Plan de acción tutorial para evitar el plagio en materias de formación básica

Tutorial action plan to avoid plagiarism in basic training subjects

Plano de ação do tutorial para evitar o plágio em matérias básicas de treinamento

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Resumen

En el presente artículo se muestra el desarrollo de un Plan Tutorial que permitió identificar y proponer estrategias que ayuden a los estudiantes de una de las Unidades Académicas del Instituto Politécnico Nacional (IPN), a evitar que incurran en prácticas de plagio tanto de trabajos académicos como de la resolución de problemas y ejercicios de áreas de formación básica.

El estudio se apoya en el paradigma sociocrítico pues se tuvo como finalidad el que los estudiantes reflexionaran y tomaran conciencia de lo nocivo que es el incurrir en prácticas de plagio.

Se trabajó con 60 estudiantes quienes cursaban dos unidades de aprendizaje de formación básica (Cálculo Aplicado y Probabilidad y Estadística). Para la toma de decisiones en el desarrollo del plan de acción fue indispensable conocer el perfil de los estudiantes, mismo que se pudo identificar mediante la fase de diagnóstico.

Se muestran algunos otros factores que intervienen en la problemática considerada, factores de tipo epistemológico, social, demográfico, didáctico, entre otros. Se emplearon instrumentos metodológicos como lo es el cuestionario y la entrevista, para recopilar información que permitió realizar un análisis cuantitativo para determinar categorías que condujeron a la realización de un análisis cualitativo, llegando a la determinación de estrategias que son sugeridas a los estudiantes

como caminos que pueden seguir para dejar de realizar prácticas de plagio y formas que pueden ayudarles a mejorar su aprovechamiento académico en las asignaturas de matemáticas.

Palabras clave: Diagnostico, educación, estrategias, tutoría.

Abstract

The present article shows the development of a Tutorial Plan that identifies and proposes strategies to help the students of one of the Academic Units of the Instituto Politécnico Nacional (IPN), to prevent them from engaging in academic plagiarism practices as in solving problems and exercises. The study is based on the sociocritical paradigm, as it is intended that students reflect and understand how harmful it is to engage in plagiarism practices.

This study examined 60 students who attended two basic training learning units (Applied Calculus and Probability and Statistics). In order to make decisions in the development of the action plan, it was essential to know the profile of the students, which was identified through the diagnostic phase.

Some types of factors to be considered in the proposed problem are: epistemological, social, demographic, didactic, and others. A questionnaire and interview were used as methodological instruments, which gathered information that allowed for a quantitative analysis. This information determined categories that led to the discovery of a qualitative analysis, which allowed the proposition of plagiarism-ceasing strategies to students as well as ways that can help them improve their academic achievement in mathematics.

Keywords: Diagnosis, education, strategies, tutoring.

Resumo

O presente artigo mostra o desenvolvimento de um Plano Tutorial que permitiu identificar e propor estratégias que auxiliam os alunos de uma das Unidades Acadêmicas do Instituto Politécnico Nacional (IPN), para evitar que se envolvam em práticas de plágio de ambos os trabalhos acadêmicos e de resolver problemas e exercícios em áreas básicas de treinamento.

O estudo baseia-se no paradigma sociocrítico, uma vez que se pretendia que os alunos refletissem e percebessem como é nocivo o envolvimento em práticas de plágio.

Trabalhamos com 60 alunos que frequentaram duas unidades básicas de treinamento (Cálculo Aplicado e Probabilidade e Estatística). Para tomar decisões no desenvolvimento do plano de ação, era essencial conhecer o perfil dos alunos, que poderiam ser identificados através da fase de diagnóstico.

Alguns outros fatores que intervêm no problema considerado são mostrados, fatores epistemológicos, sociais, demográficos, didáticos, entre outros. Foram utilizados instrumentos metodológicos, como o questionário e a entrevista, para coletar informações que permitissem uma análise quantitativa para determinar categorias que levassem à realização de uma análise qualitativa, chegando à determinação de estratégias que são sugeridas aos alunos como formas de Eles podem continuar a parar de praticar o plágio e formas que possam ajudá-los a melhorar seu desempenho acadêmico em disciplinas de matemática.

Palavras-chave: Diagnóstico, educação, estratégias, tutoria.

Introduction

As a result of the actions carried out in the Training Diploma in Tutorial Competences that is taught at the National Polytechnic Institute (IPN), this article was prepared, which reports a Tutorial Action Plan, whose formulation involved stopping and reviewing the actions that a tutor is responsible to carry out.

The National Polytechnic Institute, through the Institutional Program of Tutorials (IPN, 2012), provides a personal and academic support to students, during their stay at both the middle and upper level, in order to provide support to have a better development and strengthening of their knowledge, skills and attitudes.

The Professional Training Model of the National Polytechnic Institute is the educational reference for the operation of the Institutional Tutoring Program. Therefore, tutoring is aimed at developing students' competences, concerning the conceptual, procedural and attitudinal knowledge of the students, in such a way that it contributes to the construction of their capacities so that they can transform their reality. (IPN, 2004).

