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LALA

Building Capacity to Use Learning Analytics to Improve Higher Education in Latin America

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LALA Piloting

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1. Introduction

The LALA Project (Building Capacity to Use Learning Analytics to Improve Higher Education in Latin America) is an Erasmus+ project funded by the European Commission that aims to develop local capacities in Latin American Higher Education Institutions (HEI) to create, adapt, implement and adopt Learning Analytics (LA) tools and consequently improve academic decision-making processes.

To develop the above-mentioned local capacities, different activities have been defined, each of which results in a product. The purpose of this document is to give details about real use of LA tools by HEI. To this end, it presents a compilation of the experiences of pilot projects in the different Latin American universities that make up the LALA partnership (Universidad Austral de Chile, Pontificia Universidad Católica de Chile, Escuela Superior del Litoral and Universidad de Cuenca).

Prior to the execution of the pilots, each of the participating Latin American universities detected their needs using the recommendations of the LALA Framework (deliverable prior to project) and adapted or adopted LA tools (deliverable prior to project). In particular, these adaptations were inspired by the counselling tools using visualization dashboards designed at KU Leuven, and the tools for the early detection of dropout developed at Universidad Carlos III de Madrid (UC3M). Likewise, the University of Edinburgh gave advice and support in the use of the OnTask tool to interested Latin American universities. Details of these prior activities are available on the project website (<https://www.lalaproject.org/deliverables/>).

As a result of these prior activities, the existing tools and services were adapted/adopted, resulting in four sets of tools, each one adapted to the four Latin American partners. They all include academic counselling tools and dropout prediction tools. The toolkit has different names according to each Latin American partner; these are: TrAC (Trayectoria Académica y Curricular) at Universidad Austral de Chile (UACH), NoteMyProgress and DaP-MOOC at Pontificia Universidad Católica de Chile (PUC-Chile) and AvAc (Avance Académico) at Universidad de Cuenca (UCuenca). In the specific case of the Escuela Superior del Litoral (ESPOL), since it already had an institutional tool, the counselling and prediction tools were embedded into its previously existing counselling system called SiCa (Sistema de Consejerías Académicas).

The pilots were coordinated by UACH with the support of UC3M and have participated all the partners of the LALA project and four universities extra to the consortium, Universidad de Chile (UCHile), Universidad Politécnica Salesiana (UPS), Universidad Federal Rural de Pernambuco (UFRPE) and Instituto Tecnológico de Zitácuaro. The execution of the pilots was carried out from 2019 to 2020. This report includes experiences updated to October 2020 in which real users were involved in real use contexts. To this end, five phases were followed: preparation, agreement, training, use and improvement. Each of these phases is detailed in the following section.

We hope that the information presented in this document can help other HEI move towards effective adoption of their LA initiatives.



2. Document Structure and Piloting Methodology

This document is divided into three main sections. These are:

- **Summary of pilots.** This section summarizes the context of each participating university, the tools piloted and the main results obtained during the pilots.
- **Detail of the pilots.** This section describes the detail of the execution of the pilots. It describes the planning carried out in each participating university, addresses the summary of the execution, and closes with results derived from each of the phases defined for the execution of the pilots.
- **Summary of results.** This section summarizes the results obtained after the execution of the pilots, the common difficulties encountered by the participating universities, as well as the strategies arising from this experience that the participants recommend for dealing with these difficulties.

The four overall objectives defined for the pilots were as follows:

1. Integrate LALA tools into the institutions' academic process to improve academic decision-making.
2. Develop local capacity to introduce LA tools in the institutions involved in the LALA project.
3. Collect data to evaluate student performance and the usefulness and impact of LA tools in institutions.
4. Ensure the sustainability of the use of LALA tools in the universities of all Latin American partners.

As mentioned, to achieve these objectives the pilots were organized in the following five phases:

1. **Preparation.** The first phase (preparation) included the development of the piloting devices (instruments), the socialization of the pilot plan with the stakeholders and the training of the piloting staff.
2. **Agreement.** The second phase (agreement) enabled the generation of an agreement with the project participants, establishing the commitments with each one of the stakeholders involved (teaching staff, students, etc.) and the safeguards applicable to the information gathered during the piloting.
3. **Training.** The third phase (training) included the training of technicians, users, and administrators, for the use and maintenance of the piloted tools.
4. **Use.** The fourth phase (use) allowed participants to use the tools in their academic processes and also included accompanying the participants, socializing the experiences, and a preliminary evaluation of the tools and the process.
5. **Improvement.** The last phase (improvement) enabled the general evaluation of the tools and the piloting, which allowed for documentation of the lessons learned that will form part of the LALA Handbook (final product arising from the work of the LALA project).

It should be noted that the piloting phases may appear to be sequential, but in practice their execution was iterative. Therefore, during a pilot, multiple instances of preparation, agreement, training, use and improvement can occur. However, these experiences are included in a single pilot project because the objective is common, and the tool evaluated is the same.

Each participating university has conducted at least one pilot for the counselling tool and one pilot for the prediction tool. In addition, one university also piloted the OnTask tool. During the execution of each of the pilot phases, each of the Latin American partners was free to carry out their own implementations according to their contextual needs. As will be seen below, the training and evaluation processes and



instruments present some differences, as they respond to the nature and contexts of use of the tools. However, as can be seen in Table 1, there are many common aspects, and the methodology is common to all cases.

Table 1 summarizes the evaluation methodology with which each institution of the consortium assessed the achievement of the project indicators and their link to the overall objectives.

Objective	Type of indicator	Indicators	Institution	Tool	Evaluation methodology
<p>1.- Integrate LALA tools into the academic process of institutions to improve academic decision-making.</p> <p>2.- Develop local capacity in the institutions involved in the LALA project to introduce LA tools.</p>	Short term quantitative	A total of 300 decision makers are involved in the pilots.	UACH	TrAC	<ul style="list-style-type: none"> - Number of teachers involved who can potentially use the tools - Tool use log analysis, considering at least the following metrics: <ul style="list-style-type: none"> - Amount of application revenue per user. - Number of actions per user. - Tool use time. - Analysis of attendance lists. Number of participants in classroom educational activities.
			PUC-Chile	NoteMyProgress	
			UCuenca	AvAc	
			ESPOL	SiCa	
			UACH	TrAC	
			UCuenca	AvAc	
	Short term quantitative	At least 5000 students in total involved in the pilots.	UACH	TrAC	<ul style="list-style-type: none"> - Tool use log analysis, considering at least the following metrics: <ul style="list-style-type: none"> - Number of students involved. - Number of actions involving students (either by students themselves or by counsellors). - Tool use time.
			PUC-Chile	NoteMyProgress	
			UCuenca	AvAc	
			ESPOL	SiCa	
4.- Ensure the sustainability of the use of LALA tools in the universities of all Latin American partners.	Long term quantitative	There are at least 8 institutions in Latin America that regularly use Learning Analytics tools to make informed decisions.	UACH	TrAC	<ul style="list-style-type: none"> - Number of collaboration agreements signed with Latin American universities. - Number of institutions using learning analytics tools - Number of new repositories for versioned projects.
			PUC-Chile	NoteMyProgress	
			UCuenca	AvAc	
			ESPOL	SiCa	
3. Collect data to evaluate student performance and the usefulness and impact of LA tools in institutions.	Long term quantitative	There are positive differences in the performance of students who	UACH	Counselling at TrAC	Difference in ranking position (pre and post-test for students involved).
			PUC-Chile	Counselling at NoteMyProgress	Difference in the pass rate of courses (students with and without tools).



		receive counselling through the tools developed as a result of the project.	UCuenca	AvAc	Difference in the pass rate of courses (pre- and post-tool). Difference in the pass rate of courses.
			ESPOL	SiCa	
<p>1.- Integrate LALA tools into the academic process of institutions to improve academic decision-making.</p> <p>3. Collect data to evaluate student performance and the usefulness and impact of LA tools in institutions.</p>	Short term qualitative	The advice and guidance of teaching staff is more focused on the needs of each student, based on their data and that of previous students.	UACH	Counselling at TrAC	<p>User evaluation survey (counsellors and students), considering at least the following aspects: Perceived level of satisfaction. Perceived level of utility. Perceived level of decision quality.</p> <p>Guided discussions with counsellors, where they evaluate: - Effects on the use of time. - Effects on the number of errors in their decisions. - Impacts on the curriculum.</p> <p>Survey evaluating the perceived usefulness of the tools by students and counsellors.</p>
			PUC-Chile	Counselling at NoteMyProgress	
			UCuenca	Counselling at AvAc	
			ESPOL	Counselling at SiCa	
			UACH	Counselling at TrAC	
			UCuenca	Counselling at AvAc	
2.- Develop local capacity in the institutions involved in the LALA project to introduce LA tools.	Short term qualitative	The tools serve as an example for new ideas and implementations.	UACH	TrAC	User interview: list of proposed improvements to the tools.
			PUC-Chile	NoteMyProgress	
			UCuenca	AvAc	
			ESPOL	SiCa	
4.- Ensure the sustainability of the use of LALA tools in the universities of all Latin American partners.	Long term qualitative	Institutions use tools to predict or estimate outcomes based on mathematical/statistical/machine learning models and academic data.	UACH	Prediction in TrAC	<p>Survey to evaluate the correctness, use and improvements that could be made to ensure the sustainability of the system.</p> <p>Survey to evaluate correct use and improvements to ensure sustainability.</p> <p>Survey to evaluate the correctness, use and improvements that could be made to ensure the sustainability of the system. Use logs to measure increased tool use</p>
			PUC-Chile	Prediction in MOOCs	
			UCuenca	Prediction in AvAc	
			ESPOL	Prediction in SiCa	

	Long term qualitative	Evidence-based decision-making is part of the culture of the universities in the LALA Community.	UACH	TrAC	Survey assessing whether pilot participants recommend the tools and whether they plan to continue using them. Meetings established with the Department of Technology and Undergraduate Management for the institutionalization of the tools throughout the University.
			PUC-Chile	NoteMyProgress	Meetings established with the Management of the School of Engineering for the promotion of the tools in other MOOCs.
			UCuenca	AvAc	Meetings established with Deans for the institutionalization of the tools in other faculties.
			ESPOL	SiCa	Meetings with the Vice-Chancellor to present the results of the incorporation of the tool and to encourage its use.

Table 1. Summary of the relationship between piloting objectives, indicators, and mechanisms for measuring different aspects of piloting.

It should be noted that the universities outside the consortium also carried out measurements regarding the usefulness and impact of the incorporation of the tools. However, because the pilots carried out by these institutions were in general shorter, and with more methodological variation, they have not been included in the previous table.



3. Summary of the Pilots

The following is a brief description of the pilots carried out at each of the participating universities. For each pilot, the tool piloted and the main results obtained in the evaluations carried out are described.

3.1 Pilot Projects at Universidad Austral de Chile (UACH)

UACH is a traditional private non-profit university located in the south of Chile. Since its founding in the 1950s, the university has focused on expanding the supply of higher education in the southern region of the country and is proud to be a leading social actor in expanding access to education. Currently, the university has 16,700 undergraduate students, 850 graduate students and 750 full-time faculty members.

Due to the social characteristics of its students, one of the university's main problems is the dropout rate in the first years of the degree, as well as the time students take to complete their degree programmes. To deal with this issue, in the last two years, the institution has implemented an LA solution for student academic counselling called TrAC (Trajectory and Curriculum). TrAC has tools that support counselling as well as early detection of students at risk (prediction).

3.1.1 TrAC Counselling Tool Pilot

TrAC for counselling is inspired by the LISSA dashboard (designed by KU Leuven), which allows one to visualize academic information about students overlaid on the structure of the study programme (see Figure 1). The tool's main objective is to support school heads who act as counsellors and make decisions regarding enrolment and withdrawal applications for the subjects that students take each semester.

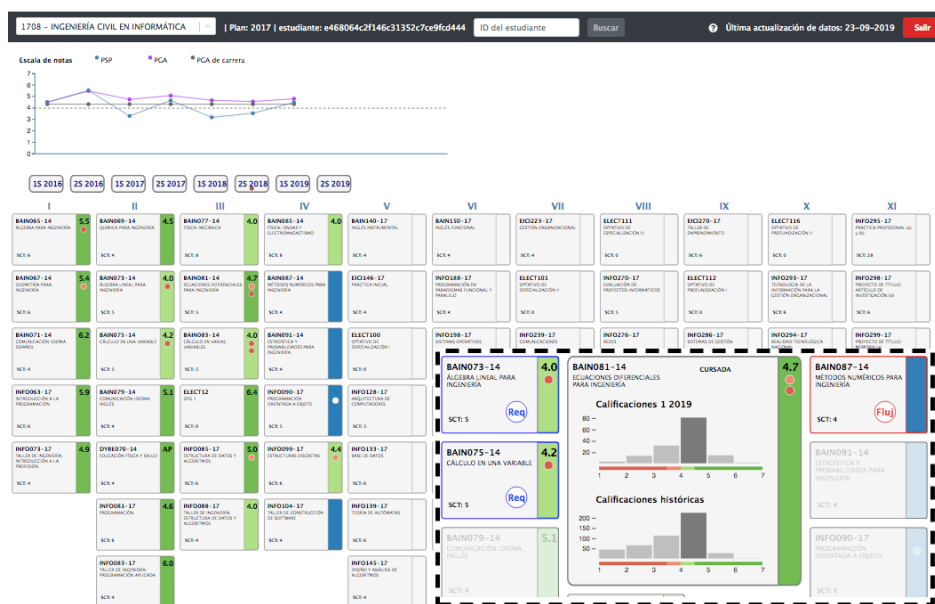


Figure 1. Screenshot of TrAC. The box with the border of dashed lines at the bottom right of the visualization is displayed when a course is clicked.

The TrAC pilot started in January 2019 and ended in December 2019. During this pilot, 21 directors from different programmes and three different campuses participated, as well as the University's Director of Undergraduate Studies. Participants represented about 30% of all programmes offered in UACH (all participants signed consent forms). Nevertheless, TrAC has been enabled for most university programs



and students, therefore, they can be potential beneficiaries of the use of TrAC. More specifically, TrAC is enabled for 42 users that covers 9085 students.

Within the pilot, four face-to-face sessions were held to a) socialize the tool and collect baseline information, b) introduce the tool and provide training in its use, c) collect interim feedback and make improvements, and d) collect final comments on the usefulness and potential impact. Not all programme directors participated in all sessions. The sessions were held in groups to stimulate discussion among the directors of different degree programmes. Information was collected through guided discussions with open questions and surveys.

The first and second sessions focused on conducting a baseline survey, to understand how much work is required by special enrolment and dropout requests, how directors perceive the support available to carry out these processes, and what information is relevant for them to make informed decisions. The second session had to be postponed until the final days of the period in which the counsellors decide on the enrolment of a special course. Therefore, some participants either already had that job completed or the work was well advanced.

The baseline results reveal that both the number of special course enrolment requests to be resolved (from 50 to 300), and the time (each request more than five minutes) to be spent on this task is considerable. Therefore, the tool is useful and such usefulness was recognized by the users. More specifically, the directors welcomed the creation of a tool that could facilitate this process. They stressed the issue of having to access information from different parts of the current system, which results in increased use of time, confusion, and possible errors in decision-making.

The third session was held after one month with the aim of introducing some improvements in TrAC (e.g., show currently registered courses) and to collect comments on two aspects: perceived utility and perceived potential impact of TrAC. The results from the 11 counsellors who participated in this session show an overall positive and encouraging attitude towards the usefulness and impact of the tool. Counsellors find TrAC very useful, even though the tool was launched just before the end of the application period.

Counsellors reported using the tool to verify applications and inspect some student cases. Through impact and usefulness assessment surveys, it was possible to show that counsellors believe that TrAC allows them to make better decisions, to better explain these decisions, and to potentially reduce errors. They would also like to continue using the tool. Interestingly, the survey also revealed that TrAC has not necessarily changed the process they follow for resolving requests, nor provided new or additional information. Guided discussions explain these results: TrAC provides the same information that is already available, but collected on one easy-to-use screen, avoiding the need to go back and forth between different sections of the current system and thus saving time. However, they still have to use the current system to submit application decisions. At least two participants quickly detected problems in the curricular structure of the programmes. These problems had not been noticed before in the current system, and this had led to an increasing number of special requests.

Data automatically collected by TrAC (data collected from January to November 2019) shows different levels of use. The users as a whole inspected a total of 464 student situations (average number of situations 21.1) and performed more than 7000 actions (load student situation, click on courses to see



statistics, click on semester to see subjects taken, etc). 59% of the participants (13) carried out more than 100 actions (maximum 1608).

Additionally, the impact of TrAC use on the performance of the students involved has been measured. To do this, an analysis was undertaken as to whether in 2019 these students have achieved a better position in the cohort ranking than in 2018. The results of this analysis show that after the pilot, 57% of the students improved their position in the ranking (a difference of 9.6 places on average).

The final session of the pilot focused on measuring the perceived impact with the aim of complementing the information already collected, informing the use indicators, and motivating the continued use of TrAC during the next period. In addition, the final session was planned to also involve new participants and extend the pilot; however, the extension of the pilot to the second half of 2019 was interrupted by the social revolution that began in Chile at the end of October 2019. Even so, a closing session was held in November 2019.

These results are encouraging, considering the following: events occurred which did not allow all the activities planned in the pilot to be carried out, and the UACH's teaching activities were interrupted.

For more details, see section 4.1 of this document.

3.1.2 TrAC Prediction Tool Pilot

At the UACH, the concept of student risk is a little explored concept, therefore within the LALA project the academic data of the students were analysed to generate a model that allows predicting the risk of dropping out of a career. Thus, a predictive component has been added to the TrAC tool that allows anticipating the needs of students who might require academic support from the school administration (see Figure 2). In this sense, TrAC moves towards stages of early detection of student risk to improve the decision-making process of both students and school directors.

