That said, it is confirmed that, in the great majority of the classes, the highest index is of students failed.

When analyzing the relation between the number of students enrolled and the percentage of failure in Calculus 1A, the following picture is taken:

[2] Box Plot is a type of graph used to present an idea of position, dispersion, asymmetry, tails, and discrepant data (BUSSAB; MORETTIN, 2010). In this work, it is used to present the position and the discrepant data.

Graph 3. Relationship between the number of students enrolled and the percentage of failure in Calculus 1A - 2016/02



Source: Authors.

Graph 3 shows that, in the second half of 2016, Calculus 1A classes with a large number of students, above 50, had an average failed rate of 58.1%. In the groups with up to 50 students, the average was 65.8% of failed. Considering only the groups with less than 40 students, the average of disapproval was 68%. Therefore, the best performance was in the classes with more students, more than 50.

According to the National Institute of Educational Studies and Research (Inep) (2012):

> The organization in smaller classes is generally seen as a way to allow teachers to spend more time with each student and less time organizing the class, which provides better teaching, adapted to the students' individual needs, and ensures better performance. In this context, class size can generally be seen as an indicator of the quality of the education system (INEP, 2012, n/p).

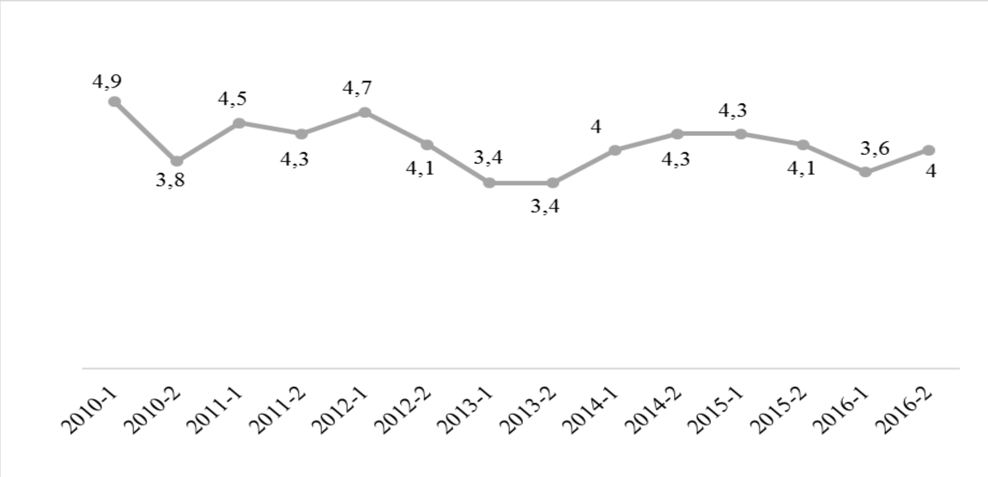
However, the data of this research indicate that the number of students per class is not a decisive factor when it comes to this type of school performance. Therefore, the performance differential may be in the quality of teaching, which is related to different aspects, such as the knowledge of the students, the time of dedication to studies, the participation of study and monitoring groups, innovative teaching practices and more .

It is important to point out that the fundamental administrative problem resulting from this high rate of disapproval is the formation of surpluses for the next semester. As a result, Calculus 1A classes are usually crowded in all semesters. Some students do not even have a place to enroll in the course, and therefore need to seek other courses in the institution. Even so, there are those who can not enroll, being retained, since in the case of lack of vacancies, one of the criteria for the choice of students to be enrolled is the priority index[3].

[3] The priority index does not take into account the student's grade but considers the subjects that he or she has taken, their passing rate and the payment in the course. The purpose of this index is to give privilege to veteran students so that they can graduate.

Another data that deserves attention is the simple arithmetic mean of the final averages obtained in Calculus 1A:

