PROJECT OF THE ACADEMIC PERFORMANCE IMPROVEMENT

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ABSTRACT

The transition of students from high school to university is a changing and complicated stage. It is during the initial phase when most drop-outs from engineering degrees occur. There are several reasons for this, however, the most highlighted ones are: i) the mismatch between the students knowledge level after finishing high school and the initial level required by the university degrees; and ii) the lack of a habit and constancy of study on the part of the students.

The proposed project aims to design specific tools to improve academic performance in the initial phase of the Degree in Industrial Technologies imparted at ESEIAAT by addressing the two problems mentioned before. In light of this, the measures adopted to solve these points will be tackled separately and properly explained in the following two blocks: block I) Initial level acces, block II) Monitoring of self-learning. Finally, an assessment of the strategies followed will be carried out in a final phase, block III) Integration project.

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1 INTRODUCTION

1.1 State of the art

The academic performance of students can be considered a key factor when analysing the quality of higher education [1]. The academic failure is on average 30% in the engineering degrees at ESEIAAT during the first years, with an accumulation of dropouts between the 1st and 2nd years. Once this phase is overcome, there is a certain stability in academic behaviour and also a notable improvement in academic performance. In addition, the dropout rate is significantly reduced to a value below 10%.

In [2], [3] and [4], there are several studies that try to determine the factors that affect the academic performance of students during these first years, in order to determine possible actions to prevent dropout, increase motivation and so, improving overall academic performance.

Of the many factors that trigger poor performance in engineering, the following points can be highlighted:

- Lack of understanding of basic concepts and even lack of preparation for the subjects taken in the initial phase, depending on the education received in secondary school.
- Difference between the learning methodology used in high school and the techniques used by university professors.
- Lack of study habits and therefore difficulties in planning autonomous learning.
- Memoristic learing habits that lead to difficulties in reasoning and extrapolating concepts when solving different problems.

Taking these factors as the basis for the deficiencies of the students, a series of tools have been desinged in order to improve these statements and therefore the academic performance of the students of ESEIAAT.

1.2 Objectives

The main aim of this project is to improve the academic performance in the initial phase of the degree in Engineering in Industrial Techonologies at ESEIAAT. To do so, the specific objectives are listed below:

- To ensure that students are able to detect their own lack of the necessary knowledge to start the engineering degree with a solid foundation. In addition, if necessary, to motivate them to carry out a series of actions in order to obtain the level required **before the start of the course**.
- Provide them with a weekly plan with all the tasks, both evaluative and autonomous learning, of the five subjects **during the first term of the initial phase**. In addition to accompanying them with a follow-up during this period.
- Assessment of the measures taken to prevent the student academic failure **during the second term of the initial phase** of the degree.
- To improve the horizontal coordination of subjects of the initial phase thereby providing a smoother change.

2 METHODOLOGY

The project has been definied by means of three main blocks which are divided into different tools integrated into the initial phase of the degree:

I. The development and implementation of tools designed to be used by future students just before access to the university degree.
II. A weekly tool for organisation, coordination and management of time as well as autonomous work during the first term of the initial phase of the degree.
III. An evaluative project within the subject called Industrial Technologies that encompasses the lectures taught during the first term of the initial phase of the degree. This project is carried out during the second term of the initial phase of the degree, thus assessing the competences aacquired.

The tools used in each block will be explained in more detail below.

2.1 Block I: Initial level access

The first block consists of a phase prior to the beginning of the course to ensure that students start the degree with a solid foundation from high school and with an adequate level to successfully overcome the initial phase.

In this block, two type of tools will be defined; one tool to assess the initial level of the students before starting the degree and another tool, for those students who require it, to acquire the necessary basic knowledge.

2.1.1 Initial level quizzes

Quizzes for each subject have been developed based on a selection of multiple-choice and true or false questions provided by each coordinator. These quizzes enable to check the level of the students before starting the course, both personally and on the part the teaching staff.

Each question have only one correct answer. In the case of a wrong answer, a feedback appears at the end of the test showing the correct answers as well as how the problem should be solved in some of the questions.

Once the student has completed the quiz, a global feedback appears (see Figure 1), so that the future student is aware of his/her level and be able to prepare for the beginning of the academic course.

Fig. 1. Global feedback: traffic light of ratings

2.1.2 Entry level retraining support material

A web page has been designed for each of the subjects imparted during the first term of the initial phase of the degree in Industrial Technologies Engineering; Physics I,

Chemistry I, Algebra, Calculus I and Graphic Expression. In which, with an agile, didactic and homogeneous format, support material of the lectures is presented to help students aquire the level required to successfully pass the initial phase. There is support material related to the content to consult during the academic period.