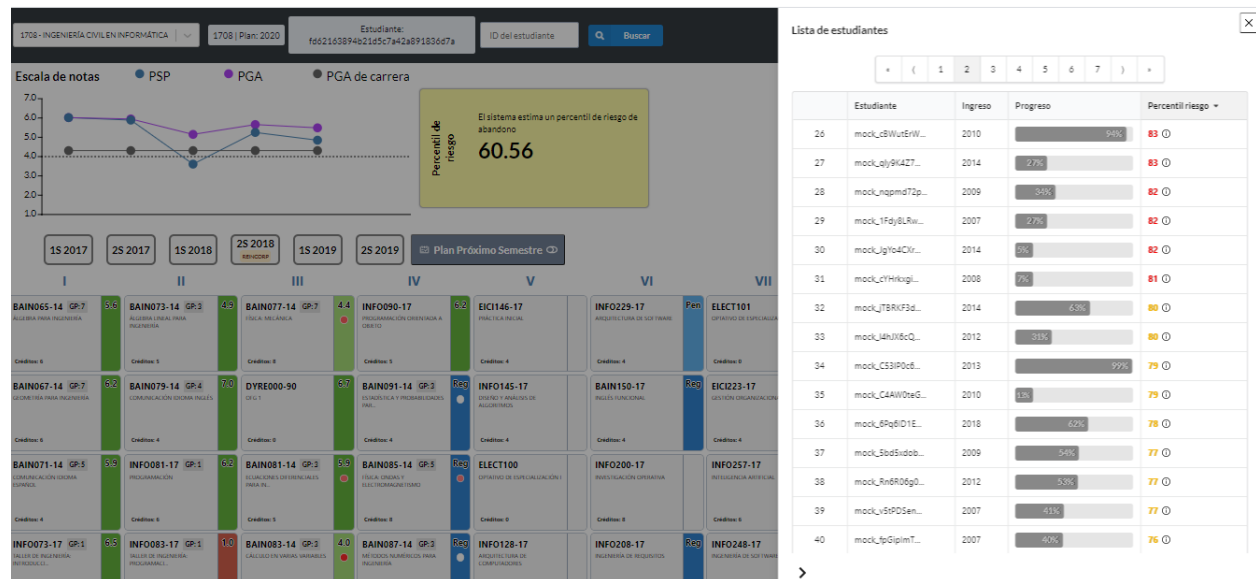


Figure 2. Screenshot of TrAC Risk. The list on the right presents the students and their relative risk relative to their fellow students. The yellow box next to the progress chart shows the dropout risk percentile that an individual student is in.



TrAC Risk pilot was intended to determine the impact of the proactive visualization of academic risk on the student risk analysis process by school directors. This process began in June 2020 and concluded in November of the same year. During this piloting, 2 program directors from different programs participated. Participants represent about 3% of all programs offered at UACH. In terms of students, these programs involve more than 800 students who can be potential beneficiaries of TrAC Risk. However, the predictive model is trained with data from the careers of the Faculty of Engineering Sciences. Therefore, it can be extended to the 8 careers of said faculty.

Within the piloting, two work sessions were carried out with school directors through virtual platforms, in which they had to: a) characterize student risk from an institutional, directives and personal perspective; and b) identify students with the highest student risk in their academic programs. Two sessions were carried out with the same purposes, one week apart and with the use of TrAC, in the first, and TrAC Risk, in the second. These were carried out individually to stimulate the reflection of each director about the variables, processes and strategies used in the analysis of student risk in their respective career programs. The information was collected through the recording of semi-structured interviews and responses to questionnaires.

The first session focused on performing a baseline survey, to understand how much work requires the analysis of student risk among students in academic programs, as well as the processes, roles and variables involved in such management.

The results of the baseline show that there is no unified or proactive student risk management process in the institution, but both principals take actions along this line to comply with the school management regulations. In particular, they mention some activities aimed at identifying students who could be at student risk, but, in general, they are not supported by academic management systems. Therefore, the directors who participated in the piloting showed different strategies for the identification and monitoring of students at student risk. Likewise, principals perceive the variables that cause academic dropout differently and, therefore, also differ in the way they approach this situation.

The second session focused on developing a reflective process about student risk, as did the first session and as an intra-subject validation mechanism. Likewise, student risk analysis tasks supported by TrAC Risk were carried out, analysing the behaviour and perception of the principals when using the variables and indicators provided by the extension of the ML tool.

The review of participants' behaviour recorded in the videos shows a positive evaluation of the information and the predictive strategy that was added to TrAC. In this session, student risk analysis patterns are observed with greater similarity among the directors, which is delineated by the variables and indicators presented by the predictive model and integrated with the visualization of the student's academic trajectory under analysis. Likewise, there is a tendency to recognize regular trajectories that influence student risk, both independent and dependent on the study program.

Based on the analysis of the TrAC questionnaires, videos and logs in the pilot period, positive results are appreciated, even when the sample is small, it is observed how the tool supports the proactive management process of student risk through a clear process based on variables and indicators that have a high level of coherence with the students' trajectories, which are visualized within the same TrAC tool.

For more details, check chapter 4.1.2 of this document.



3.2 Pilot Projects at Pontificia Universidad Católica de Chile (PUC-Chile)

PUC-Chile is one of the most prestigious universities in Chile and Latin America. It was founded by legislative decree in 1888 and was granted full academic and administrative autonomy in the late 1920s. Over the past century, it has become a large and selective institution, currently with five campuses and more than 1,200 full-time faculty members serving 32,500 undergraduate and 5,400 graduate students. In 2015, the university's School of Engineering launched the UC Online initiative, which aimed to develop massive open online courses (MOOC) in search of new models to incorporate as part of their regular programmes. As a result of the initiative, the school began collecting large volumes of data on students from around the world, from demographics to how they interacted with the materials offered online. The institution saw this large volume of data as an opportunity to launch research initiatives related to LA, aimed at improving the experience of students and teaching staff in these new digital learning environments.

In this context, and within the framework of the LALA initiative, two projects are being developed. The first is a project for the development of a student-centred academic counselling system called NoteMyProgress (NMP). NMP supports students' study and self-regulation strategies in MOOCs and educational scenarios derived from these, through customized interactive graphics that are automatically generated for each student. Although a first prototype of the NMP tool was initially funded by Chile's National Commission for Science and Technology (CONICYT) between 2017 and 2018, its beta version is being completed within the LALA framework. Thanks to the LALA project, PUC-Chile has had the opportunity to pilot and improve the tool, enabling the development of a first stable and scalable version. Specifically, during the LALA project, PUC-Chile worked on the analysis of needs associated with the institution using the LALA framework, as well as updating the visualizations offered by the tool through two pilots, one with online MOOC courses (Section 3.2.1) and another in a MOOC course used in a classroom course following the flipped classroom methodology (Section 3.2.2).

The second project is the DaP-MOOC system, a dashboard for the prediction of dropout in MOOCs designed to support teaching staff in detecting groups of students at risk of dropout in MOOCs to facilitate their interventions in the course. The aim of the visualizations is to provide MOOC course assistants/tutors with a list of students classified by their probability of dropping out to offer personalized help messages to each of these groups, to retain them and avoid their possible dropout from the course. After several years of the MOOC initiative in the Engineering School (more than 24 courses with more than 500,000 students), the Engineering Education Directorate detected the need to provide a tool of this type to MOOC course assistants. The dynamization of the courses by the assistant lecturers in the MOOCs is a fundamental necessity in order to resolve the students' doubts regarding the courses and to keep their community active. However, the teaching staff in charge of this dynamization face two main difficulties: (1) they cannot distinguish between different groups of students at risk, so they cannot send personalized messages; and (2) they do not know what characterizes different groups of students, so they cannot send appropriate messages to each group. DaP-MOOC is an attempt to resolve these two main problems.

NoteMyProgress

NMP is a student-centred academic counselling tool that aims to support students' study and self-regulation strategies in online courses in an automatic and personalized way. Unlike the tools developed by the other partners, which offer analytics for academic programmes as a whole, this tool offers course-level analytics. Through interactive visualizations, NMP provides actionable aggregate information about student activity in the online course and students' interaction with its contents.



The tool is composed of a web platform and a plugin for Google Chrome. On the one hand, the plug-in offers the student the option of taking notes while studying the course, and simultaneously takes care of collecting the student's activity on the LMS. From this activity record, the web platform offers the student a visualization of the activity in a graphic and interactive way to facilitate the monitoring of his/her activities (see Figure 2). These two features provide support for student learning within the course.

A beta version of NMP existed at the institution before the start of the LALA project. However, during the LALA project, work was done on analysing needs and improving the dashboards offered, to create a first stable version for a first pilot. The needs of the students were evaluated in parallel to the development of the LALA framework (PUC-Chile led the development of the LALA framework), as well as the improvement of the dashboards in collaboration with KU Leuven.

For the evaluation of the tool designed during the first year of the project, two pilots were carried out, one in an online environment (section 3.2.2) and the other in a course following flipped classroom methodology (section 3.2.3). Both pilots were carried out between 2018 and 2019, corresponding to the beginning and end of the academic year in Chile.



Figure 3. Screenshot of NoteMyProgress

3.2.2 Piloting NoteMyProgress Counselling Tool in an Online Environment

The first pilot of the NMP tool took place between January and July 2018. This first pilot was conducted to identify the needs regarding the use of the tool and was carried out in parallel with the definition of the LALA Framework. Specifically, work was done on the institutional analysis aspect to identify the needs of the institution and its main stakeholders (the students, in this case) to design a tool suitable for their needs.

The piloting of the NMP tool in an online environment took place between January 2018 and July 2018 involving 17 teachers. seven MOOC courses were offered by PUC-Chile through the Coursera platform.

During the pilot period, these courses enrolled 19,052 students, of which 1054 installed the NMP tool on a voluntary basis, and 657 of them used the tool in some extent.

Due to the nature of this pilot (based on MOOCs), interactions with users were conducted electronically. The socialization of the tool was done through an e-mail, which presented the tool and explained the advantages that NMP offers as a complement to the course.

The installation of the tool was voluntary, and the students did not receive any remuneration for their participation in the pilot. All students who agreed to participate received an informed consent form.

For the pilot, students answered an electronic questionnaire on self-regulatory strategies. Training in the tool was conducted online through a manual. Towards the end of the pilot, students were asked to answer a questionnaire with closed and open questions about the use of the tool that allowed them to evaluate the tool in terms of three different dimensions: data, awareness, and reflection and impact.

Although the total number of students who downloaded the tool was 1054, for the analysis of the project's impact, a sample of only 263 subjects was considered, consisting of those who answered all the questionnaires provided during the pilot. Of these 263 subjects, registered for the courses "Managing Effective Organizations" and "Road to Project Management Excellence", 91 downloaded and used NMP and 172 did not. These two groups will serve as an experimental and control group, respectively.

The data automatically collected by NMP shows different levels of use. For example, students interacted with the tool 26,229 times on average and visited the course contents 43,491 times. This represents 11,788 more visits to the course materials than students who did not use the tool. These interactions translate into students showing a greater commitment to the assessments and video lessons; they completed more video lessons and started more supplementary activities.

In addition, to measure the impact on the performance of the students involved in the pilot, the results of these students were compared with the results of the students not involved. The results show that students who used NMP scored higher than students who did not use the tool. Finally, the results of the survey on the use of the tool show that students positively evaluate the data, awareness, reflection and impact dimensions of the visualizations offered by NMP.

Although the characteristics of the pilot study and the participant population do not allow us to extract conclusive results on the direct impact of the NMP tool on student engagement and performance, they do suggest that this tool could be a potential solution to motivate their activity in the course and, as a consequence, lead to an improvement in their performance. For more details see section 4.2.1 of this document.

3.2.3 Piloting NoteMyProgress Counselling Tool in a Flipped Classroom Course

The second pilot of the NMP tool was carried out in the context of the Universidad Católica's "Behaviour of Organizations" course between August and November 2018. The lecturer of this course, which was initially taught in a traditional way, decided in 2018 to transform his course following the Flipped Classroom methodology, also known as the inverted class (hereinafter, "flipped"). For this transformation, the lecturer wanted to take advantage of a MOOC course that he had created in Coursera a year before. For the course, this MOOC was slightly transformed to distribute its content over the 11-week face-to-



face course, with the addition of questionnaires and new assessment activities linked to the face-to-face classes.

The flipped course is organized over 11 weeks, in which students must do activities before and during the two face-to-face classes they have per week:

- **Activities before class.** Students must carry out two activities: (1) review the MOOC's video lessons and (2) complete a week plan asking them for information about the week's goals and the time they plan to spend on each goal.
- **Activities during the class.** The face-to-face sessions are structured in two parts: (1) initial assessment, in which students answer a questionnaire about the videos they should have seen before the class, and (2) group work on the analysis of a case study.

The pilot involved 242 students, organized into a control group (n=109) (to establish the baseline) and an experimental group (n=133). Both groups carried out the same activities and completed the same type of evaluations. The only difference between the two groups was the use of NMP as a tool for planning and determining the week's objectives. While the experimental group used NMP for weekly planning, the control group did so through a form in *Survey Monkey*. All the students who were part of the pilot participated in a face-to-face training session to understand how to access Coursera and NMP (in the case of the group that used it).

The objective of this pilot was to evaluate the impact of using NMP to organize and plan their activities for the MOOC on the performance and involvement of students in the MOOC. For this purpose, the data logfiles of Coursera and NMP were analysed to recover the average number of interactions with the course activities and the NMP tool.

The results of analysing the activity of the two groups of students in the MOOC course show that: (1) the experimental group (which used NMP) showed statistically significant greater levels of activity than the control group and (2) the experimental group was more constant in their interaction with the course than the control group, which showed a decrease in activity in the MOOC from the beginning to the end of the course. For more details see section 4.2.2 of this document.

3.2.4 Dropout Prediction Tool Pilot

The Dropout Prediction Dashboard in MOOCs (DaP-MOOC) is a web dashboard designed to detect groups of students at risk of dropping out of MOOC courses early and to do so automatically from student interaction with the course's digital resources. A set of visualizations provides information about students and their number according to the probability of dropout (high, medium, or low risk). The aim of the visualizations is to provide MOOC course assistants/tutors with a list of students classified by their probability of dropping out in order to offer personalized help messages to each of these groups, to retain them and avoid their possible dropout from the course.

Below, you can see the first version of the tool visualization (Figure 4).

Número de estudiantes según su probabilidad de abandono



Figure 4. DaP-MOOC screen

The pilot study was structured in two stages. In the first stage, data was collected from 3 MOOCs offered by the PUC-Chile on the Coursera platform. These courses are: "Electrons in action" (N = 2,035), "Constructivist class" (N = 337) and "Management of effective organizations" (N = 526). The 3 courses focus on different target audiences, facilitating the diversity of study participants. The objective of this first pilot stage was to evaluate the validity of the proposed prediction models. For this, no visualization panels were used, but only data from previous years courses were used to improve the algorithms, draw conclusions about different variables that affect prediction, etc. Specifically, data from the course "Electrons in Action" collected between April and December 2015, and data collected between June and September 2019 for the other two courses were taken as a reference. As this first stage only has an objective of improving the algorithms, it is not considered for the total numbers of students, teachers, etc. of the pilots.

The second stage of the pilot was carried out in the course "Introduction to Programming with Python" (N = 2421) during the months of July and August 2020. In addition, two teachers participated in this pilot. In this second stage, the proposed visualizations, and their effect on students' commitment to the course.

The results of the second pilot show that the use of personalized messages according to the dropout risk group could have a positive effect on students categorized as medium risk. The data shows that these students evolve into less risky groups throughout the course. The same evolution is not observed for students classified into high-risk and low-risk groups. It is also observed that, from week 5, students who are transferred to groups with a low dropout risk remain in this group until the end of the course. Although it cannot be assured that these results have been influenced by the messages, we do observe a positive trend for medium-risk students, who could potentially become part of a low-risk group towards the end of the course.

In addition to the effect on students, the pilot points out that this tool can be useful to support the teacher in massive courses. From the perspective of the teachers involved, insights were obtained through informal interviews where they highlight the benefit of being able to have a visualization about the probability of dropping out of the different student groups and being able to send personalized messages accordingly. Finally, they also value being able to have "standard messages" to send to students that

describe and interpret the data shown in the visualizations. For more details see section 4.2.3 of this document.

3.3 Pilot Projects at University of Cuenca (UCuenca)

The UCuenca is a public institution located in the centre of the southern region of Ecuador. It was founded by legislative decree in 1867. Its mission is to train professionals and scientists committed to improving the quality of life in intercultural environments and in harmony with nature. It currently has five campuses that house some 1,200 full-time faculty members, 16,600 undergraduate students in 12 faculties, and 930 graduate students. This university had no previous experience in LA at the time of this project. The leaders recognize that LA is a powerful tool to support students in their learning process, however, there is resistance that makes adoption difficult. This resistance is due to the additional workload required and the absence of policies that allow the allocation of working hours to this type of project. As a result, AvAc (Academic Advancement) was implemented, a tool to provide faculty and academic counsellors with information on the curricular progress and academic performance of students. Some of the faculties that are part of the pilot have started to use AvAc; however, initial resistance has been detected that will make its adoption difficult at the institutional level. This resistance is due to the additional workload required of staff who would carry out academic counselling activities and the absence of policies that would allow them to allocate working hours for this type of project; an aspect that should be taken into account in order to scale up AvAc at the institutional level.

3.3.1 AvAc Counselling Tool Pilot

AvAc, inspired by the LISSA dashboard (designed by KU Leuven), allows students to visualize their academic course of study in order to provide counselling (see Figure 5). It is divided into three visualizations that summarize the progress and performance of the studies. These show the curricular structure, courses and grades; and a graph of the student's average performance in a semester and the details of each semester, in terms of academic load, course performance and difficulty of the course.

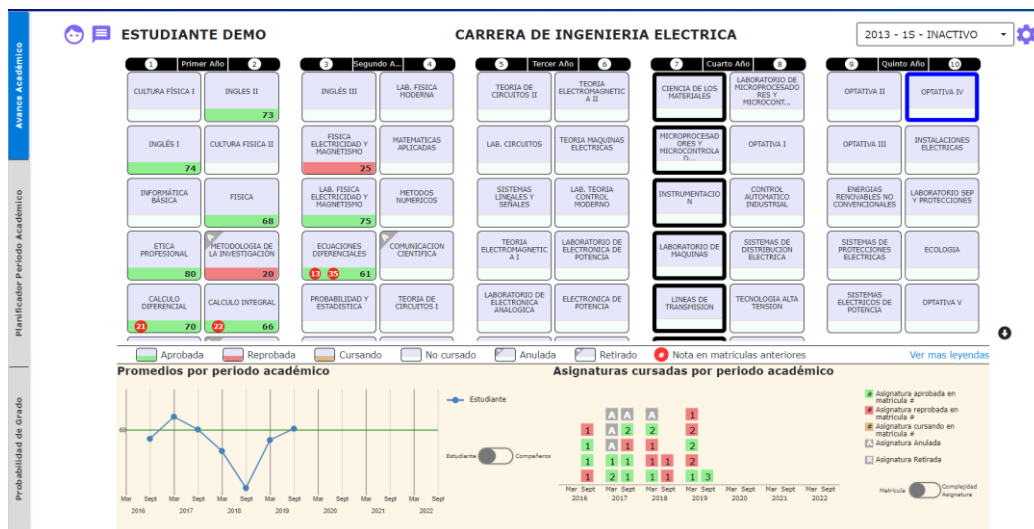


Figure 5. Screenshot of AvAc

Piloting in UCuenca began in July 2019 and will continue until September 2020, because the team faced the challenge of adopting a new tool and implementing a previously non-existent academic advisory process.

