Analysis of the Academic Performance of the Students of Mechanical and Electrical Engineering of the UNTELS

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***Abstract*—In the National Technological University of South Lima (UNTELS) there is a low percentage of graduates in relation to the number of entrants of the Professional School of Mechanical and Electrical Engineering. Therefore, it is proposed to focus on the academic development of students in each course taken throughout in their undergraduate studies; in the desire to provide recommendations and additional strategies to the student, which will allow him to be better prepared to improve his performance. For this, the collection and analysis of the total number of students enrolled, approved and disapproved of each course belonging to the curriculum of the career, from the 2007-I period to the 2016-II period. From the results obtained, the maximum percentages of disapproval were obtained, resulting that the Engineering Programming course, belonging to the third cycle, registered 75% of disapproval in the period 2014-II.**

Keywords—Disapproval rate, programming, higher education, strategies, engineering.

I. INTRODUCTION

Failure at the higher education level also results in report and desertion. The decrease in student failure rates is the task that demands the participation of all the actors involved in the different levels of the educational community.

The causes of student underperformance are related to difficulty in machine learning, scar basic knowledge about science; as well as the constant practice of a rote learning [1]. The low academic performance of the student reflects a situation that is transmitted throughout the student community: students, parents, teachers and consequently to the whole community.

This situation in the medium term tends to cause the desertion of university students, because when disapproving a subject they must stop taking other courses due to the maximum number of credits that can be taken in each academic cycle, or because the disapproved course is a prerequisite for a later course or due to the presentation of schedule crossings. Student dropout rates are an indicator of low quality, as well as a sense that the university did not do what was necessary for students to complete their career [2].

In view of this, it is important that students use particular strategies in the courses that present the greatest difficulty and cultivate good study habits that allow them to clearly understand their notes and the educational material they receive from their teachers or any other source of information. In research on study habits of students of a Peruvian university, they determined that most students said read occasionally or weekly. Being the most frequent place to read the house, in contrast to a relatively low level of students who read in the library. Likewise, the overall result of study habits obtained a low level, with high negative scores, between 54% and 42%, in the four dimensions that evaluated: habits of concentration, distribution of time and social relations during the study, reading techniques, take notes and general work habits and attitudes [3].

The studies of the academic performance in higher education seem to be even more valuable in the current world situation, due to the dynamism experienced by the university sector within the framework of a society characterized by the rapid advance of knowledge, the fluidity in the transmission of information and the accelerated changes in social structures. In this context, the qualification of human capital acquires value and this is closely linked to the results and research on the academic performance of university students [4].

To analyze this problem, we use the SPSS data analysis software. The SPSS together with the BMDP are the most used in applied research in the Social Sciences. It is aimed at students who study subjects related to educational research, degrees such as special education, hearing and language and

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psychopedagogy [5]. With the help of this software, the analysis and general graphic representation of the percentages of disapproval were made, as well as the percentages of each course in each particular course, arriving to determine the course that presents the greatest difficulty, to then provide a response to attention by the student that allows theirs to be better prepared and improve his performance.

II. METHODOLOGY

The academic performance of university students is an essential and fundamental factor for the evaluation of educational quality in higher education. The academic performance is the sum of different and complex factors that act in the person who learns, and has been defined with a value attributed to the student's achievement in academic tasks. It is measured by the qualifications obtained, with a quantitative assessment, whose results show the subjects earned or lost, the dropout and the degree of academic success [6].

In the Figure 1 identifies the methodological steps used in this projective research, since it proposes solutions for the reduction of the rate of disapproved in the course of Engineering Programming, from the collection of information and processing of information to obtain results, that allow to offer the suitable recommendations and suitable suggestions to the undergraduate students of the career of Mechanical and Electrical Engineering.

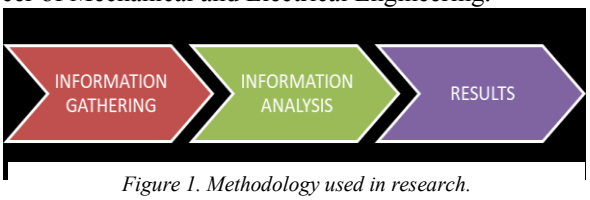

Figure 1. Methodology used in research.
Source: Own elaboration.