Below are listed the links to each of the support websites for the different subjects:

- **Algebra:** https://sites.google.com/upc.edu/greti-algebra
- **Calculus I:** https://sites.google.com/upc.edu/greti-calcul
- **Physics I**: https://sites.google.com/upc.edu/greti-fisica
- **Chemistry I:** https://sites.google.com/upc.edu/greti-quimica
- **Graphic expression I:** https://sites.google.com/upc.edu/greti-expressio-grafica

The support websites have been designed with a common structure to facilitate and speed up browsing. The structure consists of:

- Introduction and information about the current subject (see Figure 2). The contact details of the coordinators as well as the other professors.

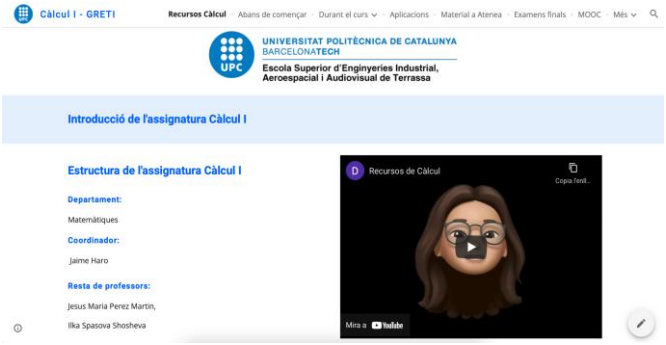

Fig. 2. Virtual assistant of the support website in Calculus I

- Support material to consolidate high school concepts prior to the beginning of the academic period separated in different sections. Within each thematic section, there are: short videos (5 – 10 minutes), teaching notes and many examples related to the lecture as well as practical applications.

- Thematic support modules for a better understanding of the content of the lectures imparted during the academic period (see Figure 3). Within each thematic module, there are: short videos (5 – 10 minutes) and some activities.

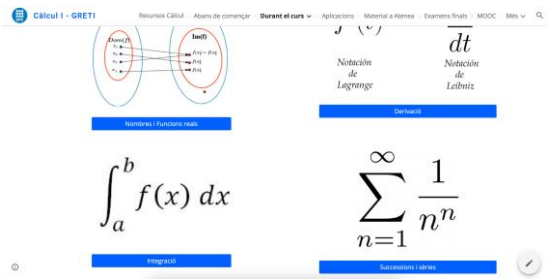

Fig. 3. Thematic modules of the content imparted during the academic period of the Calculus I support website

2.2 Block II: Monitoring of self-learning

The application of the second block takes place during the school period of the first quarter of the initial phase of the degree. This block seeks to consolidate the perseverance on the part of the students when it comes to autonomous learning.

Three types of tools will also be defined; a planning tool so that the student has the calendar of weekly tasks, exams, deliveries and number of hours of autonomous work or study scheduled for each of the subjects the first year of university career, another that will allow counting the number of weekly hours of dedication and finally a dossier that includes the proposed activities of autonomous learning by the teaching staff.

2.2.1 Weekly task planning template

A template has been developed and coordinated transversally (Figure 4), with the weekly tasks throughout the semester, of the 5 subjects that are part of the first engineering year. This template is made available to students on the first day of class to help them in the autonomous work of monitoring each subject.

Fig. 4. Weekly task organization template

With this tool, the student can know in advance the dedication that each subject requires weekly in order to be able to keep a good study agenda that allows them to organize themselves and pass the subjects.Additionally, depending on the circumstances and availability of hours of the student, it can allow him to decide what magnitude of subjects he can tackle and correctly select his dedication.

2.2.2 Weekly autonomous learning hours log form

A link is sent to the student, at the end of each week and by means of a message through the forum that he receives with an SMS on his mobile, reminding him to fill out a form with the information corresponding to the hours of dedication (see Figure 5).

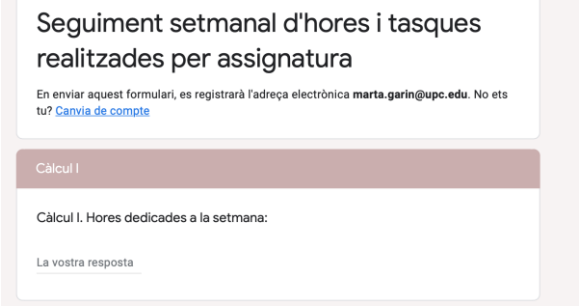

Fig. 5. Dedication hours registration form

Once the academic period of the first semester has finished, a graph has been made of the correlation between the average number of hours dedicated each week by the students based on the final grades obtained by them. It must be taken into account that factors other than the dedication in hours itself come into play, in such a way that it is not necessary to reach a firm conclusion. After a few generations, increasing the number of samples of the population, it will be possible to adjust to a more real scenario.

Below (see Figure 6) is the correlation between the average number of hours dedicated each week by a specific student and the final grade obtained by said student. From the linear regression equation, the future student could estimate the final grade for the subject based on the hours spent per week.