The general objective of the Institutional Tutoring Program is:

> *Organize the accompaniment process of personal and academic students to contribute to their comprehensive training during their school career, aimed at strengthening both the learning and the development of values, attitudes, habits and skills, while improving the teaching practice.''* (Programa Institucional de Tutorías [PIT], 2016 p.5).

The tutorial is defined by several authors as an activity that the teacher performs to accompany the student in their academic development. According to Grañedas y Parra (2008, p.211), tutoring is the guiding action carried out by the tutor and teachers, which can be carried out individually or in groups, refers to the instructional-academic and non-academic . Its field of action, according to Garduño (2012, p.4) and Ordóñez, Ibeth and Ocampo (2005, p.38), is related to academic and professional orientation, the various preventive programs and personal development. And social.

The tutoring takes place inside or outside the classroom and is an integrative and collaborative activity, since it includes the family, other teachers, school directors and support staff (Santaolalla, 1996).

Álvarez and Bisquerra (2005, p.89), and for their part Lara (2008, p.34), consider tutoring as a guiding support that the teacher-tutor provides, in addition to his teaching, to overcome both academic as the staff of your students. Pantoja, Campo y Cañas (2003, p.88), comment that the tutorial action takes into account not only aspects that allow the student to overcome their academic performance, but also the tutor must perform actions so that the students develop study and study habits. job.

González and Vélaz de Medrano (2014) quote Fernández:

> *The tutor is the person who, within the school community, encompasses and is responsible for guiding the evolution of the student in terms of their learning and personal evolution, serving as a channel for the interventions of the people involved in the education of the students, with some functions that are his own.* (p. 37).

In the definitions given by these authors, it is observed that the purpose of tutoring is to facilitate the teaching-learning processes of the students and contribute to their personal, professional and social development.

A tutorial action plan is organized in several phases. In this regard, Monge (2009, p.315), points out that planning has four phases:

- Diagnosis (where the rationale is developed).
- Design (specification of what was diagnosed and how it will be done).
- Development (produces and operates the program).
- Evaluation.

The execution of each of the aforementioned phases is what gave life to the Tutorial Action Plan that is described throughout this article, which addressed the problem of plagiarism in which some students who attend the higher level, at copy both the procedures for solving exercises and math problems of books that already contain the solutions, as well as research articles; in order to prevent these practices through the formulation and implementation of strategies that help the student to become aware of the harmful aspect of such practices.

It was chosen to address this problem because it has been observed that some students who are studying their careers in one of the Academic Units of the National Polytechnic Institute (IPN), copy from the solutionaries that appear on the Internet, the process of problem solving and exercises that they are left by the teachers, mainly from the Learning Units of basic training, so it was considered important and urgent to work in this situation.

The purpose of the proposed actions was to help the student become aware of the importance of the fact that he will not achieve something positive for his training by doing plagiarism practices and the repercussion that this has on his low achievement in math subjects, such as the case of the Learning Unit of Applied Calculus and Probability and Statistics, which are taught in the second and third semesters, respectively, of the Computer Systems Engineering career at the Higher School of Computing of the National Polytechnic Institute (ECOM-IPN)).

Delimitation of the problem

Plagiarization of students' tasks with respect to the solucionarios of textbooks, and bibliographical sources related to the research being developed, the objective that was raised was:

General purpose

Propose strategies that allow the student to become aware of the fact that plagiarism of information is a serious problem that causes adverse situations in the person's life and that is one of the causes of having low school performance.

Specific objectives

- Identify the causes for which students engage in plagiarism practices and their repercussion in a bad use.
- Implement strategies to interest students in solving exercises and problems of the different math subjects.
- Implement evaluation strategies for some math subjects.
- Carry out an assessment of the usefulness of the strategies carried out.

The scope of the objectives depends on the activities that are planned and carried out in the established time, as well as the human and material resources that are available.

We worked with a sample of 60 students who were studying the Applied Calculus and Probability and Statistics learning units (UA) during the 2017/2 school year. (Enero-Junio de 2017).

Diagnosis and situational analysis

Youth is not only a biological stage of the human being but a culturally constructed category, and product of the economic, social and political situation that the country has lived (Luengo, 1996 and Reguillo, 2003). Also Reguillo (2003) comments that the elements that give meaning and specificity to the youthful world are:

1) Technology and its repercussions on the productive organization of society.

2) Cultural supply and consumption and,

3) Legal discourse.

The social context in which the young students of the Higher School of Computing (ESCOM of the IPN) are immersed where the study was developed, strongly influences their academic performance and their way of behaving.

Fortunately ESCOM has students who are mostly respectful, and with certain values, which unfortunately have been lost in the youth of this era.

The socio-economic level of most young people is low and medium, which affects academic performance, such as the fact that they live far from school (in part because rents are cheaper in certain areas), but that distance affects as they arrive at school tired and worn out, which causes a decline in their performance. On the other hand, due to the lack of resources, many of the students need to work to cover part of their expenses, which reduces the time they could spend to fulfill their duties at school.

In the case of Mathematics, the concepts to be developed are many and of a high degree of abstraction, so that both the exercises and the problems allow to put into practice the theoretical part, which gives the student the possibility of constructing said concepts.