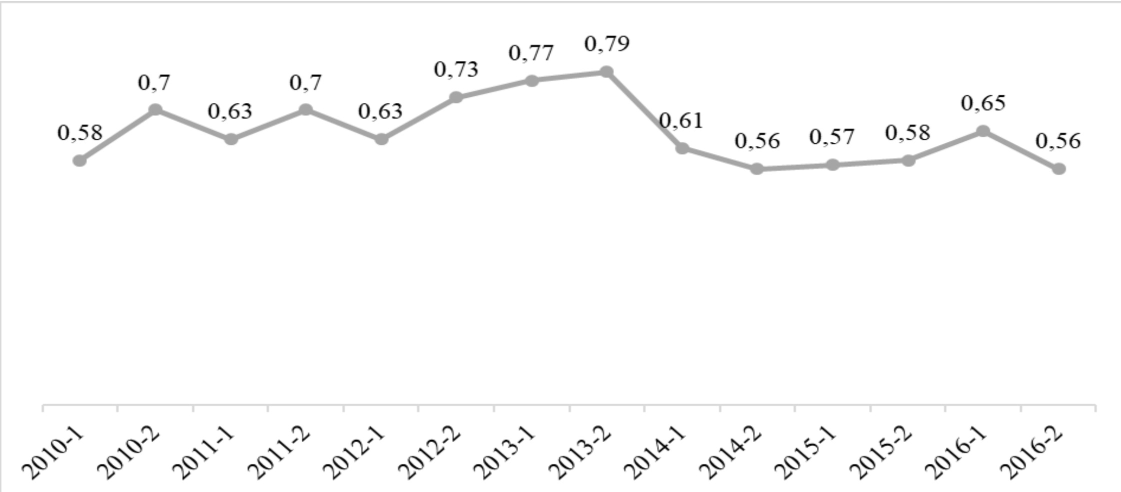
Graph 4. Evolution of the final averages in Calculation 1A - 2010/01 to 2016/02



Source: Authors

From Graph 4, it can be seen that the maximum final average was obtained in 2010/01, being 4.9. The minimum final average was observed in two moments: 2013/01 and 2013/02, which was 3.4 in both periods. It is important to note that in the analyzed period, the final average no longer reached the maximum value of 2010/01. There were only moments of approximation, which occurred in 2011/01 and 2012/01, with averages of 4.5 and 4.7, respectively. In terms of final average variation, the largest changes occurred from 2012/01 to 2013/02, being 1.3 points, and from 2010/01 to 2010/02, which was of 1.1 points. In general, it can be inferred that the performance of students has decreased over time, despite some periods of slight improvement in the average. Proof of this is that, from 2014/02 to 2016/01, that is, during four consecutive semesters, the average only declined, and only returned to show a slight growth in 2016/02, when it reached 4.0.

Graph 5. Evolution of the percentage of disapproval in Calculation 1A - 2010/01 to 2016/02



Source: Authors

Chart 5 shows that, for four consecutive periods from 2012/01 to 2013/02, the percentage of failed increased progressively, reaching an alarming 79% of failed. But after reaching this number, the percentage of failed declined, reaching, in the following two semesters, which are, 2014/01 and 2014/02, the following values: 61% and 56%. Soon after, from 2015/01 until 2016/01, the failed started to grow, but in a moderate way; and in 2016/02 decreased to 56%. In terms of final average variation, the largest differences occurred from 2013/02 to 2014/02, being 23 percentage points; from 2012/01 to 2013/02, by 16 percentage points; and from 2010/01 to 2010/02, by 12 percentage points. Therefore, it is important to say that, despite the variation around the growth of the percentage of failed in the discipline Calculus 1A in the period evaluated, the failed remained high, always above 56%.

In the foregoing, it is understood that the learning difficulties of Calculus 1A, which are revealed by the low average of the students in the discipline, as well as by the high failure rate in the same one, can have relation with several factors, among them, the breach of expectation by students and teachers. In general, students who have achieved good results in Mathematics when in basic education believe that Calculus would not be an obstacle to their learning. However, in higher education, they have this expectation frustrated, since the contents are more in depth, dense and complex. These involve more abstract ideas such as infinitesimal and boundary ideas and are based on a greater formality and conceptual systematization. In addition, these contents are developed on a background formed by algebraic manipulations, knowledge of geometry, functions, numerical sets, among others. On the other hand, teachers also create expectations regarding students' ability to understand explanations and construct their own mathematical knowledge (SILVA, 2011).

In this sense, it is necessary to recognize that the contents of Mathematics in basic education are elementary, based predominantly on algorithmic procedures. Barufi (1999) understands that at this stage of education, mathematical concepts are often worked in isolation or with a minor focus. Thus, there is no satisfactory development of logical-formal language, nor the structuring of mathematical knowledge.

At university, differently, “[...] mathematical organizations are global, result of the establishment of relations between mathematical contents and previously acquired knowledge, characterized by demonstrations and generalizations opposed to the pure practice of algorithmic procedures” (SILVA, 2011, p. 401). Therefore, it is believed that the difficulties in Calculus can also be related to the deficiency of knowledge of basic mathematics, which makes it difficult to understand more complex concepts in higher education.