Eight face-to-face socialization sessions were held, in which 74 teaching and administrative staff participated. The sessions focused on: a) collecting baseline information, b) introducing the tool and training, c) inviting and motivating lecturers and staff to participate as counsellors, and d) collecting information on the tasks and processes needed to analyse students' academic progress.

Following these socialization sessions, and thanks to the support of the Dean, 48 enthusiastic lecturers have become involved. This represents eleven programmes belonging to four university faculties covering about 50% of the university's faculties. All participants signed an informed consent form.

For the baseline survey, teaching staff were asked about the current amount of work involved in special course enrolment applications, their perception of the support available to carry out the process and what information is relevant. The results revealed that it is important for the university to offer students face-to-face assistance during the application process, and to improve assistance in resolving applications for enrolment and withdrawal. Therefore, the usefulness of the tool was confirmed.

Also, the number of applications for special courses is 50 or more per school and each application takes between two and five minutes. Participants agreed to display the academic information as a dashboard, which will function much better than browsing through different reports. However, some participants were concerned about having additional workload because of the need to adopt both a tool and a counselling process.

Furthermore, after introducing some improvements in AvAc and in the counselling guidelines according to the comments gathered in the socialization sessions (e.g., showing the withdrawal from subjects per term, allowing the analysis of the historical structures of the programme), four face-to-face training sessions were held, one per faculty.

The data automatically collected by AvAc shows different levels of use. The number of actions performed on the tool is 22707. These actions correspond to 56 out of the 74 participating teaching staff actively using the tool and involve 1873 students.

The pilot evaluation sessions focused on measuring the perceived impacts and motivating the continued use of AvAc during the next period. The results obtained in these evaluation sessions show that more than 80% of the students believe (providing a rating of between 8 and 9 on a scale of 10):

- Seeing the visual tool makes them think about what they should do from that point on.
- Using the visual tool during the session helped them better understand the tips or suggestions.
- They would like to continue discussing their academic situation using the visual tool.

These overall results of the pilot show that AvAc is relevant in supporting academic counselling sessions and they lay the foundation for both scaling up at the institutional level and for future studies on its impact on student performance. For more details see section 4.3.1 of this document.



3.3.2 AvAc Prediction Tool Pilot

The tool for predicting dropout at UCuenca allows us to observe the probability of the student dropping out in a certain curricular map. This probability is calculated by means of machine learning algorithms and contains two visualizations integrated into the AvAc tool. The first one only shows the probability of dropout, while the second one (Figure 6) shows the variables used for the calculation in more detail and an explanation of each one for a better understanding of this percentage.

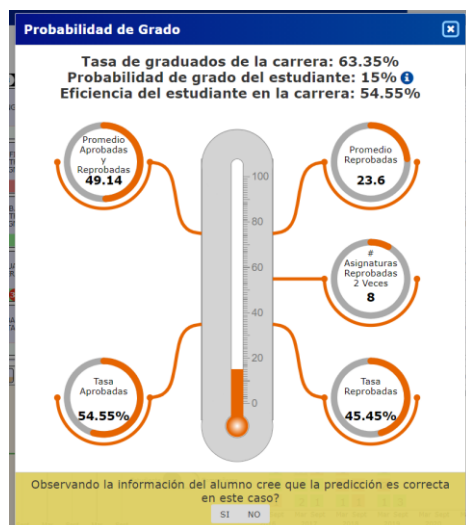


Figure 6. Visualization of the dropout prediction panel

In the case of UCuenca, the dropout prediction tool is integrated into the AvAc tool and therefore the procedure followed during the piloting stage is the same as in section Tool Pilot (see section 3.3.1).

It should be noted that the tool is a panel of the AvAc tool dashboard and therefore not all counsellors and students accessing the counselling tool necessarily have to display the prediction tool panel. Although in the training phase it was shown in the same way as the previous tool, of the 74 counsellors who have used the tools, 48 accessed the dropout prediction visualization and this was to make visible the probability of a total of 135 students. As in the case of the previous tool, a more extensive pilot is being planned for the beginning of the next semester where, in addition to the tests already carried out, the number of faculties has been increased from two to a total of five. The aim is to reach a total of 29 degrees in the five faculties in order to collect more data about the tool.

3.4 Pilot Projects at Escuela Superior del Litoral (ESPOL)

ESPOL is a public polytechnic university founded in Ecuador in the late 1960s. The university focuses on engineering related degrees with eight faculties.

The main campus has approximately 1,000 full-time faculty members and 12,000 students, including 10,300 in undergraduate and 1,700 in graduate programmes. ESPOL already has a counselling process for established students; this process seeks to reduce dropout rates in the early years. To this end, ESPOL has been working in recent years on improving its counselling tool (SiCa) for students, which has resulted in the development of new visualizations.

3.4.1 Piloting of New Counselling Visualizations in SiCa

In ESPOL the system used in counselling (SiCa) was improved by incorporating three visualizations (see Figure 7, one of them inspired by the LISSA dashboard, designed by KU Leuven). These visualizations show the courses taken each semester with grades, number of times taken, status (failed, passed), and who the lecturer was. For each course, details of average grades and the comparison with peers are shown. A second visualization shows the weekly workload (hours) and the difficulty of the courses added to the plan. The third view allows the inspection of the student's academic history by semester, including a summary and comparison of performance.

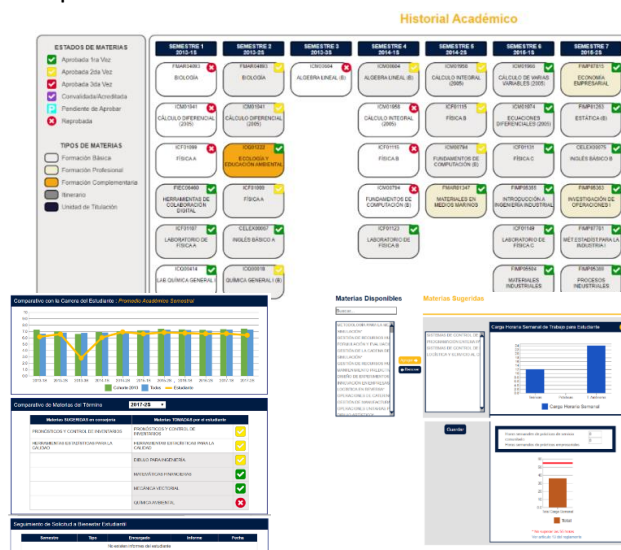


Figure 7. Screenshot of the three visualizations built into SiCa

The piloting in ESPOL began in March 2019 and ended in October 2020. Because ESPOL already had an institutional process for academic counselling, the new visualizations were tested in regular counselling sessions. As a result, the visualizations were made available to all university counsellors. During the training, which was attended by 187 lecturers, counsellors were asked for explicit consent to use their data during and after the training. This consent form was distributed by e-mail and signed electronically by 152 counsellors. However, as the new visualizations were made available to all counsellors, it was used by 416 lecturers, involving 9485 students, during the four semesters that the counselling pilot was conducted.

For the baseline survey, the 152 counsellors who signed the consent form were asked to answer a survey consisting of two questions before learning about the new characteristics. The first was a closed question ("The information currently provided by the counselling system is sufficient to make sound decisions to guide the student") and the second an open question, which covered the justification. The results of this survey show that satisfaction with the current counselling system is not complete, therefore, it endorses the usefulness of the incorporation of the new visualizations.

The training was conducted in one-hour face-to-face sessions and the new features were explained. In addition, participants were asked to respond to a satisfaction survey regarding the new visualizations. The results of this survey show that the visualizations are considered easy to access and navigate, and clearly display the information.



User interactions with the tool were collected through Google Analytics. This use data shows that the tool was consulted 37,804 times, during four semesters. In addition, not all counsellors used the same visualizations. More specifically, most of them used the visualization that allows them to know which courses are available to students, with 23,546 queries.

Additionally, the impact of the use of the tool on the performance of the students involved was measured. For this purpose, the average grade obtained by the students who received counselling during the first semester of 2018 and 2019 was analysed. The results of this analysis show that after piloting the average went from 7604 to 7632. This is not a significant difference, but even if it were, it would still not be possible to link it to the new visualizations. The student's average depends on many factors, both academic and personal. No comparative measurements were made in either of the two semesters of 2020 because the current educational context, caused by the pandemic, forced all classes to be online and could not be compared with a context of previous years when classes were 100% in person.

The final activity of the pilot was the evaluation of the tool after its use. For this purpose, participants were requested to respond to a questionnaire like the one used for the baseline survey. The results show improved results, and this is clear evidence of the usefulness of the new visualizations. Furthermore, freely expressed comments complemented this information and revealed a positive perception of the new features: "The information for counselling students is clearer and more accessible, allowing you to see what happened during the student's degree more quickly and easily, to understand the possibility that the student will fail the degree and to give recommendations that are more suited to the student's reality"; "The new functions are very useful to guide the student properly".

These general results of the pilot confirm the sustainability of the tool and show the commitment of the counsellors to the continued use of the tool. On the other hand, it is necessary to lay the foundation for future studies on the impact on student performance. For more details see section 4.4.1 of this document.

3.4.2 Piloting New Prediction Visualizations in SiCa

The dropout prediction tool used at ESPOL allows you to observe the probability of student dropout in a given curricular map. This probability is calculated by machine learning algorithms and contains a visualization dashboard integrated into the counselling tool (Figure 8). The visualization shows the variables used for the calculation in detail and explains each one for a better understanding of this percentage.

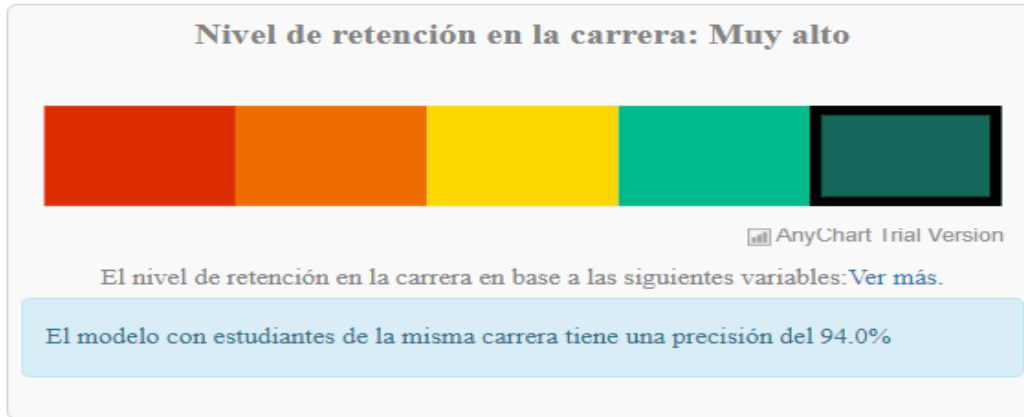


Figure 8. Final version of the visualization of the dropout prediction tool

The tool is integrated with the new visualizations in the LA tool for counselling that the university already had. Therefore, the initial process was similar. The piloting of this tool started in March 2019 but as the calculation of the probability of dropout needed to be improved, it was decided to hide the visualization in order to proceed with an improvement of the predictive models. As mentioned in 3.4 Pilot Projects at the Escuela Superior del Litoral (ESPOL), the university already had a student counselling tool and counselling was already a regular practice at the school, therefore, the pilots performed at ESPOL needed to be more demanding and to offer good predictive accuracy.

In September 2019, a second small-scale pilot was carried out with a visualization that only expressed whether the student had a high probability of dropout (greater than 50%) and the first data regarding the use of the tool's visualization was collected. Finally, in 2020 the tool was shown during the two semesters.

The baseline survey and training were carried out in the same way as with the new visualizations mentioned above in 3.4.1 Piloting of New Counselling Visualizations.

User interactions with the visualization dashboard were collected through Google Analytics. The counselling tool was consulted by a total of 322 lecturers to advise 4850 students, but due to the short time available to the counsellors and the positioning of the prediction tool on the dashboard, only 12 lecturers and 24 students made use of it. Due to this lower use of the prediction tool and with the aim of increasing the number of interactions with it, it has been decided to position its visualization on the main dashboard in the next pilot.

After the small-scale pilot, the prediction algorithms have been improved and the final display has been implemented on the main screen of the counselling dashboard. The tool has been effectively used by 26 and 12 teachers during the first and second semesters of 2020 respectively. Nevertheless, the tool has been available to the 297 and 292 teachers who gave counselling in the first and second semesters of 2020 respectively.

3.5 Summary of Pilotings in Universities External to the Consortium

3.5.1 Pilot at the Universidad de Chile (UChile)

The Universidad de Chile is one of the oldest universities in Chile. It has 5 university campuses distributed in the metropolitan region of Santiago de Chile that offer more than 69 degree programs, in addition to 38 doctoral programs and 116 master's degrees.

One of the most active schools in the field of educational technology is the School of Economics and Business. This school has a Teaching and Learning Center that aims to promote teaching innovation and the use of technology for education. In 2015, the University became part of the group of universities in Coursera and this school, from the Teaching and Learning Center, began to produce MOOCs for its various undergraduate and graduate degrees. Currently, this university has 14 courses on this platform, which are offered both as courses open to all, and as complements to classroom courses.

From the beginning, the school has been interested in attracting students to its courses and has aimed to offer them the best possible experience. One of the problems they have focused on is trying to retain as many students as possible in their courses once they have registered. To this end, the Teaching and Learning Center has experimented with different interventions for this purpose and one of the solutions it proposed as an experiment is the use of NoteMyProgress, a tool to support student self-regulation in courses, which had already been tested at the Pontificia Universidad Católica de Chile. This section describes the pilot case of the use of this tool in four of the courses offered by the University of Chile.

3.5.1.1 Pilot of NoteMyProgress counseling tool at University of Chile

The NMP tool was piloted in four massive courses created by the University of Chile (Chile) and offered through Coursera between September and August 2019. The objective of this pilot was to understand if the use of NMP could be extended to other institutions that used NMP and to detect possible problems in the installation and use of the tool. Therefore, unlike the first pilot, where the interest was to understand the effect of the tool on students, this pilot aimed to understand the problems derived from the adoption of the tool by other third-party institutions, which had not participated in its development.

Due to the nature of this pilot (based on MOOCs), interactions with users were conducted electronically. The socialization of the tool was done through an e-mail, which presented the tool and explained the advantages that NoteMyProgress offers as a complement to the course. The installation of the tool was voluntary, and the students did not receive any remuneration for their participation in the pilot. All students who agreed to participate received an informed consent form. In sum, four teachers were involved in the piloting reaching 95 students of 1252 potential beneficiaries.

For the implementation of the pilot, two researchers/developers from the Pontificia Universidad Católica de Chile and the Director of Engineering Education, all participants in the project, and two people from the Universidad de Chile-- the director of the Teaching and Learning Center of the Economics and Business School of the Universidad de Chile and the systems manager of the same center-- were involved. The development of the pilot was carried out in different phases:

1. Initial phase: During the initial phase, the director of the Teaching and Learning Center of the University of Chile and the Director of Engineering Education held several meetings to explain the



objective of the NMP tool and the pilot, and the most appropriate courses were selected to launch the pilot.

2. Installation phase: The two researchers/developers from the Pontificia Universidad Católica de Chile involved in the development of the NMP tool and participants in the LALA project participated in this phase. In addition, the systems manager of the Teaching and Learning Center of the University of Chile was involved. Before the launch of the pilot, they interacted several times and in several meetings to (1) configure the tool to integrate the courses involved, and (2) coordinate the warning messages for the students in the courses. In addition, during the duration of the pilot, they all exchanged emails to find out if the pilot's follow-up was correct.
3. Completion phase: The two researchers/developers from the Pontificia Universidad Católica de Chile and the service manager of the Teaching and Learning Center of the Universidad de Chile coordinated to finalize the project and send the corresponding completion emails to the course participants.

After the pilot experience, the following conclusions were drawn:

1. The process of installing and configuring the tool for the adaptation of the different courses requires coordination between the two institutions, to ensure that the tool is used correctly.
2. A systems manager is required at the university where the tool is applied to ensure its proper functioning and to send messages to students to inform them about its use.
3. The final coordination of the project requires the involvement of systems managers and researchers if similar conclusions to those of the first pilot are to be reached. In that case, it is proposed that the methodology of analysis explained in chapter 4.5.1 of this document be followed.

3.5.2 Pilot projects at the Universidad Politécnica Salesiana (UPS)

The Universidad Politécnica Salesiana del Ecuador (UPS), created by Law No. 63, published in the Official Register No. 499 of August 5, 1994, is a private Catholic institution of higher education. Its main residence and headquarters are in the city of Cuenca with 25 years of experience in the different branches of university higher education. Among other things, its aim is to form people with human maturity who know how to make a coherent synthesis of ethics, life, and culture, so that they act in history in the line of justice, solidarity, and fraternity, bearing witness to the highest human ethical values. Currently, it has 3 branches in the main cities of Ecuador: Cuenca, Quito, and Guayaquil and with 7 campuses hosting more than 25,000 undergraduate students and around 1,500 graduate students. In collaboration with the LALA project, dashboards have been adapted to implement the academic counseling process at the institution supported by a tool that allows the analysis of the curricular progress and academic performance of students including early grade prediction.

In March 2020, the city of Guayaquil became the epicenter of the COVID-19 pandemic. The Academic Vice-Rector's Office and the Vice-Rector's Office of the Guayaquil Branch decided that it was the most opportune moment to start implementing a pilot project in the Guayaquil Branch of the academic counseling project during the academic period from April to September 2020, in which all the courses in the Guayaquil Branch decided to participate on a voluntary basis.



The Guayaquil campus has approximately 7000 students in 18 undergraduate degree programs who voluntarily got involved and all the degree programs decided to participate with 119 professors with the goal of reaching 50% of the students.

3.5.2.1 Piloting of counseling tool in SCA

The Academic Counseling System (SCA) is an adaptation of the AvAc dashboard, designed by the University of Cuenca in the context of the LALA project, which allows the visualization of the academic trajectory of the students to provide counseling (see Figure 4) and to monitor the progress and performance of the studies. SCA allows you to see the curricular structure, the subjects in the degree program, grades, a graph of the student's academic performance in a semester and the details of each semester, graphs of academic load, the difficulty of the subjects, details of the activities carried out in the AVAC virtual classroom (Moodle), the last connection to this subject in the virtual classroom, personal information with contact details, grants, and foreign language data.



Figure 9. Screenshot of SCA

The pilot project at the UPS Guayaquil Headquarters began in May 2020. Degree program directors and volunteer teachers were trained in the SCA tool, to provide accompaniment during the COVID-19 pandemic.