Taking into account that the training of the engineer demands a considerable learning of mathematics that contributes to solving problems of different order, both scientific, technological and above all practical. The mathematics that an engineer needs must provide tools and instruments capable of achieving optimization in the use of the resources that humanity possesses and requires for its development (Ruiz y Gutiérrez, 2017a).

The Calculus gives engineers the necessary knowledge and knowledge that allows them to solve and model practical problems, which include mathematical functions with real variables. The way in which the Calculus learning unit is addressed at the university level should contribute to the student having a reflexive and critical learning.

In education, didactic resources mediated by technology are an option to support the development of teaching and learning processes. The use of these technologies has led to work in environments beyond face-to-face, and today we have multimodal, combined or mixed environments (B-learning, of English Blended Learning), digital online on the Internet (E- Learning, of English Electronic Learning) and, of mobile learning (M-Learning, of English Mobile Learning). (Ruiz and García, 2017b).

Because in this age students have the need to belong to a group, and identify with their peers, it is important that they are oriented to join a club or workshop offered by the school as chess, or robotics , sports or dance activities.

The ESCOM teachers of the IPN, have identified, in a general way, the following characteristics that predominate in the students:

- The young students form groups based on their personal interests where they identify with each other, but the first semester students show apathy attitudes to be integrated into the different groups of the school.
- As of the second semester, in general, students are participatory and have an interest in collaborating in activities that are not part of their academic program.
- • For the most part, they are respectful, responsible and disciplined, although there are also those who are not.
- 80% of students have a smart cell phone
- About 50% of students use the cell phone as an agenda and for academic activities. The other 50% acknowledge that cell phone use only distracts them in their academic activities.
- Some of the students are incorporating the use of their cell phone for academic benefit, but many of them use it to connect to social networks at inappropriate times provoking distractions in their academic life.
- Students come from families with low and medium purchasing power.
- By relying on all the information found on their mobile devices, they do not want to resort to their memory to remember data.
- The vertiginous change in technology causes young people to conflict in order to make decisions. Young people are becoming impatient because they get everything quickly through their cell phone.
- Young people have conflict of concepts of values and in the handling of emotions.
- There are students with different family and diversity models and interpretation of values.

In relation to technology there are several factors that benefit him but also hurt him when the young

person makes inappropriate use of it, such as the fact that he is now immersed in a world of information, to which he has easy access through his cell phone, or from any mobile device, but poor use is causing conflicting situations, ranging from encouraging bad habits that then become serious faults. Such is the case of plagiarism of information, which begins with the copying and pasting of paragraphs of texts to accomplish a task, but that eventually makes the student useless since it makes him unable to write reports, reports or tasks entrusted to his work and what say write your thesis to graduate. These conflicts confuse him to the degree of considering it easy to impersonate someone he is not, and use some of the social networks to show a false identity.

Another big problem is that many of the students no longer solve the exercises, problems and tasks that the teachers leave, instead they search the Internet for the solucionarios of the books that are used in class and from there they copy the processes of solving the problems , but copying them does not mean solving them, so there is no process of reflection on the part of the student and with this type of actions he is unable to construct the concepts of the areas that are required for his learning.

Materials and methods

The method used to carry out the study was the so-called research-action method.

Bisquerra (2009, p.379) points out that a specific feature of the method is to develop an action plan to improve the practice or established purpose. "The intention is to achieve an improvement in congruence with the educational values expressed in the action."

The research was carried out by the concern that arises from reviewing the reason why higher level students copy the solution processes of the solvers of the books that are on the Internet, as well as articles that download from the network .

The research-action method is based on the socio-critical paradigm that has the purpose of transforming the structure of social relations and its principles, according to Bisquerra (2009, page 382), they are:

1. Understand and know the reality of the practice in the classroom.
2. Unite theory and practice (knowledge, action and values).
3. Involve the teacher based on self-reflection.
4. The educator is the agent of socio-educational change and the student is the subject involved in their own process of educational change.
5. 3 types of built knowledge are handled:
   - Education as a social construction
   - Dialectic and subjectivity.
   - Construction of new educational realities and innovations.

Study design

To know more about this problem, we interviewed 5 teachers who taught a subject of mathematics and then a questionnaire was applied to 60 students of ESCOM, 50% of them were studying the subject of Applied Calculus and the other 50% of students They studied the subject of Probability and Statistics, corresponding to the second and third semesters respectively, of the Computer Systems Engineering degree.

The 5 professors who were interviewed were teachers who voluntarily wanted to participate. Four of them are full-time professors and one part-time professors. Of the full-time teachers 2, they have been teaching at the institution for 15 years and the remaining 3 have been teaching 10, 8 and 5 years of different learning units in the area of basic education (Mathematics and Physics).

In relation to the 60 students in the sample, they were divided into two groups, a division carried out randomly by the school and assigned to a teacher who teaches at the institution. In one group the subject of Applied Calculus was taught and in the second group the subject of Probability and Statistics.