According to Donel (2015), the learning of mathematics demands logical reasoning, abstraction, generalization and projection. However, students who present gaps from basic education also experience learning difficulties at graduation. And, at this juncture, the difficulties that are not overcome at the beginning of the course generate new problems that jeopardize the formation of the student. Some errors are persistent if not healed in time (CURY, 2007) and then can be regarded as "hits" by students, which is a serious problem.

However, students cannot be held liable for failure in CDI subjects, especially in Calculus 1A. This is because there are experiences that reveal that a differentiated performance of the teacher can contribute to the better student performance. Proof of this is that, according to a report published in the newspaper "Correio Brasiliense" on December 10, 2015, at the University of Brasília (UnB), Professor Ricardo Fragelli developed projects that value the student that stands out positively, and places him to help the students who face greater difficulties in the discipline. Differing from the traditional lectures, the result of these projects led to the approval of Calculus from 50% to 95% in UnB - Campus Gama.

In the same direction, Garzella (2013) affirms that the procedures and activities of teaching adopted by the teacher are an important aspect to be analyzed when it comes to teaching and learning process. According to the author, when an activity is chosen by the teacher, it must meet the objectives established for the course, adapting itself to the learning of the contents. The teacher, therefore, must strive to use appropriate resources that lead students to learn the content taught. She believed that,

> [...] what affects students based on the teacher's pedagogical practices is mainly based on the following aspects: first, if the class is organized step by step, in order to facilitate the students' understanding and, also, obeying the internal epistemological organization of the object of knowledge in question; second, if the teacher uses resources that support the explanation of the contents; and, finally, the demonstration by the teacher of his relation to the object of teaching, which is permeated by his mastery of content and his passion for this knowledge (GARZELLA, 2013, p. 96).

So, accordingly, the high reproof in Calculus 1A cannot be attributed only to the disinterest and difficulty of the student body. The role of the teacher is to teach, and if a great part of his student does not learn, and therefore is reproved, his actions must also be reviewed, analyzed. One cannot conform to a framework of mass disapproval in a discipline and understand this situation as natural because of the difficulty attributed to problematic content. This is a phenomenon that involves several variables that must be analyzed together.

Understanding that the lack of basic knowledge in Mathematics is a problem for success in CDI, some institutions propose courses that seek to remedy this gap and promote basic knowledge. However, Rezende (2003) warns that lack of base is not a specific problem of Calculus but reaches other disciplines and courses. The difference is that in other areas, the results of failure are not as worrisome.

But why is math so feared? And, why, even students who have opted for higher education courses that have the CDI as a fundamental curricular component - in this study, the courses of Environmental and Sanitary Engineering, Civil Engineering, Computer Engineering, Transport Engineering, Physical Engineering, Chemical Engineering, Physics (undergraduate and baccalaureate), Medical Physics, Geology, Mathematics (undergraduate and baccalaureate) and Chemistry (baccalaureate) - do not have such a satisfactory result?

In Fragoso's understanding (2001, p. 96), "[...] the teaching of mathematics has been traumatizing. Basic discipline in courses of all grades around the world, for various reasons it is considered difficult by many, uninteresting by others, even inaccessible to some. " Thus, it is believed that, first, it is necessary to break with the social and cultural representations that, historically, consider Mathematics, and as part of it, Calculus, as a hard, difficult, and painful area.

At UFG, in 2014, the Pro-Rectory of Graduate Studies (Prograd) presented alarming data about the failure in CDI, showing that, in that year, about 1,800 students were disapproved in the discipline. On that occasion, it was agreed that the IME would teach a Basic Mathematics course, with the purpose of getting students to overcome the learning gaps in the discipline, and thus to try to minimize reproof (ALVARENGA; DORR; VIEIRA, 2016).

In order to select the candidates for the course, a test was applied to evaluate which students really needed to do the same. 390 students enrolled, but only about 180 participated in the evaluation. Finally, approximately 150 students enrolled in the course, among those who participated in the evaluation or not. Considering the low demand, in the first semester of 2015 three classes of Basic Mathematics and one of Basic Mathematics Inclusive were offered. Therefore, as noted, the project did not reach the expected objectives, as the number of interested parties was extremely low, in comparison with the number of students failed in the discipline in the previous period; and, in addition, the failure rate in the course was also high (ALVARENGA; DORR; VIEIRA, 2016).