Sixteen socialization and training sessions were carried out through the Zoom and Webex Cisco platform in which 119 teachers and 16 degree program directors participated. The sessions focused on introducing the tool and giving guidelines on counseling.

Those responsible for distributing the students to their professors were the directors of all the degree programs at the Guayaquil headquarters. 3668 student received counseling in during the piloting.

The data collected by the SCA shows different levels of usage. The number of actions carried out in the tool at the end of the pilot period was 26,074 actions corresponding to the participating tutors who actively use the tool and involve 3,668 students.

In order to evaluate the academic counseling pilot at the end of the cycle, students were sent a survey asking how they would rate the approach of the person who contacted them to talk about their personal situation. Through that, positive results were obtained, with students giving these ratings: 81.59% as friendly, 11.26% said they felt the tutor was interested in their situation, 4.29% warm, and 2.87% Other.

Using the SCA made teachers have personalized conversations with each student. These general results of the pilot show that the system implemented is relevant for the support of academic counselling sessions and lays the foundation for scaling it up at the institutional level as well as for future studies on its impact on student performance.

For more details see chapter 4.5.2 of this document.

3.5.2.2 Prediction Tool Pilot in SCA

The Undergraduate Prediction Tool at the UPS allows you to see the likelihood of a student graduating from a certain degree program (degree prediction). This probability is calculated using machine learning algorithms and contains two displays integrated into the SCA tool. The first one only shows the probability that a student will graduate from a certain degree program while the second one (Figure 5) shows in more detail the variables used for the calculation and an explanation of each one for a better understanding of how different variables influence that degree probability.

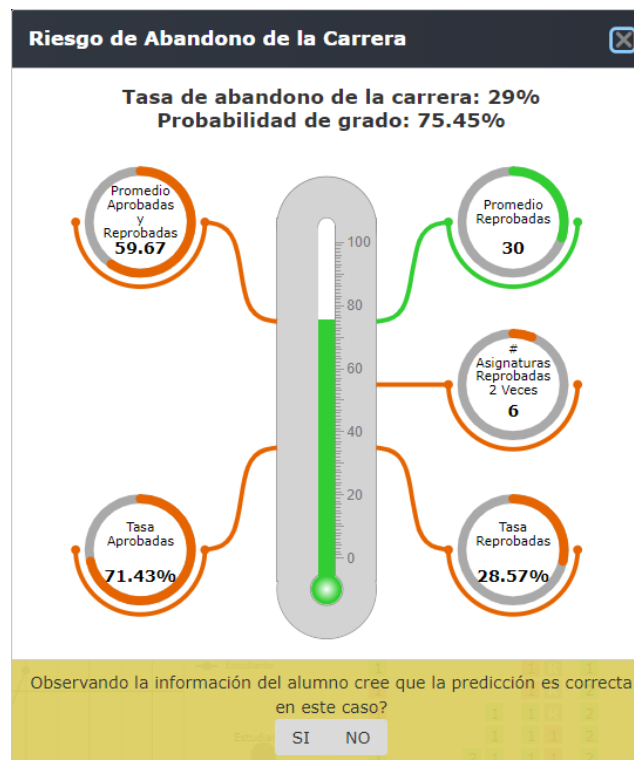


Figure 10. Abandonment Prediction Panel Display

It should be noted that the SCA academic counseling tool also includes grade prediction, that is, it is a functionality that can be seen as part of the counseling. As with the University of Cuenca, everything is integrated and therefore the pilot procedure was carried out in conjunction with the counseling pilot (see section 3.5.1 Counseling Tool Pilot in SCA 3)

Of the 119 tutors who have made use of the SCAs, 511 actions have been performed to display the student information in which the grade prediction thermometer is contained and 87 actions to view the grade probability in detail.

The positive evaluation of the UPS authorities, as well as those involved in the SCA pilots, has enabled the institutionalization of SCA. Evidence of this is that the superior council of the Universidad Politécnica Salesiana in RESOLUTION N°199-10-2020-09-16 resolves: "To approve the "Instructions for Academic Councils" presented by the Academic Council, whose implementation will be in force from the 57th academic period (2020 - 2021) at the national level."

For more details see chapter 4.5.2 of this document.

3.5.3 Pilot Projects at Federal Rural University of Pernambuco (UFRPE)

Federal Rural University of Pernambuco (UFRPE) has 104 years of tradition. UFRPE was founded in 1912, offering one course, and now it covers 59 undergraduate courses, including Administration, Economics, Physical Education, Gastronomy, Information Systems, Computer Science and several Engineering in different campus, as well as Distance Education. UFRPE has more than 1200 professors, more than 1000 technicians and around 17000 students. UFRPE has achieved good results due to investments in teaching, research and extension actions.

However, in Brazil, low completion rates of undergraduate programmes (33%) have been a persistent issue in higher education (OECD, 2019), and UFRPE is no exception. Students at UFRPE have frequently complained to the course coordinators about the lack of interactions with the instructor outside the class sessions. Although it is recognised that feedback plays a crucial role in learning success and the overall learning experience, the teaching staff are generally overwhelmed with teaching and administrative activities, which are time consuming and demanding.

In this context, it was decided that UFRPE would benefit from the adoption of the counselling tool, the early dropout prediction tool and On-task. However, due to COVID-19, among others unexpected events, only OnTask has been successfully piloted to date.

3.5.3.1 OnTask Tool Pilot

The OnTask tool aims to improve the academic experience of students through the delivery of timely, personalized and actionable student feedback throughout their participation in a course. To do this, OnTask gathers and assesses data about student's activities throughout the semester and allows instructors to design personalized feedback with suggestions about their learning strategies (See Figure XX). By providing frequent suggestions about specific tasks in the course, students will be able to quickly adjust their learning progressively. The tool receives its data from various sources such as video engagement, assessments, student information systems, electronic textbooks, discussion forums, etc. Instructors and educational designers can use the platform to connect large data sets about students with concrete and frequent actions to support their learning. Examples of feedback OnTask can facilitate include directing students to specific chapters or worked examples in their textbook, suggesting additional



reading or resources, enrolling them in required workshops or laboratory tutorials, suggesting the most effective study techniques for the tasks in the course, directing them to university support services, etc. The tool is also designed to provide evidence to management bodies about student support actions and their impact on the overall learning experience.

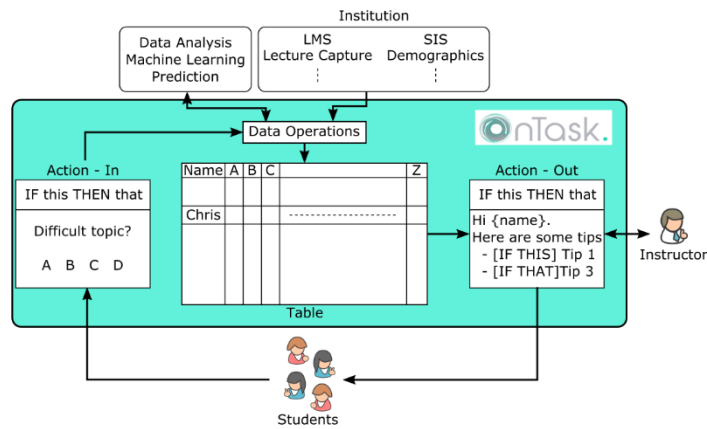


Figure 11. Workflow in OnTask.

OnTask pilot at UFRPE started in August 2019 and ended in December 2019. During this pilot, 3 instructors from the computing department taught 3 courses using OnTask to provide personalized feedback (all participants signed consent forms). In terms of students, these courses involve 112 students.

Within the pilot, one day face-to-face session was held to socialize the tool and provide training about its use. After the use of OnTask, informal interviews were held with the instructors and information was collected from the student by a survey.

The aim of the survey was to evaluate student experience with the feedback that you have received from your instructor using OnTask. Also, this survey helps the extent of the improvement in feedback practices at the UFRPE.

From the informal interview with instructors and logs analysis, we can conclude that: OnTask is easy to use for instructors with computer science background; 3-4 session of 30-40 minutes each are needed to prepare weekly feedback.

Form the survey response we can conclude that: students show highly appreciate of feedback practice; students were generally satisfied with the feedback received through OnTask. From the impact perspective, due to the feedback, students declare that they can develop and adjust learning strategies and are motivated to work towards a desired goal. Additionally, students declare OnTask is useful because they receive oportune feedback and help to mapping with goals in the course.

For more details, see section 4.5.3 of this document.

3.5.4 Pilotajes en el Instituto Tecnológico de Zitácuaro

Instituto Tecnológico de Zitácuaro is a higher education institution from Mexico. In collaboration with the LALA Project, an early dropout prediction tool has been adapted.

3.5.4.1 Pilots with the prediction tool

The early dropout prediction tool is an adaptation of the tools developed in the LALA project. In this case, for the pilot, there are no graphical interface but the prediction results are presented to the actors in a textual form.

The pilot revealed acceptable prediction results, but there is room for improvement. A qualitative analysis revealed interest in the tool but there are different issues to improve.

For a more detailed description, please see chapter 4.5.4 of this document.

4. Detail of the Pilot Projects

4.1 Pilot Projects at Universidad Austral de Chile (UACH)

4.1.1 TrAC Counselling Tool Pilot Project

The TrAC (Trajectory and Curriculum Advisory) tool allows school directors (programme directors) to view academic information about their students superimposed on the curriculum structure.

The main objective of the tool is to assist school directors in making decisions regarding enrolment and withdrawal applications for courses that students take each semester, mainly at the beginning of the semester, based on the possibility of visualizing, in an integrated manner, the structure of the curriculum of each student (courses, semesters, requirements), and the performance of students in courses (grades, withdrawals, repetitions).

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool
- Computer technician for service support (tool availability)
- Project researchers for data collection and analysis
- Pilot Team
 - **Project Coordinator**
 - **Specialists in technological infrastructure**
 - **Group for training, pilot project support and monitoring**
 - **Administrative Assistant**
- Participants. The target audiences to be reached within the university are:
 - End users:** directors of schools of the Faculty of Engineering Sciences and of the degree programmes in English Pedagogy, Nursing, Chemistry and Pharmacy, Medical Technology, Occupational Therapy and Veterinary Medicine.
 - Managers:** Dean's team of the Faculty of Engineering Sciences, Director of Undergraduate Studies, Director of Institutional Analysis and Accreditation Officer.
 - Others Involved:** Directorate of Information Technology and Head of Computer Science at the Institute of Computer Science.

Planning

Table 2 presents the phases, activities, dates, methodologies, efforts, and artefacts planned for the execution of the pilot project. During the execution of the project, these phases were adapted to various emerging situations, such as the rescheduling of academic activities following student strikes.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Artefact development		25/01/2019	Development of artefacts such as presentations, email support.
	Socialization of the pilot plan with stakeholders		16/01/2019	Socialization Conference (directors of the schools of Engineering and English, Nursing, Chemistry, Pharmacy, Medical Technology, Occupational Therapy, Veterinary Medicine, Dean and Staff) Socialization workshop
	Training of pilot programme staff	14/01/2019	25/01/2019	Pilot staff training workshop (student working toward a degree)
Agreement	Agreement with the participants		25/01/2019	Project meeting
Training	Training for technicians	27/02/2019	15/03/2019	Training workshop for technicians
	Training for users	27/02/2019	15/03/2019	Training workshop for users (school directors who signed agreement)
	Training for administrators	27/02/2019	15/03/2019	Training workshop for administrators (Dean's Team, Undergraduate Director, Institutional Analysis Office, Accreditation Office)
Use	Accompanying users	16/03/2019		Face-to-face support Remote support
	Socialization of experiences		April, May, July 2019	Workshop of socialization of experiences (1st Report of the experience, 2nd Report of the experience, 3rd Proposals of continuity of use)
	Evaluation		April, May, July 2019	Partial evaluation workshop
Evaluation and Improvement (includes internal work)	General evaluation	04/2019	08/2019	Evaluation study
	Documentation of improvements	05/2019	09/2019	Documentation of improvements

Table 1. TrAC counselling pilot planning

A description follows of the development and results obtained after carrying out each of the activities in the phases mentioned in Table 2.

Phase 1: Preparation

Processes included in the pilot project

During the pilot, the process of deciding on special course enrolment and withdrawal applications was included. This process does not currently have a decision support system, so the TrAC (Trajectory and Curriculum) tool is incorporated into it.

This tool allows school directors (Program Directors) to visualize academic information about their students overlaid on the structure of the curriculum. The main objective of the tool is to assist school directors in making decisions regarding enrolment and withdrawal applications for courses that students take each semester, mainly at the beginning of the semester, based on the possibility of visualizing, in an integrated manner, the structure of the curriculum of each student (courses, semesters, requirements), and the performance of students in courses (grades, withdrawals, repetitions).

The dates on which the enrolment and withdrawal processes are carried out are defined in the university's academic calendar. The following table shows the detail of each one:

FIRST SEMESTER of 2019	
18 to 29 March	Period in which the Schools receive applications for enrolment of subjects corresponding to the first semester 2019.
1 to 12 April	Period for school directors to resolve subject enrolment requests, according to applications made by students.
15 to 29 May	Period in which the Schools receive requests for the withdrawal from subjects corresponding to the first semester 2019.
30 May to 12 June	Period for school directors to resolve student requests to cancel courses.
Second semester 2019	
12 to 23 August	Period in which the Schools receive applications for the enrolment of subjects corresponding to the second semester 2019.
26 August to 6 September	Period for school directors to resolve subject enrolment requests, according to applications made by students.
12 to 23 October	Period in which the Schools receive requests for the withdrawal from subjects corresponding to the first semester 2019.
24th to 30th October	Period for school directors to resolve student requests to cancel courses.

Table 2. List of relevant pilot activities

Current situation of the processes included

Information was collected that offers evidence on the situation currently faced by school directors in terms of the tasks related to the processes of resolving enrolment and withdrawal applications for courses (baseline). The information collected has served to measure the relevance and impact produced by the incorporation of the TrAC tool. The instrument used to collect this information, the population surveyed, and the results obtained are detailed below.

Utility and impact baseline

For the baseline survey, two face-to-face surveys were conducted with school directors. Baseline Survey (ELB): "Baseline" or "Diagnostic" survey (UACH Annex 1) and EPPA: "Perception of the Application Process Survey" (UACH Annex 2). These surveys assess the following aspects.

1. Perception of time compared to various other tasks related to the post.

2. Perception of the number of applications that must be answered at the beginning of each semester.
3. Perception of amount of time needed to resolve a request.
4. Perception of the support they receive from the university to perform the task.
5. Importance of the university offering a support service in the application process.
6. Self-reported level of trust in enrolment and withdrawal decisions.
7. Perception of the importance of reviewing academic records and identifying relevant information
8. Number of students per school.

In the first survey (ELB) a total of 27 faculty directors participated and in the second survey (EPPA) a total of 20 faculty directors participated, corresponding to faculties at the Valdivia Campus and Puerto Montt Campus detailed in Table 4.

Faculty	Quantity ELB	Quantity EPPA
Faculty of Engineering Sciences	8	5
Faculty of Medicine	4	3
Faculty of Philosophy and Humanities	1	1
Faculty of Agricultural Sciences	1	1
Faculty of Sciences	3	2
Faculty of Architecture and Art	2	2
Faculty of Law and Social Sciences	1	1
Campus Puerto Montt	7	5
Total	27	20

Table 3. Faculty directors participants by each survey.

In general, the results of the surveys show that the process of resolution of applications (process to be involved in the pilot) can be improved. Their improvement could impact the quality of decisions, decrease the time dedicated to this work and also generate greater satisfaction with the support provided by the university.

The results obtained for each aspect evaluated in the surveys are described below.

1. Perception of time compared to various other tasks related to the post.

62.9% of those surveyed considered that the amount of work involved in dealing with special subject enrolment and withdrawal requests at the beginning of the semester was greater than other school management tasks.



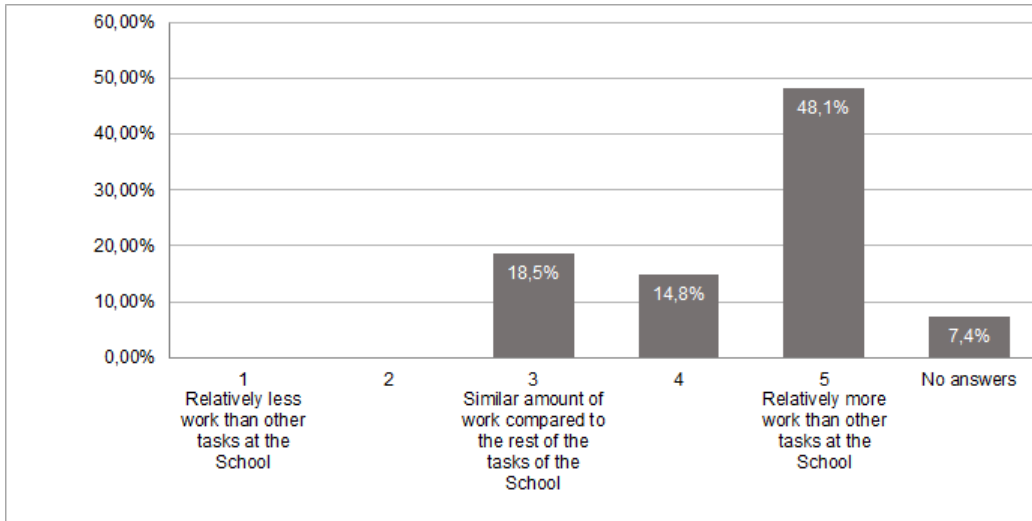


Figure 12. Perception of time compared to other tasks of the post.

2. Perception of the number of requests to be answered at the start of each semester

- 51.9% of those surveyed resolved more than 50 applications for enrolment of subjects online at the beginning of each semester.
- 44.4% of those surveyed resolved between 11 and 50 applications for enrolment of face-to-face courses each semester and another 25.9% resolved more than 50 applications.
- 59.2% of those surveyed resolved between 11 and 50 requests for withdrawal from online courses during the semester.
- 66.6% of those surveyed resolved between 1 and 25 requests for the withdrawal from face-to-face courses during the semester.