From the interviews, the following was found:
An activity that several professors perform in their engineering groups is to ask the students to solve problems of the topics that are addressed in class. In such a way that they leave lists of exercises to solve them. Some professors have noticed that in the network are the solucionarios of

the exercises of the textbooks that they use. What many students do is copy the process of solving the problems. This is a bad practice in which students are incurring, which leads them to not develop the skills and abilities required as part of their training. On the other hand, when they are left with a research paper, many download information from articles on the network and make a copy at the foot of the letter of that information, they are not making an analytical and reflective reading, so they are not developing certain skills required in their training.

To investigate more about the situations of plagiarism in which the student community of ESCOM is incurring, a questionnaire was designed and applied, which is in table 1. Its application was carried out in the following way: of the course the students were asked to answer a questionnaire where the information they gave would be anonymous and would only serve the purpose of a research work in which their names are not included, so they are not asked to write them down. But if it is required that they be as truthful as possible.

First, a quantitative analysis was carried out to have a first approximation to the results given by the students. The percentages of the answers are shown in table 1.

Table 1. Cuestionario para alumnos con la finalidad de identificar las causas por las que incurren en la realización de prácticas de plagio

Pregunta con opciones de respuesta	Porcentaje de respuestas
1.- ¿Tus maestros de Matemáticas te dejan como tarea resolver ejercicios y problemas? a) Siempre b) Casi siempre c) Algunas veces d) Nunca	Al 100% les dejan de tarea resolver ejercicios y problemas.
2. ¿Resuelves los ejercicios de tarea? a) Siempre b) Casi siempre c) Algunas veces d) Nunca	Setenta por ciento resuelve siempre los ejercicios de tarea. Treinta por ciento la resuelve casi siempre.
3. Por qué motivos haces la tarea de los ejercicios y problemas a) Por compromiso de que no te bajen puntos. b) Porque te ayuda a estudiar. c) Porque quieres practicar lo aprendido.	Veinticinco por ciento hace la tarea de los ejercicios y problemas porque lo ayuda a estudiar. porciento porque quiere practicar lo aprendido Cincuenta por ciento para que no le bajen puntos.
4. Cuando no puedes resolver algún ejercicio qué haces a) Reviso algún libro para estudiar el tema b) Busco en internet la solución c) Le pregunto a algún compañero	Setenta por ciento busca en internet la solución. Veinte por ciento revisa en algún libro Diez por ciento le pregunta a algún compañero
5. ¿Tus maestros revisan los ejercicios y problemas de las tareas? a) Siempre b) Casi siempre c) Algunas veces d) Nunca	Treinta por ciento de los estudiantes le revisan los ejercicios de tarea algunas veces. Al setenta por ciento no le revisan los ejercicios de tarea.

6. ¿Tus maestros preguntan sobre las dudas que tuviste al resolver los ejercicios de las tareas? a) Siempre b) Casi siempre c) Algunas veces d) Nunca	Al 50% les resuelven las dudas de los ejercicios de tarea Al 50% % no les resuelven las dudas de los ejercicios de tarea.
7. ¿Te han dejado trabajos como resúmenes o ensayos de algún artículo de revista o de algún libro? Si No	Al 70 % le han dejado resúmenes o ensayos. Al 30% no es dejan ensayos o resúmenes.
8. Para elaborar el resumen o el ensayo qué haces: a) Lees todo el artículo y redactas con tus palabras de qué trató b) Lees todo el artículo y copias fragmentos del artículo c) Lees partes del artículo y copias fragmentos de éste.	Cincuenta por ciento lee partes del artículo y copia fragmentos. Treinta por ciento lee todo el artículo y copia fragmentos. Veinte por ciento lee todo el artículo y redacta con sus palabras.
9. Cuando te ha tocado exponer algún artículo en tus clases, qué haces: a) Lees el artículo y lo que entiendes lo explicas. b) Te aprendes de memoria algunos párrafos para presentarlos. c) Lees en la presentación algunas partes del artículo.	Cincuenta por ciento lee la presentación algunas partes del artículo. Cuarenta por ciento se aprende de memoria párrafos para presentarlos. Diez por ciento lee todo el artículo y explica lo que entendió.
10. ¿Por qué crees que algunos estudiantes copian la tarea ya sea los ejercicios o los resúmenes o ensayos? a) Por falta de tiempo. b) Por falta de interés. c) Porque no han entendido lo trabajado en clase.	Setenta por ciento copia los ejercicios y problemas de tarea porque no ha comprendido lo que se vio en clase. Veinte por ciento copia los ejercicios y problemas de tarea por falta de interés. Diez por ciento copia los ejercicios de tarea por falta de tiempo.

Fuente: Creación propia

Results and Analysis

One hundred percent of the students in the sample must solve exercises and problems as part of the tasks left to them by their professors who teach the different mathematics subjects, such as Calculus, Applied Calculus, Probability and Statistics, Differential Equations, Linear Algebra, Discrete Mathematics , which are the learning units (UA) that are taught in the ESCOM of the IPN. A quarter of the students in the sample consider that solving the task helps them to study for the exam and another quarter of the sample considers that it allows them to practice what they learned, but half of the sample of the students mentioned that they solve the task exercises so that they do not lose points.

The total number of students in the sample recognizes that they can not solve any task, so 70% search the internet for the solution, 20% review the procedures in books to solve the exercises left and 10% ask a question friend.