Specifically, in the IME/UFG, in 2016, two teachers offered attendance and extra classes to solve exercises for students who present difficulties. These same teachers are doing a collaborative work, so they prepare classes, exercises and exams together. In addition, they performed a diagnostic evaluation, and, from the identification of the fragilities of the students, offered a month of basic mathematics and monitoring for the students with greater difficulties. It is believed that this experience can have positive effects in terms of content learning. Therefore, your results will be evaluated in another research.

When talking about academic performance, one should not fail to reflect on the evaluation. What are the criteria used to evaluate student learning? If the student body of universities is increasingly heterogeneous, composed of students from different social strata, with differences in terms of schooling, access to culture, employment and income, how to assess their knowledge? Does a standardized assessment, usually made up of tests, performed on predetermined dates, take into account the singularities, ways and times of learning of each student?

When it comes to evaluation, one must be very careful because, according to Cruz and Monteiro (2013), the simplifying understanding of the evaluation processes ends up blaming only teachers and students for the low student performance. And, as far as students are concerned, there are arguments that seek to explain performance as something proper and natural to the subject, as a gift. There are also those who attribute the difficulty of learning at a distance from the school contents of students' lives. And, school failure is sometimes justified by the social and cultural inequalities of students and falls mainly on working students (CRUZ; MONTEIRO, 2013).

Agreeing with Luckesi (2013),

> If what we are presenting are results that are not being satisfactory, what is behind this lag? Many factors may be present, but one of them may be our evaluative practice. We may be using inadequate instruments to collect data on their performance, a factor that leads to misunderstandings about our students (LUCKESI, 2013, n/p).

It is therefore believed that it is necessary to review the evaluation criteria adopted by higher education teachers or, at least, to reflect on their effectiveness, considering the diversity of the public in a classroom. It is necessary, therefore, to go beyond the limits of summative evaluation, which focuses on numbers, on grades obtained, to classify students into good and bad, with strong background or without background, strong and weak, capable and incapable, hardworking or disinterested. The numbers, that is, the grades, are able to indicate whether the students have learned or not; to point out whether the teacher's mission, which is to teach, has been successfully or failed.

Luckesi (2013) argues that what matters to the school system, be it basic or higher education, is that the student learns and that, for that reason, is approved. In this perspective, Pavanello and Nogueira (2006) understand that the notes should serve as a strategy for the orientation of pedagogical practices, so that the errors are treated and serve as a route, guide to a practice that will overcome the difficulties manifested in numbers.

Final Considerations

Understanding the academic performance in Calculus 1A of the students of the regional Goiânia UFG becomes relevant to elucidate the problems that hinder the success of students. The academic community recognizes the high percentages of CDI disapproval and drop-outs. However, there are few detailed studies on data recorded in academic secretariats. And the intention of this research was to analyze, in fact, this much commented data.

The results of this study point out, beyond common sense, that the academic performance in the Calculus 1A discipline was unsatisfactory, given that, from the first half of 2010 to the second half of 2016, the failure rate was 65%, and the mean of the final averages in the discipline, in the same period, was only 4.1.

This fact points to the need to problematize, within the university, but above all, the IME/ UFG, the teaching and learning processes. In addition, it is fundamental to think about the proposition of educational actions that may change this picture of learning difficulty and, consequently, of failure in CDI. It is believed that new research must be carried out in order to understand the factors that interfere in students' knowledge construction. It is from the recognition of the factors that make learning difficult that one can look for alternatives of intervention and renewal of this process.

But, despite some studies aimed at identifying failure rates, especially in the exact disciplines, it is necessary to recognize that a culture is lacking in creating measures and instruments capable of minimizing reprobation; and, more than that, to lead students to learn the content taught, so that knowledge becomes meaningful. Therefore, continuous and effective actions are needed with the scope to minimize or reverse this poor performance framework.

Given this, it is recognized that it is necessary to overcome the phase of conformism and identify the causes of this failure in the teaching and learning process. In this sense, based on the identification of the numerical data that strip the reprogramming frame in Calculus 1A in the UFG, as part of the research project being developed in the IME, the purpose is to investigate the causes of this high reprobation, to then go to the proposition of actions in the sense of minimizing it.

This problem requires a lot of attention, since the consequences of this situation reflect in large investments in an attempt to encourage students not to give up and not to delay their courses too much, as this also causes several reflexes on self-esteem and invaluable personal consequences.

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