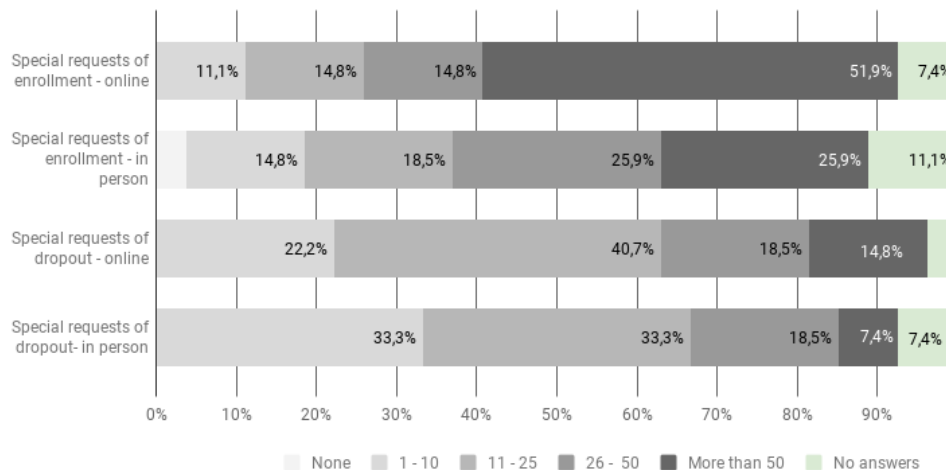


Figure 13. Number of requests.

3. Perception of amount of time to resolve a request

- 40.7% of respondents take an average of 5-10 minutes to complete each online course enrolment request.
- 44.4% of respondents take more than 10 minutes on average to complete each application for face-to-face courses.
- 44.4% of respondents take an average of 5-10 minutes to process each online course withdrawal request.
- 40.7% of respondents take more than 10 minutes on average to deal with each request for withdrawal from face-to-face courses.

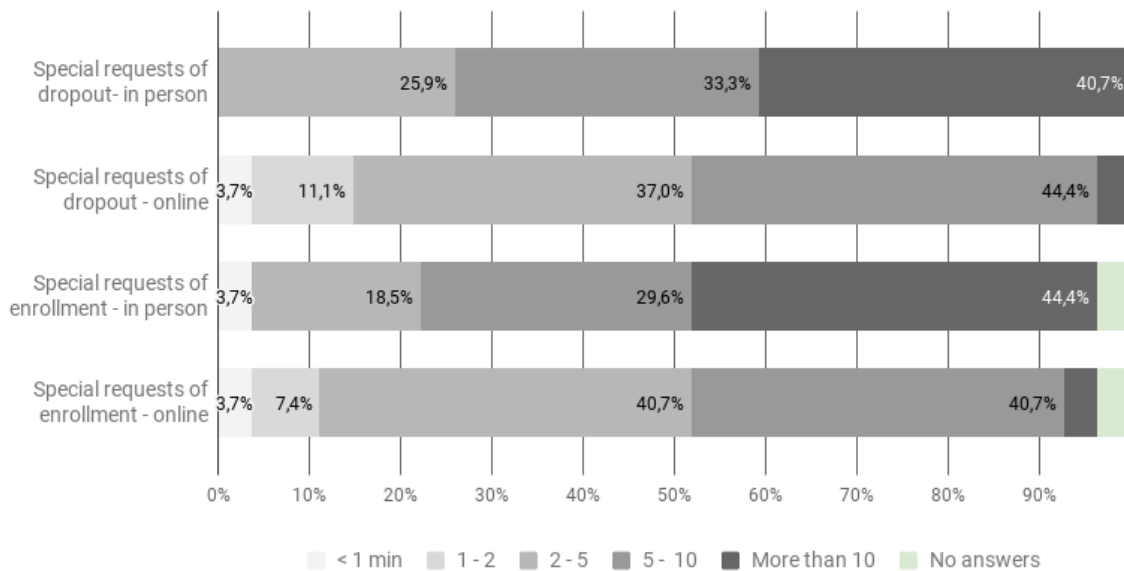


Figure 14. Estimated time to resolve requests.

4. Perception of the support they receive from the university to perform the task

- 55% of the respondents agree completely to partially that the University provides tools and information needed to resolve enrolment and withdrawal applications effectively.
- 45% of respondents moderately to strongly disagree that the University provides the tools and information needed to resolve enrolment and withdrawal applications efficiently.

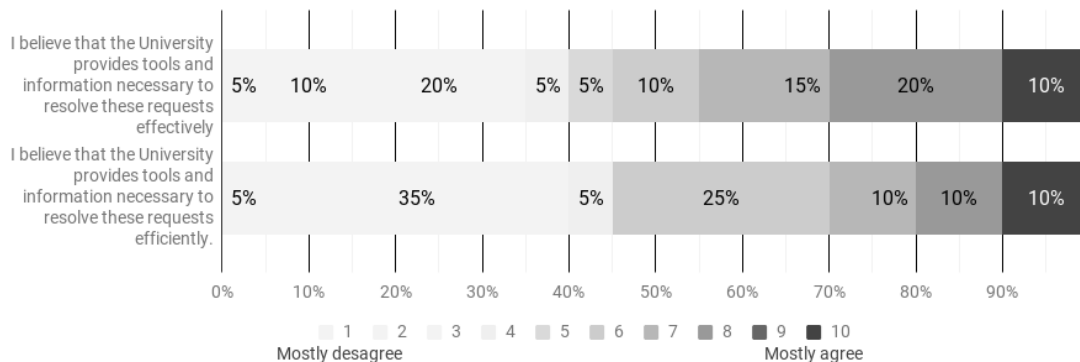


Figure 15. Perception of the support they receive from the university to perform the task.

5. Importance of the university offering a support service in the application process.

- 85% of respondents strongly agree that it is important for the university to have a service to support the process of attending to and resolving applications for enrolment and withdrawal from courses.
- 55% of respondents strongly agree that it is important for the university to offer students a face-to-face support service in the application process.

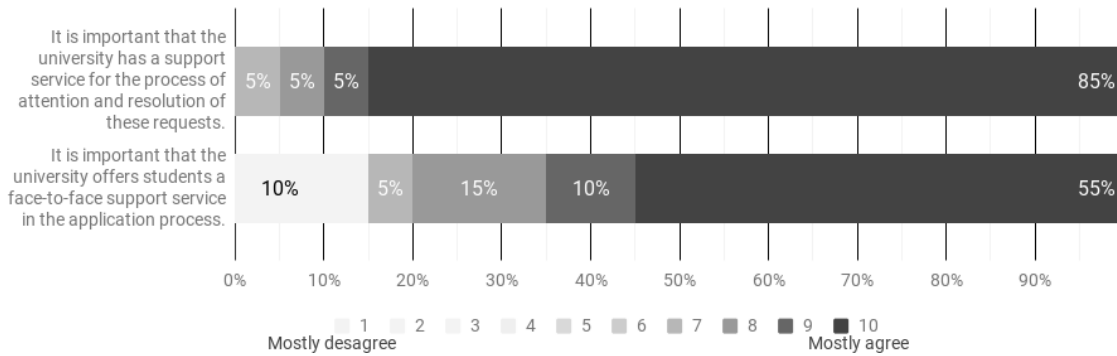


Figure 16. Importance of the university offering a support service in the application process.

6. Self-reported level of confidence with enrolment and withdrawal decisions

- 57.9% of those surveyed agree that they are generally satisfied with the decisions they make when deciding on special enrolment and withdrawal applications.
- 50% of respondents agree that they are confident that special enrolment and withdrawal requests are properly dealt with.

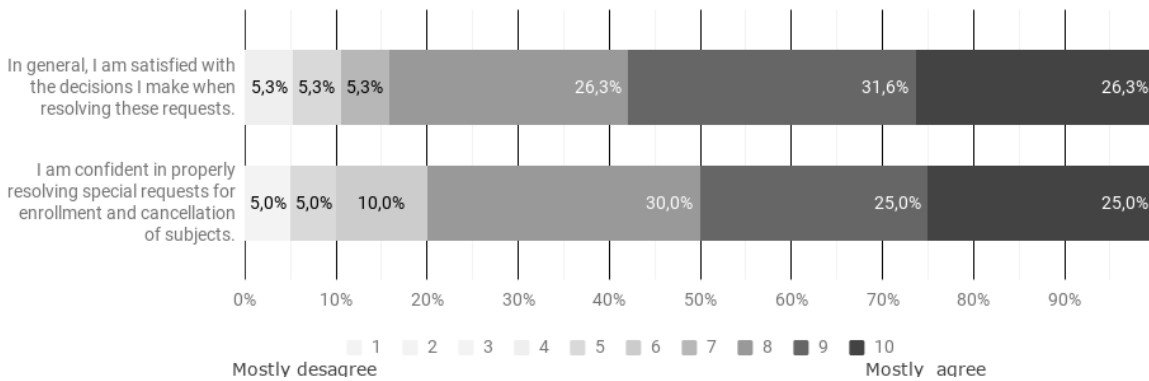


Figure 17. Self-reported level of confidence with enrolment and withdrawal decisions.

7. Perception of the importance of reviewing academic records and identifying relevant information

Through an open-ended question, opinions were collected on the importance of reviewing academic trajectories and relevant information in making decisions regarding enrolment and withdrawal applications.



Figure 14 shows that the vast majority of respondents (90%) say that it is important or very important to be able to access the academic record of the student who makes a special subject request in order to make a decision about it.

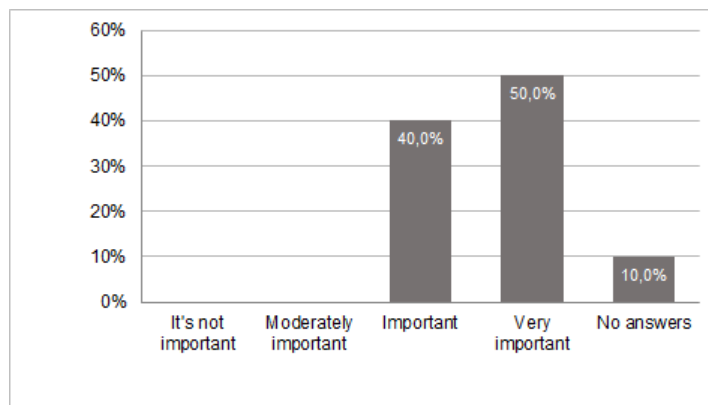


Figure 18. Importance of access to the student's academic record

School directors consider the following data to be the most relevant for decision-making:

- Curriculum development.
- Cumulative General Average (CGA) and Semester Weighted Average (SWA).
- Number of subjects passed per semester.
- Previous year's grades.
- Courses cancelled/failed (how many times).
- Subjects registered in the corresponding semester.
- Applications from previous years.
- Undergraduate resolutions.
- Fulfilment of pre-requisite subjects.

8. Number of students per school (potential impact)

This information was not collected from the surveys. The information is relevant because it shows the number of students potentially benefiting from the use of the tool. Based on the statistics published in the 2019 report, the number of students per degree programme involved in the pilot is detailed in Table 5. There are 5870 students who could potentially benefit from the pilot.

Faculty / Degree	Total number of students potentially involved
Design	81
Visual Arts	155
Geology	335
Chemistry and Pharmacy	403
Agronomy	513
Law	468
Civil Engineering in Informatics	304
Civil Engineering in Civil works	421
Acoustic Civil Engineering	122

Naval Engineering	258
Bachelor in Engineering Science	88
Pedagogy in Communication of the English Language	207
Kinesiology	285
Occupational therapy	300
Nursing	314
Industrial Civil Engineering (Puerto Montt)	494
Commercial Engineering (Puerto Montt)	339
Information and Management control Engineering	257
Nursing (Puerto Montt)	291
Pedagogía en Educación Diferencial con Mención	235
TOTAL	5870

Table 4. Total number of students potentially involved by degree.

Phase 2: Agreements

Description of the pilot population

A total of 23 school directors signed the agreement document (see UACH Annex 3) to participate in the pilot project. Sixteen of them were from the Valdivia headquarters and seven from the Puerto Montt headquarters (see Table 6).

Rol	Unit	Number
Faculty Director	Design	1
Faculty Director	Geology	1
Faculty Director	Chemistry and Pharmacy	1
Faculty Director	Agronomy	1
Faculty Director	Electronics Civil Engineering	1
Faculty Director	Informatics Civil Engineering	1
Faculty Director	Civil Engineering in Civil works	1
Faculty Director	Building Engineering	1
Faculty Director	Pedagogy in Communication of the English Language	1
Faculty Director	Kinesiology	1
Faculty Director	Public administration	1
Faculty Director	Speech Therapy	1
Faculty Director	Industrial Civil Engineering	1
Faculty Director	Commercial Engineering	1
Faculty Director	Information and Management control Engineering	1
Faculty Director	Psicology	1
Faculty Director	Pedagogy in Differential Education with Pedagogy mention	1
Faculty Director	Bachelor in Engineering Science	1
Faculty Director	Naval Engineering	1
Faculty Director	Acoustic Civil Engineering	1
Faculty Director	Occupational therapy	1
Faculty Director	Visual Arts	1
Faculty Director	Nursing	1
Total		23
Distribution by gender		
Women 11 (47,8%)		
Men 12 (52,2%)		

Tabla 5. Total number of Faculty directors by Unit which have signed the agreement.



Phase 3: Training

Description of the training phase

Three training workshops were held, each at the participants' headquarters. That is, two workshops at the Valdivia headquarters and the other at the Puerto Montt headquarters, with a duration of 3 hours each.

The objective of the workshops was to provide instruction that would allow school directors to understand how the TrAC tool supports decision-making processes and how TrAC facilitates feedback to students during their university life.

The workshops consisted of three activities detailed below:

Activity 1

- Response by the participants to the questionnaire on perception (See UACH Annex 2) of the process of attention to applications.
- Presentation of the TrAC tool.

Activity 2

- Presentation of real cases that exemplify how the TrAC tool can be used.
- Individual work by the participants that consisted of the resolution of one or two real requests, writing the sequence of steps when solving each one.
- Group discussion.

Activity 3

- Evaluation of the training through a satisfaction survey

Description of participants in the training phase

The workshops brought together a total of 20 school directors (11 women and 9 men) from the Valdivia and Puerto Montt sites. The first workshop was held on April 8th in Puerto Montt, the second workshop on April 9th in Valdivia, and the third workshop on August 10th in Valdivia, which we call session 1, session 2 and session 3, respectively.

The profile of the participants can be summarized through the following characteristics:

- The time spent in the role of school director. This characteristic varies among participants, where the shortest time in the role is only one month compared to the longest of nine years. Most of them have been in the role for less than three years.
- The age of the participants. Most participants are between 40 and 49 years old.
- Level of technology use. The participants state they possess a medium-high level of technology use. Tables 7, 8 and 9 detail the characteristics of the participants in sessions 1, 2 and 3, respectively.

Role	Unit	Time at this role	Age range	Gender	Level of technology use
Faculty Director	Nursing	9 months	40 to 44	Woman	Medium
Faculty Director	Industrial Civil Engineering	9 years	40 to 44	Woman	Medium
Faculty Director	Commercial Engineering	4 years	40 to 44	Woman	Medium
Faculty Director	Information and Management control Engineering	1 year and 6 months	35 to 39	Woman	High
Faculty Director	Pedagogy in Differential Education with Pedagogy mention	No information	No information	Woman	No information



Total: 5 Participants
Distribution by gender
Women 5 (100%)
Men 0 (0%)

Table 6. Summary of participants in session 1 of training

Role	Unit	Time at this role	Age range	Gender	Level of technology use
Faculty Director	Design	No information	No information	Man	No information
Faculty Director	Geology	No information	No information	Man	No information
Faculty Director	Chemistry and Pharmacy	10 months	45 to 49	Woman	Medium
Faculty Director	Agronomy	4 years	40 to 44	Woman	Medium
Faculty Director	Law	1 months	40 to 44	Man	Medium
Faculty Director	Civil Engineering in Informatics	3 years	45 to 49	Woman	High
Faculty Director	Civil Engineering in Civil works	1 year and 2 months	45 to 49	Man	High
Faculty Director	Pedagogy in Communication in English language	7 months	40 to 44	Woman	Medium
Total: 8 Participants					
Distribution by gender					
Women 4 (50%)					
Men 4 (50%)					

Table 7. Summary of participants in session 2 of training

Role	Unit	Time at this role	Age range	Gender	Level of technology use
Faculty Director	Naval Engineering	3 years	40 to 44	Man	High
Faculty Director	Kinesiology	No information	No information	Man	No information
Faculty Director	Nursing	3 years	45 to 49	Woman	Medium
Faculty Director	Bachelor's in science engineering	1 month	60 to 64	Man	High
Faculty Director	Visual arts	1 month	40 to 44	Man	Medium
Faculty Director	Acoustic Civil Engineering	3 years	50 to 54	Man	High
Faculty Director	Occupational Therapy	No information	No information	Woman	No information
Total: 8 Participants					
Distribution by gender					
Women 2 (28,6%)					
Men 5 (71,4%)					

Table 8. Summary of participants in session 3 of training



Evaluation of satisfaction of training phase participants

To ascertain each participant's assessment of the training, a satisfaction survey was carried out in an online format (see UACH Annex 4). In it, each participant had to select his or her level of satisfaction in relation to different aspects of the training. In addition, lessons learned from the workshop and suggestions for improvements to the tool were collected. This survey was answered at the end of the workshop.

The main results of the satisfaction survey are:

- 55.6% of the respondents had a positive perception of the workshop.
- 44.4% of the respondents had a positive appreciation of the format in which the workshop was held.
- 33.3% of respondents fully agreed that they felt confident about starting using the tool in the pilot, whereas 33.3% said they agreed somewhat with feeling confident.
- 44.4% of respondents fully agreed that they knew where to go or who to contact for problems or questions during the pilot.
- 55.6% of respondents fully agreed that they would recommend the training to another colleague.

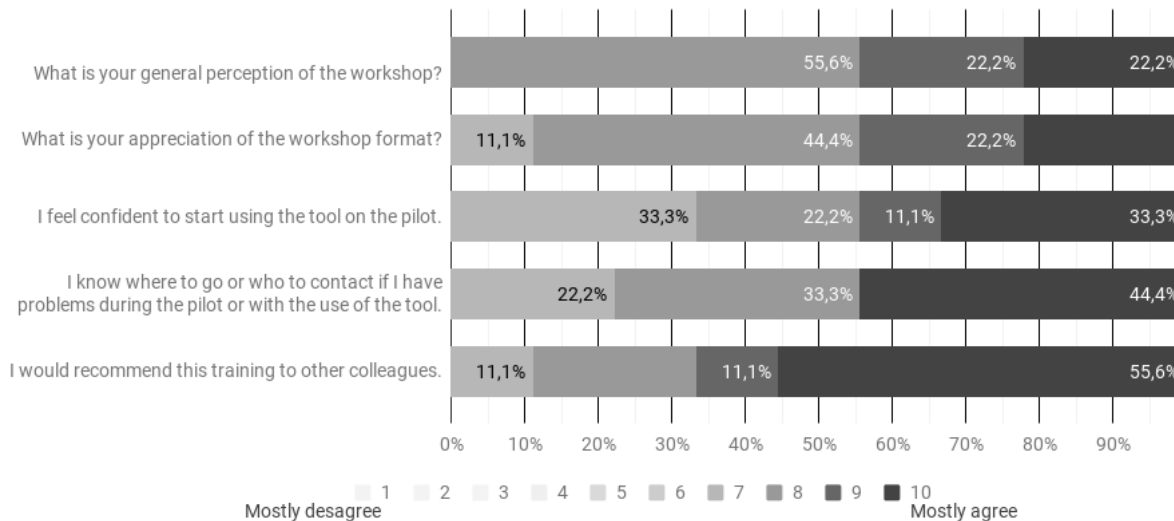


Figure 19. Training satisfaction survey results

Evaluation of learning achievement of training participants

To assess learning achievement, participants were asked to resolve actual requests regarding their programme (degree). As they resolved each request, they were asked to record the resolution process on a form (see UACH Annex 5).