It is also known that 70% of the students do not have their homework reviewed and half of the students in the sample do not resolve the doubts they have had in the resolution of the homework exercises, which implies that the students they may lose interest in carrying out the exercises, in case they do them to comply with the total points that are part of the evaluation, which makes them look for solutions on the internet since the procedures to solve the problems are not explained.

70% of students in the sample are left with homework summaries or essays in the basic training area and for its preparation more than 50% read parts of the article and copy fragments of it. Which implies that they do not have the habit of reading and are used to copying and not to analyze.

The students of the sample pointed out that they do not understand the topics studied in class and that it is one of the reasons why students copy the processes of problem solving and exercises that they leave homework.

When analyzing the results, it was found that many students are accustomed to copying both solution processes and paragraphs of articles and using more memory than other cognitive processes, such as reasoning or analysis. Previously in a study reported by Ruiz and Gutiérrez

(2017a), found that about 50% of students from the same academic institution (ESCOM-IPN), studied for the exam and not so much to learn, in addition to lacking habits of study.

There are several factors that are influencing students to consider better option to copy than to write or solve problems for them, but the main factor is that students do not find interest in solving the exercises because they do not understand what is seen in class and how teachers do not review the task or solve doubts, they decide to have the points for their evaluation without making the minimum effort. Students despair easily and want to see results immediately, and given that the Internet currently provides a lot of information and quickly, students who lack study habits prefer to take this option and leave aside the effort to study.

In this current world in which we live as teachers, students should be made aware of the importance of developing different cognitive processes and the relationship they have with their growth as people, who will soon be inserted into the working world.

This problem must be addressed by formulating and carrying out different strategies and actions, through a tutorial action plan.

To achieve the corresponding objective to avoid the plagiarism of tasks between the students and of the solucionarios of the text books that are in Internet. As well as the plagiarism of articles found in the network for research tasks, several strategies are proposed, which are found in Table 2, with their respective material and human resources:

Tabla 2. Plan de Acción tutorial

Problemáticas	Objetivos	Estrategias	Recursos humanos	Recursos materiales
Los estudiantes plagian la tarea y/o trabajos de investigación que se les solicita.	Disminuir la práctica de plagio en el semestre 17/2 en los estudiantes, mediante acciones que se lleven a cabo en el salón de clases y con los tutorados.	1. Realizar en clase lecturas de artículos científicos y solicitar a los estudiantes que en forma verbal expresen las ideas que consideran importantes.	- Docentes - Alumnos	- Artículos de revistas científicas
		2. Elaborar algún gráfico como un mapa conceptual que permita contener las ideas principales y su conexión entre ellas.	- Docentes - Alumnos	- Software para elaborar el gráfico. - Cuaderno para escribir.
		3. Elaborar un resumen de 1 o 2 cuartillas, extrayendo la información del mapa conceptual, no del artículo, (para no dar oportunidad a que copie y pegue párrafos íntegros).	Docentes y alumnos	- Cuaderno del alumno.
		4. Solicitar que el estudiante lea el resumen realizado y que de un opinión sobre el artículo. Pedir al grupo escuchar la lectura dada por su compañero y que formule preguntas y/o sugerencias, con la finalidad de mejorar el resumen elaborado por el compañero.	- Docentes y alumnos	- Pizarra. - Cuaderno del alumno.
		5. Si se pide un trabajo de investigación por parte del maestro, sería conveniente que el alumno lo vaya construyendo a lo largo de un periodo de tiempo, de tal forma que le permita hacer entregas parciales, las cuales el profesor va revisando (puede hacerlo empleando un software anti plagio para determinar si hay plagio y en qué porcentaje). Las entregas parciales de un trabajo de investigación le permiten al profesor no saturarse de trabajo al final de un semestre y poder revisar con calma lo que el estudiante le está entregando, además de hacer una retroalimentación al estudiante. De esta forma el estudiante está cociente de que el profesor lee el trabajo y no es tan fácil copiar textos íntegros sin citarlos.	- Docentes y alumnos.	- Software antiplagio.
		6. En el caso de que se les deje a los alumnos listas de problemas a resolver. Pedirles que pasen a resolver y explicar al grupo algunos de los problemas que se dejaron. El maestro o los mismos compañeros de grupo pueden formular	- Docentes y alumnos.	- Libros de texto.