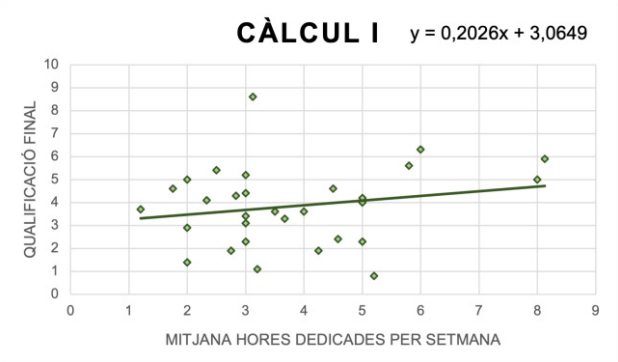

Fig. 6. Correlation between the time record and the final grades obtained

2.2.3 Autonomous learning dossier (Figure 7)

This tool consists of a compilation of the self-learning activities proposed by the professors during the academic period. In this way, students have in an ordered way a serie of activities which summarise the content of the lecutres. In addition, a transversal agreement has been reached with the coordinators of the subjects so that the delivery of these activities is worth 5% of the final mark.

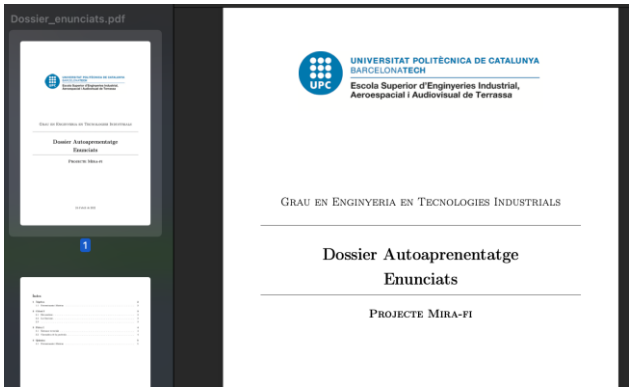

Fig. 7. Dossier of autonomous learning tasks

2.3 Block III: Integration project

This final block is the third phase of the project. It takes place during the second term of the initial phase in order to continue with the monitoring of the academic

performance of the students. It consists of the **Integration Project**, carried out within the subject of Industrial Technologies.

The main objective is to evaluate the understanding of all subjects previously coursed through the creatin of a transversal project. The subjects that can not be assessed within the project itself have been integrated by means of a *Scape Room (Figure 8)*.

To carry out this project, students are divided into groups to encourage teamwork and motivate students with practical applications of engineering.

Fig. 8. Integration project website

3 RESULTS

The different tools designed for the implementation of the project are summarized below:

- **Database with personalized questions for each subject** of the first semester of the initial phase. From it, the questionnaires are generated that allow determining the level of access of the student.
- **Web page with support material** so that new students can acquire the necessary level to successfully follow the first semester of the initial phase.
- **Template for planning and managing autonomous work** that allows the student to have at the beginning of the course an organized and coordinated vision of the different tasks on a weekly basis for the block of subjects to be studied.
- **Registration form of the hours dedicated by the student to each subject weekly and real measurement of the work** required by the teaching staff to the students of the subjects of the first semester of the initial phase. Once the semester is over, it has been possible to graph a correlation between the average number of hours dedicated each week by the students based on the final grades obtained.
- **Autonomous learning dossier** that compiles a series of activities proposed by the teaching staff with the aim of consolidating a record in the self-learning of students.

- **Integration project made up of a series of enigmas** related to each of the subjects of the first semester of the initial phase for the evaluation of the skills taught in said subjects.
- **Homogenization of the teaching/learning methodologies** used in the different initial phase subjects.

4 CONCLUSIONS

The tools designed address the main problems detected in students who access an engineering course for the first time and their implementation gradually allows:

- Generate a study habit and encourage student involvement in their autonomous learning process.
- Improve student self-management and self-planning of their weekly study time.
- Improve overall academic performance.
- Increase student satisfaction/motivation.

5 SUMMARY AND ACKNOWLEDGMENTS

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REFERENCES

[1] Chen, X. (2013). STEM Attrition: College Students' Paths into and out of STEM Fields. Statistical Analysis Report. NCES 2014-001. National Center for Education Statistics. Retrieved from https://eric.ed.gov/?id=ED544470.

[2] Regards sur l'éducation 2017. (2017). OECD. doi:10.1787/eag-2017-fr

[3] Regards sur l'éducation 2019. (2019). OECD. doi:10.1787/6bcf6dc9-fr

[4] Willems, J., Coertjens, L., Tambuyzer, B., & Donche, V. (2019). Identifying science students at risk in the first year of higher education: the incremental value of non-cognitive variables in predicting early academic achievement. European Journal of Psychology of Education, 34(4), 847–872. doi:10.1007/s10212-018-0399-4