For each request, the director had to record the level of complexity of the request (1: very simple, 10: very complex), then for each action performed, its type was recorded (A: Analysis, B: Search, D: Decision), description and level of satisfaction (1: not very satisfied, 10: very satisfied)

The following indicators were defined to describe whether the expected learning was achieved in the participants:

1. The participant is able to resolve any request.
2. The participant performs at least one action of each type.

3. The participant solves requests of different difficulty.

The results with respect to the indicators can be seen in *Table 10* and *Figure 16*. The results show that the vast majority of participants who carried out the activity achieved the learning objectives, where Indicator 3 caused the most difficulty, as most participants solved low difficulty requests. Indicators without information are due to participants who were not able to participate in the entire workshop.

Faculty	Indicator 1	Indicator 2	Indicator 3	General result
Nursing	No information	No information	No information	No information
Industrial Civil Engineering	Achieved	Achieved	Not achieved	Achieved
Commercial Engineering	Achieved	Achieved	Not achieved	Achieved
Information and Management control Engineering	Achieved	Achieved	Partially achieved	Achieved
Pedagogy in Diferential Education	Achieved	Achieved	Not achieved	Achieved
Design	No information	No information	No information	No information
Geology	Achieved	Achieved	Not achieved	Achieved
Chemistry and Pharmacy	Achieved	Achieved	Achieved	Achieved
Agronomy	Achieved	Achieved	Not achieved	Achieved
Law	Achieved	Achieved	Not achieved	Achieved
Civil Engineering in Informatics	Achieved	Achieved	Partially achieved	Achieved
Civil Engineering in Civil works	Achieved	Achieved	Partially achieved	Achieved
Pedagogy in Communication in English language	No information	No information	No information	No information
Naval Engineering	Achieved	Achieved	Partially achieved	Achieved
Kinesiology	Achieved	Achieved	Achieved	Achieved
Nursing	Achieved	Achieved	Achieved	Achieved
Bachelor in Engineering Science	Achieved	Achieved	Achieved	Achieved
Visual Arts	Achieved	Achieved	Partially achieved	Achieved
Acustic Civil Engineering	No information	No information	No information	No information
Occupational Therapy	Achieved	Achieved	Partially achieved	Achieved

Table 9. Indicator results by degree



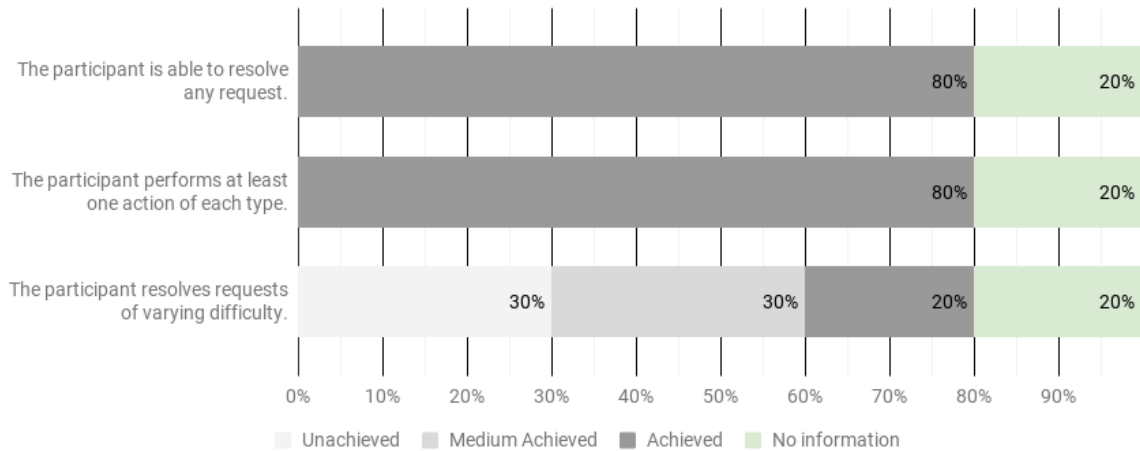


Figure 20. Results of learning achievement indicators by degree programme.

Phase 4: Use and Impact

Descriptive statistics of use records

The TrAC tool has a system that records the actions performed by users on it. The analysis of these registered actions, in the period from March to November 2019, shows that 22 users have used TrAC at least once. These users correspond to those who participated in the pilot from the beginning and to new users who joined after the training. Of the 22 users, 21 are school directors, and 1 user is the undergraduate director general (who requested access to TrAC to inspect cases within his competence). The 22 users have performed a total of 7007 actions (actions in the system other than logging in). These actions involve inspecting students, clicking on courses, etc. In total, users have inspected 464 different students (not all of them have participated in face-to-face sessions).

Figure 18 and Figure 19 show the distribution of the actions carried out by the users and students inspected, respectively. As can be seen, there are different intensities of use.

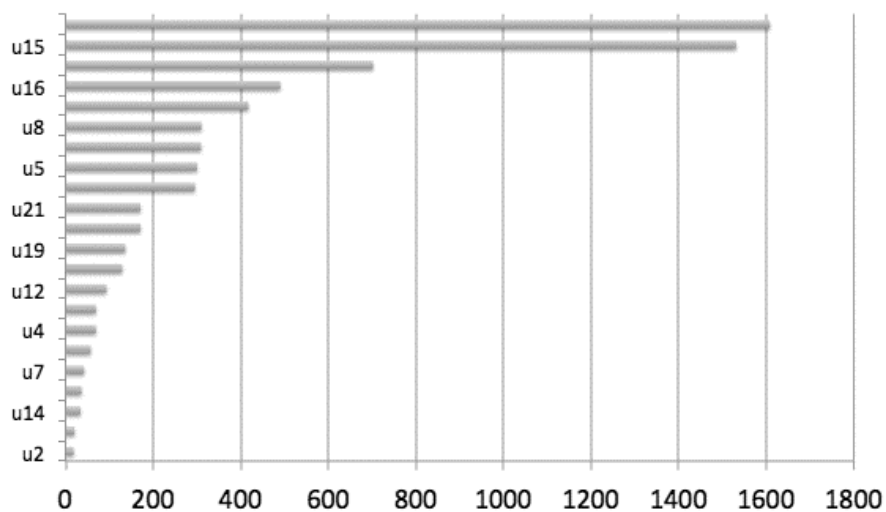


Figure 21. Number of actions by school directors

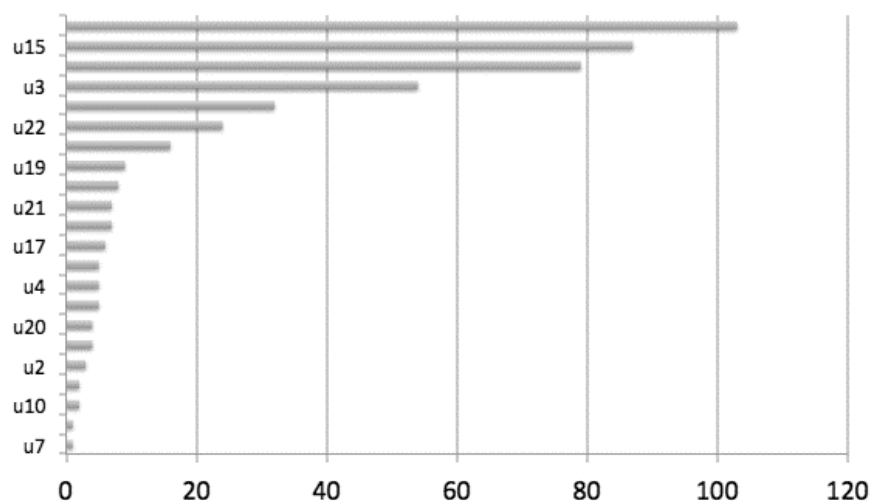


Figure 22. Number of students inspected per user.

TrAC use and utility survey

To collect information on the use or practices supported by the TrAC tool during the counselling process, each director was asked to use the tool during sessions where they receive students in person. It should be noted that these face-to-face sessions represent a subset of the directors' work with respect to the resolution of applications, the vast majority of which are resolved online. At the end of the face-to-face counselling sessions, both the director and the student involved answered a survey (See UACH Appendix 6). This survey consists of open and closed questions.

The surveys were delivered on 7 May 2019 to school principals at the Valdivia site and on 7 June, 2019 to school principals at the Puerto Montt site. The results of these surveys are discussed below.

Results of the survey on the use and utility of TrAC in face-to-face counselling

To obtain results, the records made by two school directors in 17 counselling sessions were analysed. In these face-to-face sessions, school directors interacted with 19 students who also recorded their views on the use of TrAC in the session. The answers to the open questions allow us to determine that:

- School directors have used TrAC in face-to-face counselling sessions and the vast majority positively assess all aspects evaluated in the survey. That is, attention to students using TrAC becomes more effective and efficient, as well as helping to communicate and understand the current situation and look at the future situation of the student.
- Likewise, students consider that the use of TrAC in face-to-face sessions supports the visualization of their academic situation by facilitating reflection on the past and present situation. It therefore facilitates decision-making. It is noteworthy that the vast majority of students would like to continue using TrAC and also have access to TrAC independently.

The results of the closed questions are shown in the following figures:

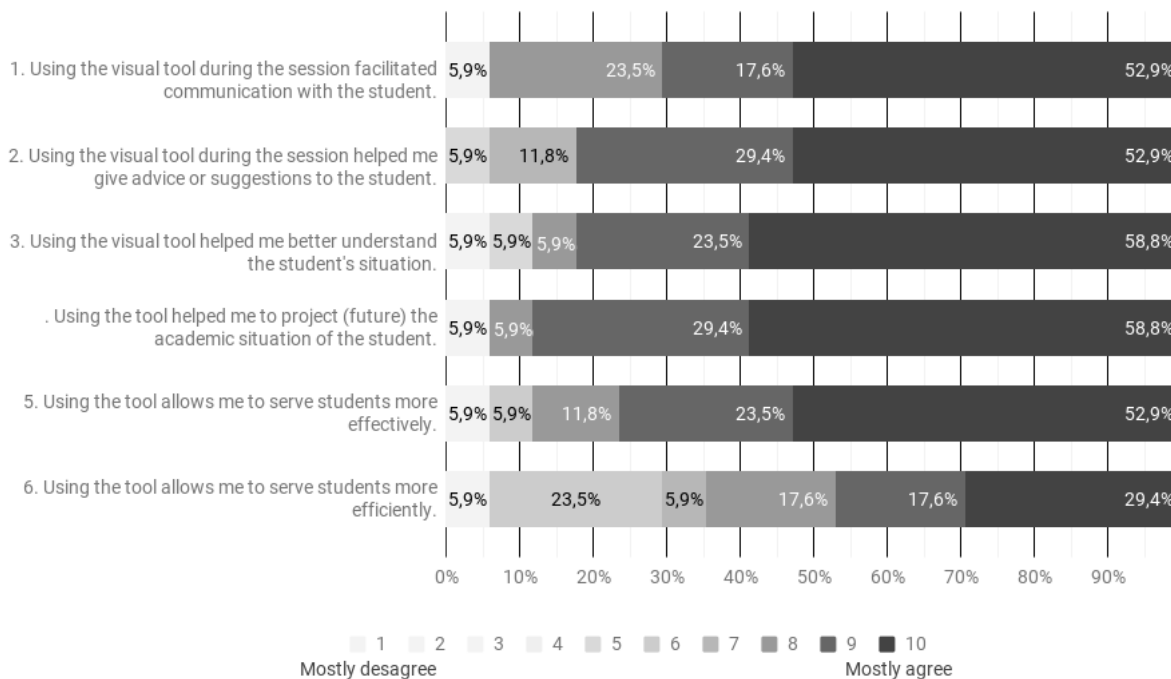


Figure 23. Results of a survey on the usefulness of TrAC in face-to-face counselling (counsellors).

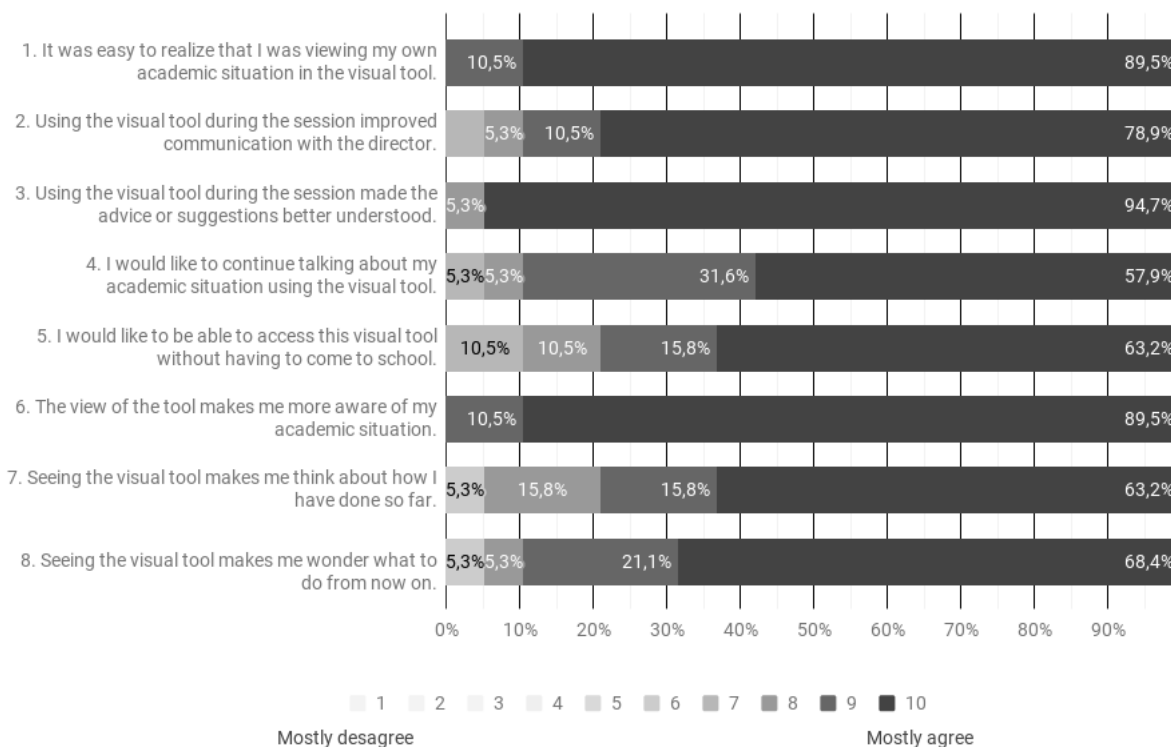


Figure 24. Results of a survey on the usefulness of TrAC in face-to-face counselling (students)



Impact on student performance results

To evaluate whether the pilot has positively influenced student performance, the change in position of the students involved in the 2018 versus 2019 ranking was analysed. The choice of measuring performance according to the cohort ranking was made to mitigate the effects of unexpected events in a semester, as all students in the cohort are exposed to these events. It also enabled evaluation of the performance of each student before and after the incorporation of the tool.

The analysis of the 352 students involved during the first semester 2019 demonstrated that 200 of them (57%) showed an improvement in their performance in the following semester. This improvement is shown by the fact that the students included held a better place in the ranking with respect to their cohort. More specifically, they improved 9.8 positions on average. Figure 21 shows the distribution of this difference.

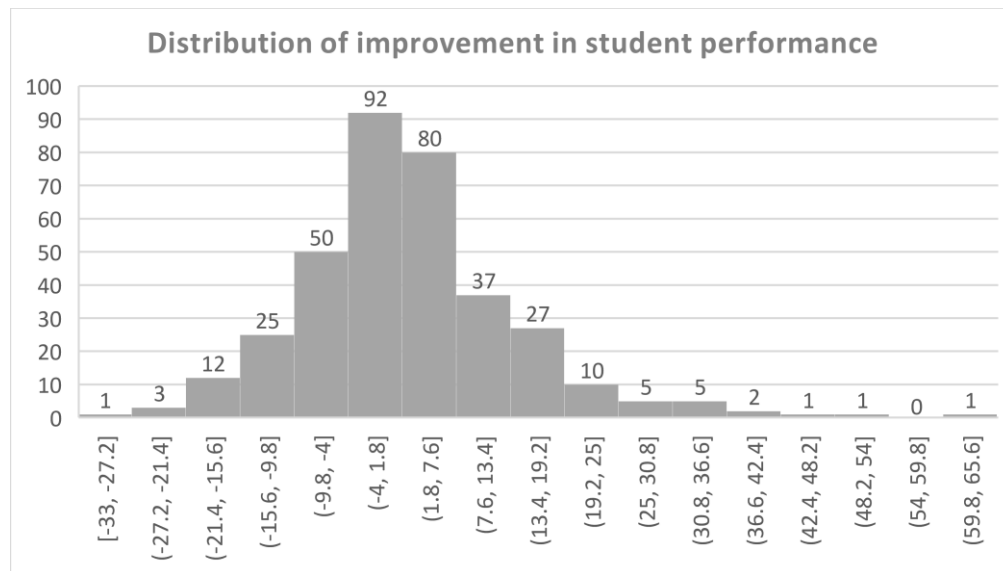


Figure 25. Impact on student performance

While these results are inconclusive because isolating the effect of one counselling tool from the other events that affect a student's performance is very difficult, it provides a basis for future, more detailed analysis.

Phase 5: Evaluation and Improvement

Description of evaluation and improvement

After training and making the tool available for use, an assessment was made of whether participants perceive an improvement in the application resolution process. This improvement is measured in terms of time, confidence in decisions and the perception of support in this work. Based on this assessment, an analysis was made of possible improvements and adaptations to be made to use TrAC in other institutions.

The activities and results of this evaluation are discussed below, and as will be seen below, they show a positive impact that meets the expectations for the tool and for the pilot project.