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		preguntas en relación al proceso de solución mostrado por el alumno. De esta forma, en caso de que el estudiante haya copiado el procedimiento de solución sin haber entendido lo que copió, no va a poder explicarlo al grupo y será evidente de que la tarea que resolvió bien, fue copiada y no resuelta por él, por lo que se verá en la necesidad de estudiar en libros o en sus apuntes.		
		7.Como se encuentran en la carrera de Ingeniería en Sistemas Computacionales, solicitar al estudiante que anime alguno de los problemas que se dejaron de tarea, haciéndolo interactivo mediante la programación. El maestro debe fungir como guía en esta actividad.		
		8. Solicitar al estudiante documentar por escrito las dificultades que tiene en el proceso de aprendizaje de algún concepto matemático, revisar literatura especializada y realizar una propuesta didáctica que incluya tecnología que ayude a la comprensión de dicho concepto. El maestro será guía en la actividad a desarrollar por los alumnos.		
Alto índice de reprobación en el área de formación básica. Principalmente	*Proponer estrategias para la evaluación en materias de formación básica*	1. Identificar los diferentes factores que están influyendo para que el estudiante no obtenga una calificación aprobatoria del curso. - Falta a clases. - Falta de concentración en las clases.	Docente, maestro tutor, alumno y Padres de Familia	Lista de asistencia. Aula, Pizarra
		- No cumple con las tareas. - No participa en clase.	Docente tutor, alumno.	Lista de concentración de calificaciones. Tareas.
		- No toma asesorías. - No cuenta con los conocimientos previos necesarios para abordar los temas de clase.	Docente tutor, alumno.	Programa de estudios Actividades a resolver.
		- Falta de práctica resolviendo ejercicios y actividades de los temas de la materia.	Docente y alumno.	Libros de texto. Actividades, ejercicios
		2. Revisar los motivos por los cuales se presentan los factores antes expuestos. Para ello se puede platicar con el estudiante y el profesor	Docente tutor y alumno.	

		que imparte el curso.		
		3. Proponer soluciones para atacar cada factor expuesto. -Indagar el motivo por el cual está faltando a clases, si es por problemas familiares, económicos, o porque no se logra despertar temprano, o porque no le gusta cómo el profesor imparte la clase.	Padres de familia, maestro tutor, docente y alumno.	Medios de comunicación.
		-Que el maestro preste atención en el estudiante que tiene evaluaciones muy bajas, para ver si dicho estudiante muestra alguna discapacidad, ya sea visual o auditiva o si se distrae con cualquier cosa. -Que el maestro se interese más en sus estudiantes y les pregunte de forma directa por qué no están entregando las tareas y dependiendo de las respuestas que tome alguna medida.	Docente y alumno.	Lista de calificaciones. Medios de comunicación.
		-Invitarlo a tomar asesorías, hablar con su maestro tutor individual o incluirlo en el grupo de tutoría.	Docente, maestro tutor, alumno.	Lista de calificaciones y de asistencia.
		-Diseñar un sistema interactivo cuyos contenidos abarquen las Unidades de Aprendizaje del Nivel Medio Superior (Álgebra, Geometría, Trigonometría, Geometría Analítica, Cálculo Diferencia y Cálculo Integral), que incluyen los conocimientos previos requeridos por el estudiante para cursar las materias de nivel Superior. Este sistema el alumno lo puede emplear en su casa y con ello repasar los temas que no haya entendido y que son indispensables para continuar con las materias de Matemáticas.	Docente, maestro tutor y alumno. Docente, alumno, alumno de servicio social, alumno BEIFI.	Aula. Libro de texto. Actividades. Programa de estudios. Computadora. Lenguajes de programación.
		4. Acompañar al estudiante en su trabajo académico.	Maestro tutor, docente, alumno.	

Fuente: Creación propia

For the execution of some of the strategies proposed in the tutorial action plan presented in Table

2, the following describes the actions that were used to carry them out, for which a sample of 60 students was taken, of which 30 students were studying the Applied Calculus Learning Unit (UA) and 30 the Probability and Statistics Unit, corresponding to second and third semesters, respectively.

Below is a description of the way in which some of the strategies were worked on with the sample of the 60 students, which were divided into 2 groups, 1 Applied Calculus group and one of Probability and Statistics:

Once the instruments were applied that allowed to determine the diagnosis of the groups, where it was found that several students have failed between 1 and 2 subjects, that they lack study habits and that they copy from the textbook solvers, the procedures of the problems and exercises that are left of homework. The strategies mentioned in Table 2 were put into practice.

Counseling strategy

The students were informed that in order to do the task they had to solve the problems because they would have to go to the blackboard not only to solve the exercises but also to explain the procedures used. They were told that they could take advice to reaffirm their knowledge and that in these consultancies the different doubts they had would be solved.

In this way, in the sessions in which exercises or problems were left to be solved, the students went to the blackboard and solved the problems explaining to the group the way to solve them. In this way the classes were more dynamic and more students came to counseling outside of class time.

On the other hand, when a topic was initiated, students were asked to read about it so they could remember the concepts worked in the first semester (with the UA of Calculus) and on several occasions mental maps were constructed with the information they had.

More than half of the group attended counseling during the semester 2017/2.

All the students of the groups went on to solve several problems of the ones left of homework and explained how they had solved them.

Strategy: encourage some problems through programming.
They were also asked to meet in teams of 4 members to develop a research project throughout the semester. They were asked to read some articles on the learning difficulties that students have when dealing with different topics of Calculus and Probability and Statistics, other readings were aimed at reviewing aspects of the usefulness of certain mathematical knowledge and mathematical modeling.

Below are some of the animations and interactive that students developed.

Figure 1 shows the interactive interface of a problem of the optimization theme that was solved in class. The problem asked to determine the dimensions of a box that had the largest volume which was built with a cardboard rectangle 28 cm long and 21 cm wide.