A. Information Gathering

The research was carried out in the Professional School of Electrical and Mechanical Engineering that belongs to the Faculty of Engineering and Management in the UNTELS, which is the only National University in the South Lima area, Peru. Which hosts more than 5000 students per year. To obtain the information, we requested through a Single Processing Form (FUT), to the office of the Professional School of Electrical and Mechanical Engineering, the number of registered, approved and disapproved in each of the courses of the syllabus from the period 2007-I until the current period 2018-II, which was responsible for the respective administrative procedures with the office of Academic and Computer Records.

After a period of two weeks, the requested information was delivered through the boss of the Professional School, giving rise to the Information Analysis.

B. Information Analysis

The information provided contained the data of the five professional schools that the university has. From 2007-I (first period) to 2018-I (Last period completed). It was identified that from the period 2017-I onwards, a new curricular network was implemented according to the new university law issued by the National Superintendence of Higher Education University (SUNEDU), for this reason only the subjects studied were considered in the analysis. until the period 2016-II. Only regular periods were selected excluding the leveling periods, because there is a big difference in the number of enrolled students.

The courses were divided according to each cycle of the professional career of Mechanical and Electrical Engineering, higher and average disapproval rates were determined, comparisons between courses and trend lines.

We proceeded to the organization by means of tables and graphs to obtain an interpretation of the information and how it has been its variation throughout the periods, the statistical tool with which we worked was the IBM SPSS Statics (Product of Statistics and Service Solution), this software is used to understand data, analyze trends, forecast and plan new assumptions and precise conclusions, also the IBM SPSS Modeler will help us in the graphic form through the collected data, has an ease in text analysis, analysis geospatial and optimization, its purpose is to help in the design of bar charts, pie charts, histograms, graphics of areas of the data obtained.

This software, because it is so complete, allowed us to exclude LOTUS or EXCEL since it allows the definition of variables that act in the column headers (registered, approved, disapproved) and the data was subsequently recorded in the rows (per cycle of a course), making it possible to work large amounts of data in an organized manner, large samples and above all saving time. Then with the calculations already processed in the software, trend graphs could be made, emphasizing the disapproved students by the cycle of a course with respect to the total of enrolled students.

III. RESULTS

Between the periods 2007-I and 2016-II, 49622 students enrolled in the School of Electrical and Mechanical Engineering, of which 38245 approved (77%) and 11377 disapproved (23%). From this general analysis, it is not evident that there are problems in student performance, due to the high percentage of approved students.

But once analyzed the subjects during the 20 periods that are the object of study, it was found that the course of Engineering Programming, belonging to the third cycle, registered a 75% of disapproval in the period 2014-II, having the highest rate of disapproval found.

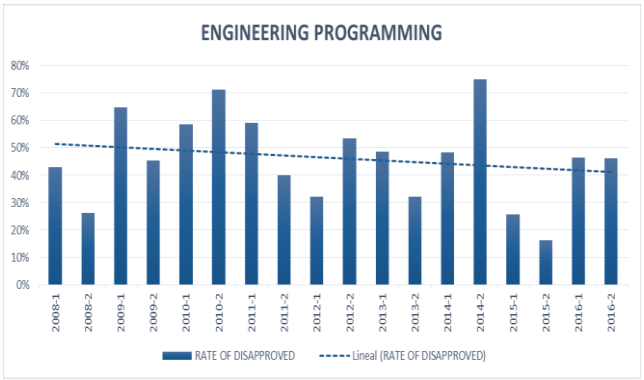

Figure 2. Curve of the rate of disapproval and its trend line.
Source: Own elaboration.

In the 18 periods in which this course was taught, 1339 students enrolled, of which 715 passed (53%) and 624 disapproved (47%).

The Figure 2 indicates that over the 10 years the average disapproval rate has been reduced by only 10%. Where was obtained the maximum rate of 75% in the period 2014-II, and the minimum of 16% in the period 2015-II, obtaining a maximum variation of 59%.

IV. DISCUSSION

As a result of the research it was found that the Engineering Programming course has an average disapproval of 45% and a maximum of 75% registered in the period 2014-II, for this reason we will take this course as a sample and propose a methodology that contributes to improve the learning of the students in the course of Engineering Programming, specifically in the way of solving the problems and exercises that the course poses.

It has been observed that in most cases, when the university student tries to solve programming problems, he always goes directly to the computer and begins writing codes without first analyzing the problem to be solved, or analyzing it the time you write the code. In some cases this practice works, as long as the problems are simple or when they have previous knowledge and experience. But the same does not happen with more complex problems and with greater reason when you are learning to program.