Socialization and evaluation activity

Two socialization and evaluation sessions were held with school directors, one on 7 May at the Valdivia site and the other on 7 June at the Puerto Montt site, each lasting one and a half hours. The workshops were held during the course withdrawal process. The objective of these sessions was to provide a space for school directors to socialize about the use of the TrAC tool and its integration into their activities. Through this activity it was possible to evaluate the usefulness and impact of TrAC and also the relevance of the process followed during the pilot.

The workshops were divided as follows:

Activity 1

- Responding to a questionnaire on the perception of the usefulness and impact of the TrAC tool and the perception of the piloting process (see UACH Annex 7).
- Presentation of the new features of the TrAC tool.

Activity 2

- Guided group discussion.

Activity 3

- Delivery of surveys for face-to-face counselling (discussed above in the Use Phase).

A total of 11 school directors from the faculties and degrees detailed in Table 11.

Faculty	Number
Faculty of Science Engineering	2
Faculty of Philosophy and Humanity	1
Faculty of Sciences	2
Faculty of Architecture and Arts	1
Faculty of Law and Social Sciences	1
Commercial Engineering	1
Industrial Civil Engineering	1
Information and Management control Engineering	1
Nursing	1
Total	11
Distribution by gender Women 7 (64%) Men 4 (36%)	

Table 10. Involved degrees in the activity.

TrAC utility results

Regarding the use of the tool, the directors say that while for them it does not change the process they follow when resolving an application, TrAC has helped them to optimize the time spent on resolution as it allows them to visualize a lot of information more easily. Also, the tool helps them to reduce errors during resolution thanks to the easy access to the information they need, several mention that with the current system they must access different sections to obtain the necessary information.

Figure 22 illustrates the results obtained in the questions concerning the usefulness of using TrAC. The results show that:

- Most participants consider that after the incorporation of TrAC the decision-making process for resolving applications has not changed.
- Most participants consider that the use of TrAC has provided access to more information for deciding on applications.
- Most participants fully agree that using TrAC helps to make better decisions about applications.
- Most participants feel that using TrAC helps to better explain their application decisions.
- Most participants say they would like to continue using TrAC if the tool is available.

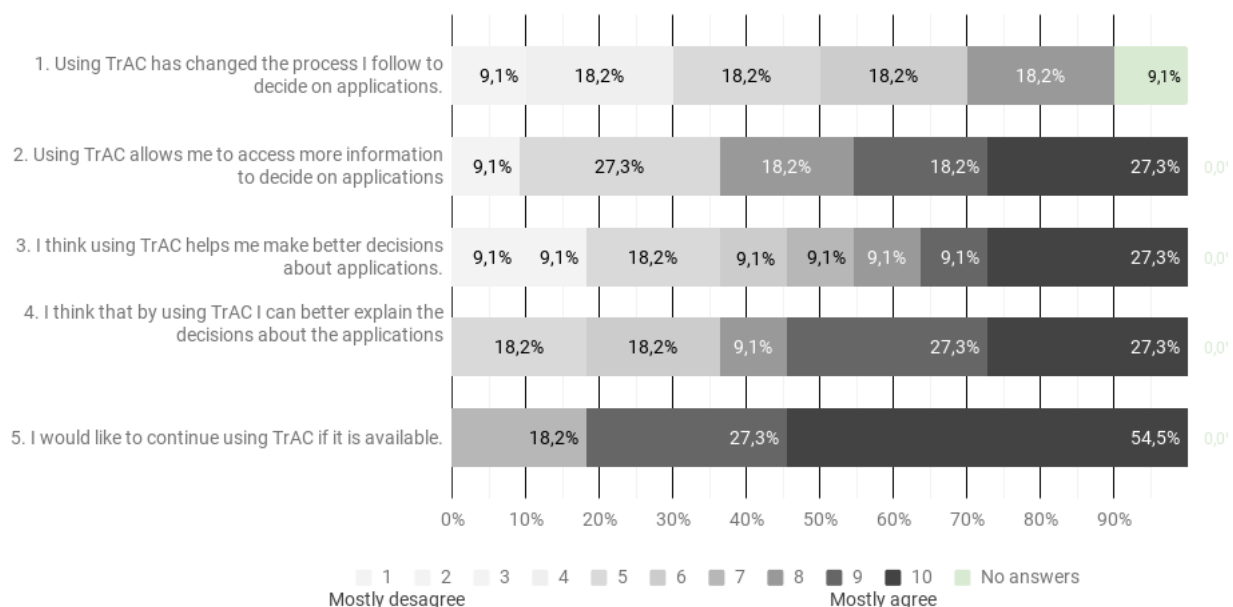


Figure 26. Usefulness results on the use of TrAC.

Results related to impact (decision-making) of TrAC

TrAC has allowed school directors to visualize problems in the structure of the curriculum. For example: in the case of end-of-studies subjects that require having fulfilled all the previous requirements, when looking at the grid in its entirety, you can see that these subjects have not taken that into consideration, thus identifying errors with the curriculum.

Several directors mention the importance of students accessing the tool in order to improve their own decisions when requesting their subjects and to advance in their degree programme, to plan more effectively.

Figure 24 illustrates the results obtained in the questions concerning the impact produced by the use of TrAC. The results show that:

- On average, most participants felt that TrAC allowed them to visualize 'bottleneck' subjects on the curriculum (question 1 in the graph).
- Most participants stated that TrAC has enabled them to generate new ideas for curriculum improvements (question 2 in Figure 15).



- On average, TrAC has changed directors' perceptions of students' academic progress trajectories (question 3 in the graph).
- Most participants agree that using TrAC has made them think about possible changes in the prerequisite subject structure (question 4 in the graph).

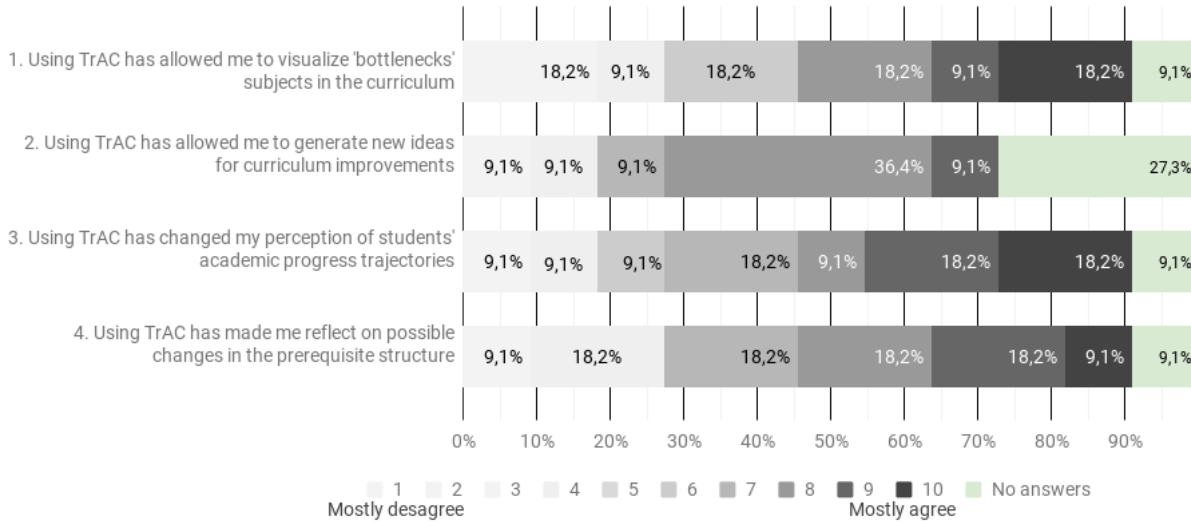


Figure 27. Results of the impact of the use of TrAC.

Results of the pilot process perception

In general, the activities carried out during the pilot process have been evaluated very positively by the participants, as most of them rate them as "Very relevant" (see Figure 25).

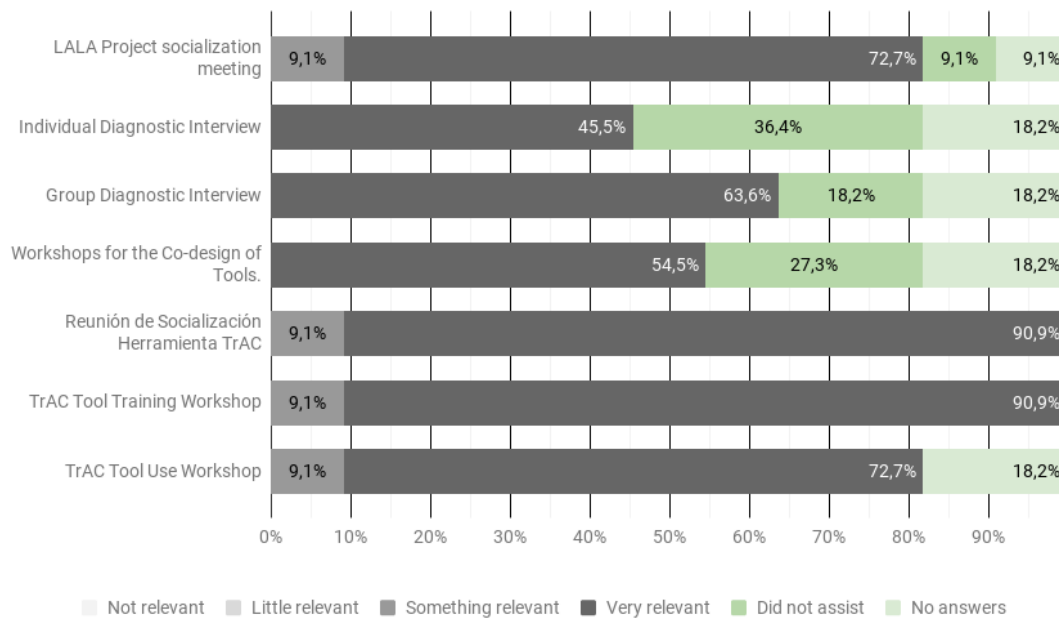


Figure 28. Results of the relevance of the piloting process.



Summary of improvement proposals

During the socialization activities with the school directors, proposals for improvement in the visualization of the tool were detected. The improvements that were addressed during the piloting process are listed below.

- Improved requirements display including subjects that have the currently selected subject as a requirement
- Highlights of subjects the student is currently taking
- Treatment of equivalent subjects
- Show eliminations
- The 4.0 threshold and the AGA of the degree programme were incorporated into the student's trajectory
- Users with multiple programmes
- Student version tool
- Case of mentions (in process)

The following is a list of improvements that have not been addressed during the pilot and will be addressed in future work:

- Median on histograms
- Integration with the schools' administrative system
- Display of e-mail, name, and photo of the student
- Cohort Views
- Organization of the curriculum by disciplinary areas and specialization
- Allow dashboard to be exported to PDF

During the pilot, improvement possibilities were detected that impact the ease of operation and administration of the tool. The following is a list of improvements that have been addressed during the pilot:

- Creating a user administration module
- Code refactoring for automatic detection of using the anonymization service
- Improved error handling while maintaining safety
- Incorporation of continuous integration practices

Closing and evaluation activity

Two closing and evaluation sessions were held with school directors, one on October 4 at the Puerto Montt headquarters and the other on November 27 at the Valdivia headquarters, each lasting one and a half hours. The aim of these sessions was to provide a space for school principals to reflect on the use of the TrAC tool and integration into their activities. Through this activity it was possible to evaluate the usefulness and impact of TrAC as well as the usability of the tool.

The workshops were divided as follows:

- Guided group discussion
- Development of a questionnaire on the perception of utility, impact, and usability of the TrAC tool (see UACH Annex 8).

A total of 8 school directors from the faculties and degree programmes detailed in *Table 12*

Faculty	Number
Faculty of Science Engineering	3
Faculty of Sciences	1
Faculty of Law and Social Sciences	1
Commercial Engineering, Puerto Montt	1
Information and Management control Engineering	1
Nursing, Puerto Montt	1
Total	8
Distribution by gender	
Women 5 (64%)	
Men 3 (36%)	

Table 11. Degrees involved in the activity.

Closing survey results

The System Usability Scale (SUS) results average 76.9, which is considered good. The distribution of the score is shown in the *Figure 26*.

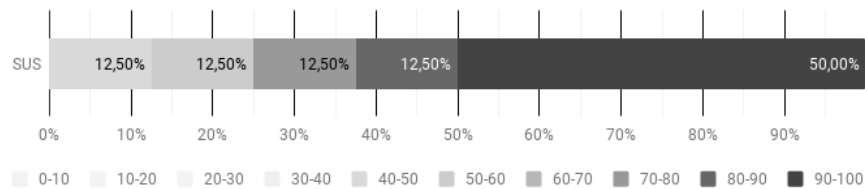


Figure 29. Distribution of SUS score in TrAC tool

The results on the impact and usefulness of the tool are shown in Figures 27, 28 and 29, corresponding to the resolution of applications for special subject enrolment, subject withdrawal, and counselling sessions, respectively.

The results show a positive evaluation of the tool, especially because it promotes more efficient and effective work and provides means to a better explanation of decisions.

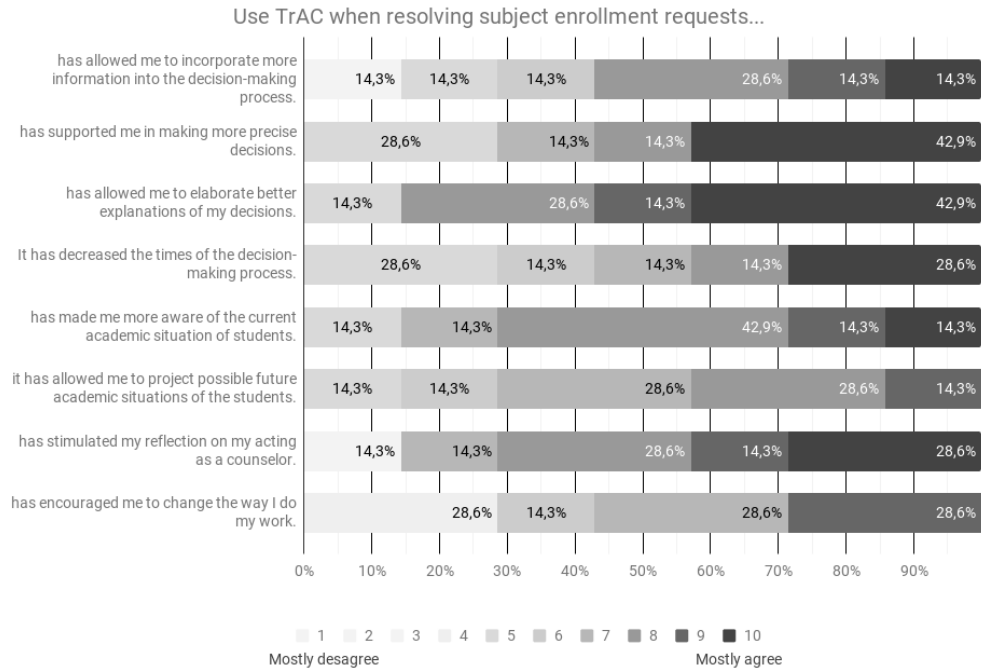


Figure 30. Perception of impact and usefulness of TrAC in the resolution of special applications for the enrolment of subjects

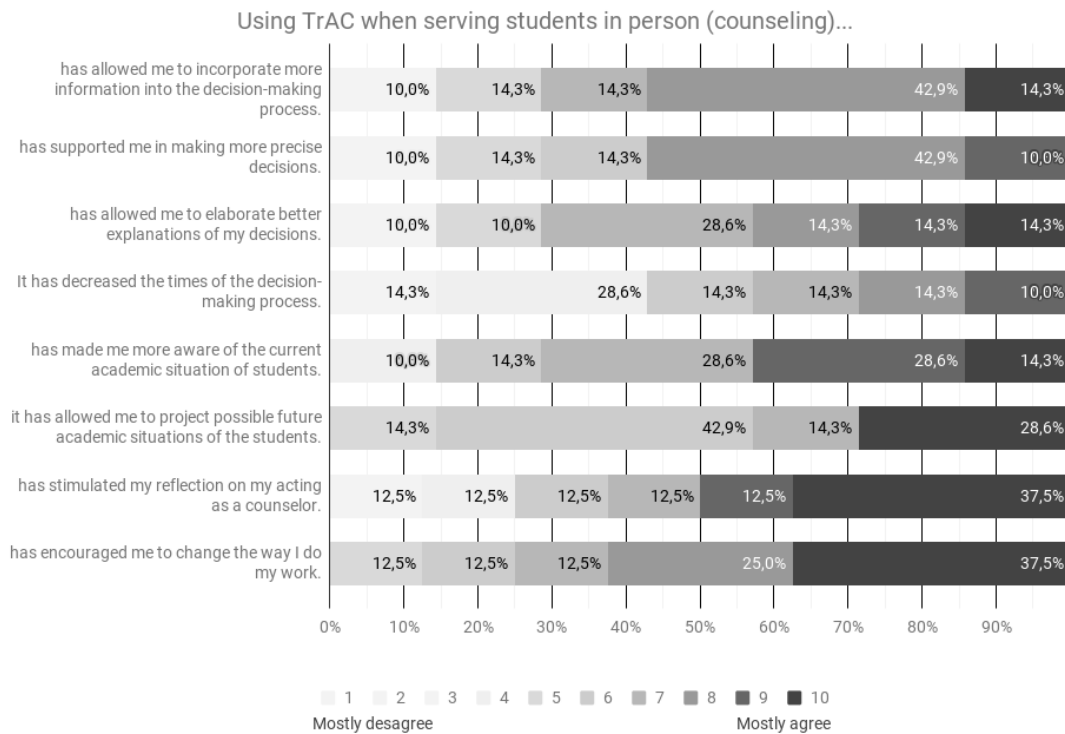


Figure 31. Perception of impact and usefulness of TrAC in the resolution of special requests for withdrawal from courses



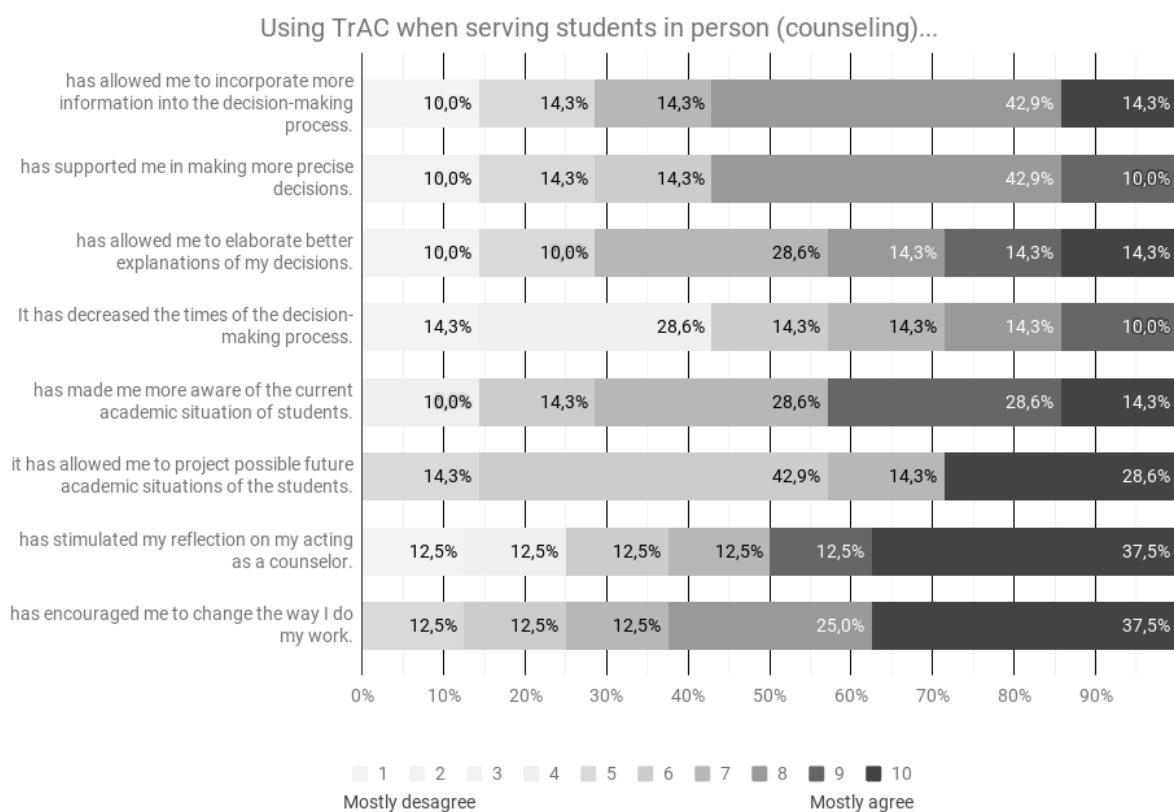


Figure 32. Perception of impact and usefulness of TrAC in face-to-face counselling sessions

Post-pilot analysis results

This section presents the **list of lessons learned** from the pilot conducted. This list is intended to guide other institutions in their piloting process when adopting TrAC or another LA solution.