The team used different registers to represent the information. Through the tabular register he constructed a table, identifying the dimensions of the box (length, width and height) recognizing that the independent variable is the height and giving it values to obtain the different volumes. Parallel to the tabular register, the figure of the box was shown, according to the different values of the dimensions, as well as the graphic register, through which the graphic expression of the function was constructed.

The students of the team programmed the interactive and explained the logic followed in the programming, as well as recognized the need to understand both the approach and the process of solving the problems.

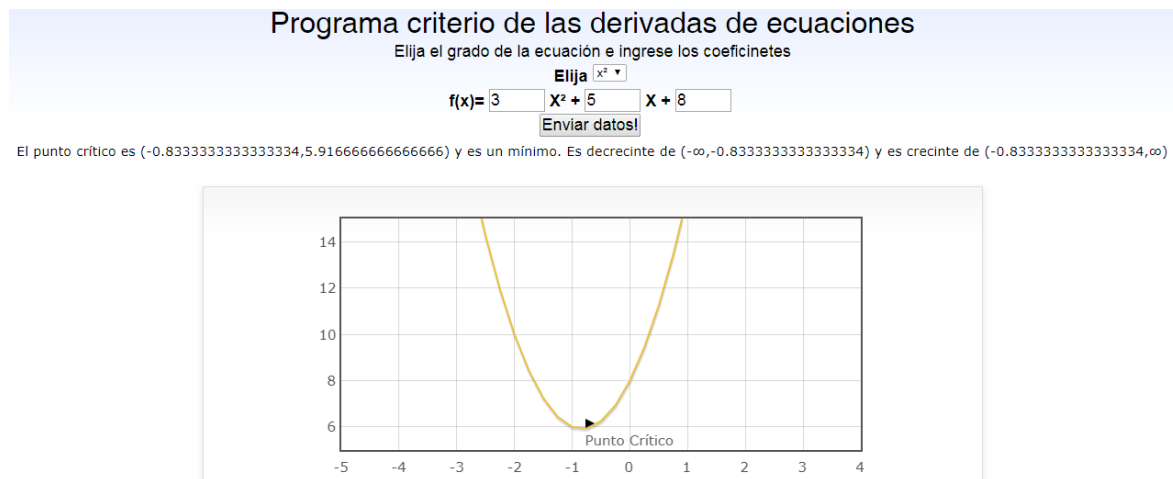**Figura 1.** Interfaz del interactivo del problema sobre la obtención del máximo volumen de una caja.

Se desea conocer el mayor volumen de una caja sin tapa usando una lámina de 28cm x 21cm
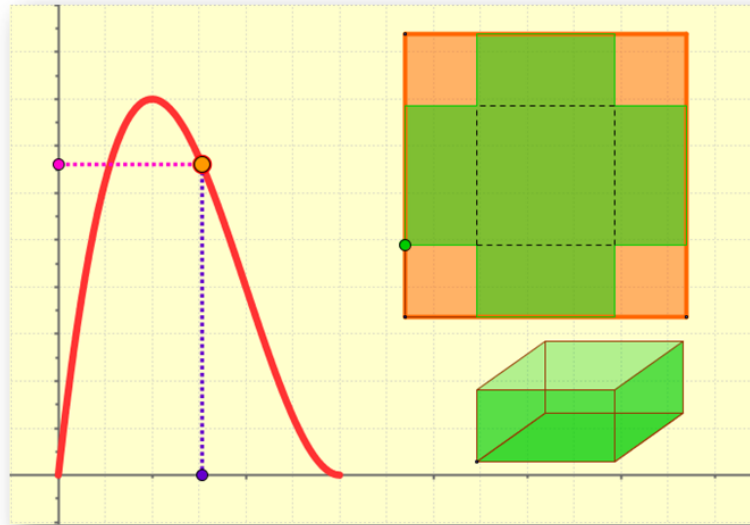
Fuente: Creación propia

Another team developed a program that calculates the maximum, minimum points, as well as the intervals where the function is increasing or decreasing. In the same way, they explained step by step the logic of the program, expressing the importance of analyzing the content of the problems in order to understand their purpose and how they should be resolved. Figure 2 shows the interface of this program.

Figura 2. Interfaz del programa que calcula puntos críticos e intervalos de crecimiento.

Programa criterio de las derivadas de ecuaciones

Elija el grado de la ecuación e ingrese los coeficinetes

Elija x^2

f(x)= 3 X^2 + 5   X + 8

Enviar datos!

El punto crítico es (-0.8333333333333334,5.916666666666666) y es un mínimo. Es decrecinte de (-∞,-0.8333333333333334) y es crecinte de (-0.8333333333333334,∞)

Fuente: Creación propia

Strategy: Didactic proposal

Another of the strategies that was carried out to interest students in the resolution of exercises and problems of the different subjects of mathematics was to request that the team pose a situation in which they detected the lack of understanding of concepts worked in mathematics, as the derivative, limit or integral of a function, to name a few, and to review specialized literature on educational mathematics, whether articles or theses in which these situations have been addressed and the didactic proposals made. They were asked to document in writing the difficulties they have had in learning these concepts and to elaborate a didactic proposal using technology since they are very accustomed to using it mainly because they are in the Computer Systems Engineering career and have a great taste for programming and software design.