Sometimes it is thought that doing things directly will win more time, but in reality it is not, often the time it takes to program a problem directly, without doing a previous analysis, is twice or triple what would be used if an analysis will be carried out previously. By programming in this way many mistakes are made causing more time than necessary, which makes the programming task more tedious.

In Figure 3, the basic steps that we must follow when designing an algorithm are presented, and it is advisable to convert it into a habit.

1. Previous Analysis of the Problem

At this stage, you must define and be clear about what the program has to do together with the tasks or actions you must be done to carry out the solution. We must ask ourselves the following questions: What will be the desired result? What data are needed to perform the calculations? What types of input data and variables will be used? Where does the input data come from? How are these data obtained? How do the data, the variables and the operators interact with each other to obtain the result? What restrictions must be included when processing the data?

In the same way, all the scenarios that can occur must be analyzed, since a change of scenery can vary the final result of the program, it is always worthwhile to question and ask: What would happen if I change this or that? What behavior will the program take?

To clarify doubts one must ask for formats (forms of presentation of the data or where the data are obtained when they are done manually), formulas, make examples and verify the results. Basically, at this point or phase, all the requirements and specifications of the problem must be collected.

This point must be one of the most important and critical of the resolution of problems, since a bad analysis leads to a bad design and results. At the beginning it is not so important the time that is delayed in this stage, the idea is to have things clear; although the first time it may take us a long time, with practice, the experience will be gained and it will develop faster and faster.

2. Algorithm Design

Once we have the problem clear, we have defined all the inputs and outputs that the program will have and the tasks to be performed, it is time to design the algorithm according to all the previous specifications and then implement it in a programming language that will be executed by a computer.

The algorithm can be done in any way: Pseudocode or Flowchart, the main idea is that it is understandable, and not only by the one who designed it, but by any professional. In conclusion, in the previous stage we define what the program will do, and in this phase, we define how it will do it.

3. Configuration of the Environment of development and codification

This stage consists in transcribing or adapting the algorithm to a programming language, it will have to adapt all the steps designed in the algorithm with sentences and syntax proper to the language.

It is important to verify errors, organize the code (so that it is easy to locate each one of the parts of its structure: the data capture, the calculations, the results and its presentation) and comment it (specifying the use of a certain function, a restriction or applied criterion). These good practices make programs more readable and facilitate debugging.

Prior to coding, the work environment must be configured: IDEs, libraries to be used that must be called in the program header, Frameworks and then pass the algorithm to the programming language.

4. Compilation and Evidence

The compilation phase will detect errors of execution and logical. In this phase, it is also necessary to perform tests with a large amount of data to find possible errors and correct them.

5. Documentation and Maintenance

Finally, it is important that the student makes a simple documentation of the structure of their algorithm or program, of all the steps that I carry out until arriving at the solution of the problem, of the errors that he committed and how he solved them; Sometimes this phase is a bit tedious, but it is also very important to make later modifications, because when a program is poor in documentation this process of modification is totally complex.

It is very important to analyze the academic performance of university students through research, since it is an essential factor in debates about the search for the quality of higher education, it is a fundamental indicator that allows us to approach the educational reality; and it gives us solid information for decision making in public higher education that optimizes the use of resources to achieve a quality education.

It is also proposed to establish the following aspects for the correct development of the engineering programming course: For the greater interest of the students, the study of other types of programming language such as Java is proposed, in order not only to be limited to the C ++ language and not to be It becomes tedious and monotonous for the students. It is important that during the development of the course, we seek to design algorithms that solve practical problems, and execute the algorithms using microcontrollers and actuators for different applications. This will ensure that students learn through practice to consolidate all the theoretical knowledge acquired in each session.

Finally, the realization of a project is presented at the end of the course using any programming language studied and microcontrollers. Each group of students during a period of 5 weeks will develop a project in security, control, monitoring or automation of industrial processes, and will present a final report that includes the following points: Project planning, project design, simulation, implementation and exhibition, where the teacher will observe the errors and propose possible improvements in the project.

All this in order that the student obtain sufficient practical and theoretical knowledge to propose concise solutions to engineering problems that are presented to the future in the labor field, through the use of techniques and steps such as those used when developing their project.

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