They were informed about the organization of the research work, which should have an introduction, background, delimitation of the problem, objectives, methodology, results, analysis and conclusions.

They were also told that they could not copy fragments of the articles because anti-plagiarism software would be used, so they had to read and write what they had understood. In addition, it was necessary to understand what they read to write the information of their research work.

They used as a strategy, underlining statements in the articles and formulating conceptual maps. Advances were periodically reviewed and teams were asked to come forward and explain the articles they had read which would serve as a theoretical framework for their work.

Finally, each team presented their research work through an exhibition in front of the group.

It is important to point out that one of the works developed by two students from the Probability and Statistics group was articulated as an article, which was presented at the XVIII International Symposium: "Contributions from universities to teaching, research, technology and the development ", carried out the days, 13, 14 and 15 of November of 2017, in the building of the Superior School of Chemistry (ESIQIE-IPN).

The article title is: "Implementation of a software tool as an auxiliary in the learning of Venn diagrams".

Resources

To carry out the proposed strategies, the resources that are required are listed in Table 3.

Tabla 3. Recursos humanos y materiales

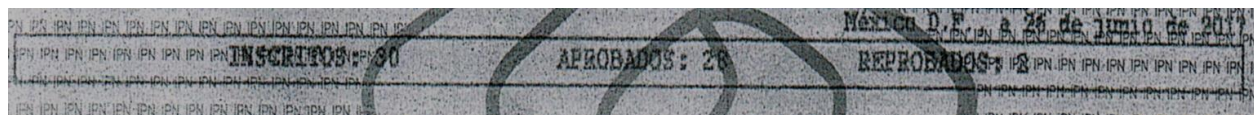| Recursos humanos	Recursos materiales
Subdirector Académico. Jefa del departamento de Ciencias Básicas. Docentes que impartes materias de matemáticas. Estudiantes. Estudiantes de servicio social.	Programa de Estudios de materias correspondientes a Formación Básica en el Nivel Medio Superior. Programa de Estudios de materias correspondientes a Formación Básica en el Nivel Superior. Libros de texto. Computadoras. Los programas en los que se hará el Sistema Computacional. Revistas científicas

Fuente: Creación propia

Evaluation

The work was carried out during the semester 2017/2 and at the end of the semester a lot of improvement was obtained in the students.

Of the 60 students, only 1 student did not pass the subject of Applied Calculus, that is, 96.6% passed the UA of Applied Calculus and 93.3% of the students of Probability and Statistics approved the subject. The average obtained was 7.76 in Applied Calculus and 8.4 in Probability and Statistics.

See figures 3 and 4, where only the final part of the report cards are presented, which contain the number of students enrolled in each group, the number of passed and failed, as well as the date of conclusion of the semester.
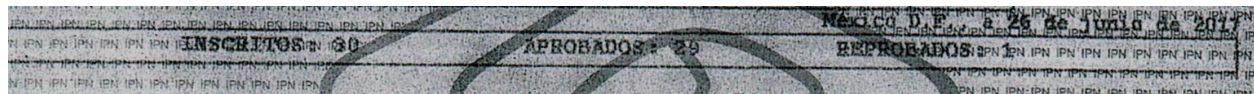
Figura 3. Parte final del acta de calificaciones del grupo de Probabilidad y Estadística.

Fuente: Acta de Calificaciones oficial (IPN)

Figura 4. Parte final del acta de calificaciones del grupo de Cálculo Aplicado.

Fuente: Acta de Calificaciones oficial (IPN)

A more qualitative evaluation can say that the students managed to find pleasure in the subjects, as well as to solve problems, seeing them as challenges that are achievable to solve.

Indicators for monitoring and evaluation of the program

The following are presented as indicators for the evaluation of the tutorial action program:

- Explanation by students of problems and exercises left homework.

- Construction of mental and conceptual maps of mathematical theory.

- Construction of mental and conceptual maps of the content of articles in scientific journals

- Drafting of the different aspects of the research work.

- Programming to give animation to some mathematical problems left of homework or seen in class.

- Exhibition in the group of the research works developed by the students.

Conclusions and Future work

It is essential that as tutors we know the various services that ESCOM has to inform the students, pretending that it helps them to have an integral development.

It requires the participation of some school officials, as well as teachers and the students themselves.

In relation to the officials, it is necessary that the Academic Deputy Director provide information on the percentages of students who have more than one failed subject in the Basic Training area.

Teachers who teach basic science subjects should be sensitized to the problem of high failure rates.

Once the system has been built, it will contain digital material for students to review the topics they have not understood and in which they show deficiency. It is required that the President of the Academy, the head of the Basic Training Department and the teachers who teach a Mathematics Learning Unit, know this system and use it with their students.

It is important that as teachers we find a way to stimulate in young people the desire to learn and know. It is important to tear down the barriers or conceptual barriers that have to do with teaching in the classroom. In this way the teaching challenge currently is to generate an education where the

main thing is the desire to know, which can be done largely with what was learned in school. Therefore, it is necessary: 1) to carry out more studies on the dynamics of the teaching process in the classroom and 2) to have access to courses focused on obtaining the necessary tools to establish an effective communication with the young students.

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