For an organization to implement an LA pilot requires a **multifunctional team** to lead the initiative. This team should oversee defining the pilot plan and coordinating the relationship with the rest of the stakeholders. This team should be responsible for the following tasks: (1) planning of the pilot and the ethical management needed to carry out the activities; (2) preparation of the contents to be disseminated during the pilot, such as presentations of the tool, manuals, and an invitation to participants; (3) coordination of the pilot from planning to execution, data collection and analysis.

It is necessary to have **technical staff** as part of the team. They should oversee updating the data related to the programmes (degrees) in which the pilot is going to be held and of verifying that the data shown in the tool reflects reality. In addition, they must periodically analyse the tool use data. This is of great importance to take remedial action if users are not actively participating.

Define **data exchange protocols**. In the case of the UACH there is no protocol for exchanging data with non-institutional tools. Therefore, an early definition of this protocol and concrete data exchange allows the tools to be more useful and their real relevance to be evaluated.

Communication of concrete results is vital to the success of an LA pilot, so a data analyst should be responsible for collecting and analysing the logfiles collected, as well as processing the data collected in surveys and group discussions. From these data, analytical reports should be generated to be shared and

disseminated with the participants of the pilot, and with the leaders of the institution. The communication of the activities carried out and the results of the pilot are very relevant evidence when it comes to ensuring sustainability.

In addition to the lessons learned, we have identified **some aspects of improvement for the planning of future pilots**:

- The activities defined in the pilot must be complemented by intensive dissemination activities. And a manager must be defined for this activity.
- The tools should be socialized early with the authorities of the institution. To detect possible conflicts with the institution's security and ethical policies.
- Socialize the tools with other users, even if they are not specifically designed for them. In the case of TrAC it was found that with minimal modifications the tool could be used by students.
- Detailed planning at the beginning of the pilot should be considered useful to guide the process. However, social mobilizations (particularly frequent in the Latin American context) have a wide participation of university students. This is why academic calendars are likely to be affected and, with them, the key activities for piloting and availability of those involved.
- The data used by the tools as well as the results of the algorithms must be analysed in detail before being shared with the end users. Because data errors can undermine the trust built by the team.



4.1.2 TrAC Prediction Tool Pilot Project

The prediction extension to the counseling tool in TrAC (Academic and Curricular Path) allows school directors (program directors) to preventively attend to possible students at student risk, considering this model a complement to the visualization of information academic award granted by TrAC. Consequently, TrAC is an integration of visualization and prediction of academic trajectories to support the counseling of principals.

The main objective of the extension is to proactively support school directors in making decisions regarding the detection and monitoring of students who are at risk of dropping out, mainly at the beginning of the semester, based on the possibility of visualization, in an integrated way, of the structure of the curriculum of each student (courses, semesters, required courses), the performance of students in courses (grades, cancellations, repetitions) and the risk indicators that extend the visualization.

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool
- Computer technician for service support (tool availability)
- Project researchers for data collection and analysis
- Pilot Team
 - **Project Coordinator**
 - **Specialists in technological infrastructure**
 - **Group for training, pilot project support and monitoring**
 - **Administrative Assistant**
- Participants. The target audiences to be reached within the university are:

End users: directors of schools of the Faculty of Engineering Sciences and of the degree programmes in English Pedagogy, Nursing, Chemistry and Pharmacy, Medical Technology, Occupational Therapy and Veterinary Medicine.

Managers: Dean's team of the Faculty of Engineering Sciences, Director of Undergraduate Studies, Director of Institutional Analysis and Accreditation Officer.

Others Involved: Directorate of Information Technology and Head of Computer Science at the Institute of Computer Science.

Planning

Table 13 presents the phases, activities, dates, methodologies, efforts, and artefacts planned for the execution of the pilot project. During the execution of the project, these phases were adapted to various emerging situations, such as the rescheduling of academic activities following student strikes.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Artefact development		25/06/2020	Development of artefacts such as presentations, email support.
	Socialization of the pilot plan with stakeholders		02/07/2020	Socialization Conference (directors of the schools of Engineering)
	Training of pilot programme staff	25/06/2020	01/07/2020	Pilot staff training workshop
Agreement	Agreement with the participants		02/07/2020	Project meeting
Training	Training for users	09/07/2020	25/07/2020	Training workshop for users (school directors who signed agreement)



Use	Accompanying users	09/07/2020	25/07/2020	Remote support
	Socialization of experiences		25/07/2020	Workshop of socialization of experiences
	Evaluation		25/07/2020	Partial evaluation workshop
Evaluation and Improvement (includes internal work)	General evaluation	08/2020	10/2020	Evaluation study
	Documentation of improvements	10/2020	11/2020	Documentation of improvements

Table 12. TrAC prediction pilot planning

A description follows of the development and results obtained after carrying out each of the activities in the phases mentioned in Table 13.

Phase 1: Preparation

Processes included in the pilot project

During the piloting, the decision-making process of detection and monitoring of students at risk of dropping out was intervened. This process does not currently have a support system for decision-making, but users have already used the TrAC (Academic and Curricular Path) tool as a platform for viewing and evaluating students' paths during academic application processes.

Current situation of the processes to intervene

Information was collected that evidences the situation that school directors currently face in terms of the tasks related to the processes of detection and monitoring of students at student risk (baseline). The information collected has served to characterize the relevance and impact produced by the incorporation of the prediction model in the TrAC tool.

Baseline of utility and impact

To obtain the baseline, a survey (see UACH Annex 8) and a semi-structured interview (see UACH Annex 9) were conducted with the participating School Directors. These instruments are intended to identify and characterize the process intervened from the experience of school directors and current regulations. Below are some of the findings identified from the sessions with the school principals.

The **results of the survey** show that the information available in the current management system of the UACH to identify students at risk of being a student is complete, relevant, and accessible (8.3 out of 10). However, there is no consensus regarding aspects such as the timeliness of the information and the ease and speed with which it can be accessed. For its part, TrAC counselling is evaluated positively (8.8 out of 10) in aspects such as relevance, accessibility, ease and speed. In summary, TrAC complements the current management system of the UACH, since it is better evaluated in those weak aspects of the management system.

These results show that there is room for improvement in both systems, as far as this project is concerned, the improvement should focus both on addressing those aspects in which TrAC has been evaluated negatively, but also improve even more in the aspects evaluated positively.

During the semi-structured interviews, the school directors describe the process of identifying students at risk of dropping out as reactive. For example, one of them mentions, when faced with the task of

identifying students at risk, that "it is more reactive. The boys come to ask, or to request something, and there I look at them". While the other participant indicates that "you show me ten students and tell me, let's see which of these is going to have a possible dropout, I don't know that." Likewise, the tools available to principals to determine possible students at risk of dropping out correspond to request instances, where principals observe the academic trajectories of students to make decisions. Thus, one of the directors mentions "the requests make me see [the trajectories of] a large number of students who have complications entering their subjects, and there, I do an analysis of why and talk with them, the requests tell me [problems]". Which shows how reactive the identification process is. In the same way, the other director mentions that "I, only, based on the hard data that I have in the system, could infer which person is going to be able to cancel a semester or could gather all the academic part", reaffirming the reactive characteristic of the process, as well as the heterogeneity of actions that contribute to the identification of students at risk.

On the other hand, the criteria used to identify possible students at risk appear to be diverse and heterogeneous among participating principals. However, it seems that social and emotional factors have a strong presence in the decisions of students when leaving the race. In other words, one of the directors describes the difficulties of the students regarding learning strategies as "Good students who have sent me a semester suspension because they have not been able to get used to remote study and self-study online for the issue of COVID-19. As long as there is COVID-19, I am going to suspend my studies and good students, with a good development in their career, with semesters with good averages. How do I tell you something very personal ", while the other director mentions that the emotional can be influenced by academics, mentioning that" for me it is a mixture of ... emotional or psychological issues, pressures and academic performance, and that academic performance may be mainly related to mathematics, physics, and basic sciences, which are not prepared."

Likewise, the directors have indications about what could be the main causes of academic dropouts, due to their trajectory in office. Shortcomings are recognized in academic preparation before entering university, as indicated by one of the directors saying that "they do not come prepared and you have to take care of all that ... and that falls back, it weighs on the boys." Furthermore, patterns are identified in the academic trajectory, which is analysed when students make requests to school principals. This is evident in the director's comment, where he indicates that he recognizes a student in difficulty when "this person first had PGA (accumulated general average) 4, then it dropped to 3.2 and then to 3.9. I also check the amount of cancellation of bouquets. The first semester did not cancel anything, then it began to cancel in the following semesters "or from the other director, who indicates that" one of the things that is a bad symptom is when the student begins to throw out bouquets, some begin to appear in the subjects".

In any case, the initial evidence shows that the process is based on the observation of the academic trajectory, analysing key indicators that require attention. However, the process continues to be reactive, responding to student requests and, perhaps, at times that may be late to provide support or follow-up to those in difficult and even critical situations.

To follow up on students who have or could have academic difficulties, there is also no consensus on the approach based on specific activities or strategies. Rather, the initiatives arise from the experience of the directors, the management tools available and the context of the school. Thus, for example, one of the directors bases his strategy on building community and trust, indicating that to address the



accompaniment of students he relies on “conversations, conversations in the room, in corridors, some in the office, if it is already something, he's seriously turning his head, ehhhh to the office. So, but it is, mainly, because I have taught them, and for a matter of face observation”. While the other director bases his strategy on those students who come to the school for support in academic management, indicating that “[students] who communicate a lot, talk a lot, are people who find it difficult.”

The process of detecting and monitoring students at academic risk of dropping out requires a considerable effort, since it is necessary to explore institutional data sources where it is necessary to do “a lot of click, the information is very dispersed in the same system on many screens”, which obfuscates and reduces the quality of the information. Or it is necessary to maintain close contact with the students, considering that “data management is that, in itself, having contact with students takes time” and that the director mentions that he must “enter the student's routine or the I search for their surnames. I click on the subjects taken. Seeing how this person entered such a year, for example 2016, I begin to see the degree of advancement in the career, and I see that he is not making much progress”.

Therefore, the academic management system presents deficiencies in the quality of the information and its usability, complicating not only the process under study but also others associated with school management.

Phase 2: Agreements

Description of the pilot population

The two school directors who participated in this pilot have signed the agreement document (see UACH Annex 3) to participate in the pilots of the LALA project. However, as the sessions were recorded, they were asked verbally for permission to record.

Both participants belong to the Faculty of Engineering Sciences, at the Valdivia campus of the University (see Table 14).

Role	Unity	Number
Faculty Director	Civil Engineering in Computer Science	1
Faculty Director	Civil Engineering in Civil Works	1
Total		2
Distribution by gender		
Female 1 (50%)		
Male 1 (50%)		

Table 13. Number of Faculty Directors per Unit who have signed an agreement.



Phase 3: Training

Description of the Training Phase

A training session was held with each director independently. That is, each director received the credentials of the version of the tool that had the prediction extension and that they could explore, autonomously, during a week before the training session. This session lasted approximately 1 hour, where the participants had to make use of the new predictive functionalities of the tool to detect, visually analyze and monitor the academic trajectory of students at risk of dropping out.

Phase 4: Use and Impact

Descriptive statistics of use records

The TrAC tool has a system that records the actions that users perform on it. The analysis of these registered actions, in the period from July to October 2020, shows that both participants used TrAC at least once. It is important to note that these users have participated in the piloting of the tool from the beginning, so they know the functionalities of visualizing academic trajectories and the different options for their analysis. Users have performed a total of 352 actions (actions in the system other than entering the system). These actions involve inspecting students, clicking on courses, etc. In total, users have inspected 14 different students.

TrAC Risk Use and Utility Survey

To collect information on the use or practices supported with the TrAC Risk tool during the counselling process, each principal was asked to use the tool to identify and follow up on students at risk of dropping out. Notably, these sessions represent a subset of the directors' work. At the end of the sessions, the participating directors answered a survey (See UACH Annex 10) and participated in a semi-structured interview (see UACH Annex 11). The purpose of both instruments was to evaluate the quality of the information presented by the tool in the intervened process and their perceptions about its usefulness in the risk detection process.

The **results obtained in the survey** reveal that the incorporation of TrAC Risk did not alter the frequency of use of the tool when addressing the academic processes carried out by school directors. Likewise, the results regarding the relevant, accessible, easy and quick access to information to identify students at risk remained positive (9 out of 10) compared to the initial evaluation of TrAC counselling. The greatest improvement in the results is observed in the timeliness and completeness of the information offered by TrAC Riesgo. This represents a substantial improvement over TrAC counselling.

In summary, the evaluation of the use of risk TrAC shows that it is a more useful and usable tool than the current management system of the UACH in all the aspects evaluated and also presents an improvement compared to TrAC counselling.

From the **semi-structured interviews**, it was determined that, with the incorporation of the risk model extension in TrAC, the principals naturally recognized the criteria associated with the student's risk of dropping out. For example, they combine risk variables that are present in tab a of TrAC, indicating that "for example, I would start looking at them with the highest risk percentile. And, what catches my attention, for me is a decisive factor, the fact that students have low progress in relation to the year of entry "or that" this one entered recently and has been short "or that" 90% abandonment 'yes poh, he's



been fed up and he's made little progress". Therefore, the tab presented variables that made sense to the directors in relation to the process of detecting students at risk.

Likewise, it is observed that the directors follow a similar pattern of analysis, that is, they first select the risk and progress criteria to then validate the indicators with respect to their academic trajectory and, finally, extract common patterns of academic behaviour. This is evidenced by the fact that, when selecting a student who, according to the principal, was at high risk, identifies that "he is doing almost pure end-of-basic science subjects ... that is, he is playing everything for everything" or "Here is one thing, in my personal experience as a school principal it is a field that costs them a lot. Graphic Methods for Engineering, mmm, this is a kind of [complicated] field for students "or" he has had difficulties, but not all of them in ... no, I think this person can advance, if he passes this semester. " Therefore, the extension not only allows identifying possible students at risk of dropping out, but also provides evidence of academic trajectories that probably lead to dropping out and, therefore, provides rich information for decision-making and academic advising. to the students. This is recognized by the directors, who indicate that "I think yes [I would accompany him], because he is in a critical situation this semester, he is playing it, and I would like to know if he is doing well at the moment or is he going wrong, maybe before ... [it fails] ". On the other hand, one of the directors mentions "I could keep looking at this question all the time", which could be associated with the ease of use for the analysis. However, there are also spaces for improvement, such as the transparency of the algorithmic decisions behind the prediction model, as one of the directors mentioned in his comment "I don't know if they take this into account in their model", as well as well as the ability to update the model to changes in the trajectories of each student, since "these things [academic performance], of course, remain as a precedent, but that perhaps does not mean that the behaviour continues to occur in the student , that they do not change, it will not necessarily go badly afterwards ".

Consequently, it is observed in the comments of the participants a standardization of the process of detection and monitoring of students at risk motivated by the extension of TrAC, as well as support for decisions and counseling from the visualization of patterns in the trajectories of students with different levels of academic risk. However, it is necessary to consider future improvements in terms of transparency and updating of the prediction model, both to increase the confidence of career directors and not to overestimate the risk of students who have improved their academic performance.

Phase 5: Evaluation and Improvement

Description of Evaluation and Improvement

After the training and after making the tool available for use, it has been evaluated whether the participants perceive an improvement in the quality of the information regarding the process of identifying and monitoring students at student risk. This improvement is measured in terms of availability, use and confidence on the information presented to support the decisions associated with the intervened process. Based on this evaluation, an analysis of the possible improvements and possible adjustments to use TrAC Risk was carried out. The evaluation follows a mixed process based on a semi-structured interview and a questionnaire, from which we have been able to triangulate the perceptions of the directors about the impact of the tool.

Results Related to the Utility of TrAC Risk

Regarding the use of the tool, the directors recognize the value of the predictive extension incorporated in TrAC regarding the support of the decisions associated with the process of identification and monitoring of students at student risk. TrAC has contributed to the improvement in the time invested in the identification of students, since it allows them to recognize and validate students who could be at risk, verifying the proposal of the model through the visualization of the academic trajectory. Likewise, the tool allows them to recognize and validate critical trajectories of the curriculum in relation to student stagnation and, with this, identify student profiles based on their risk trajectories. In addition, managers mention that, with the current system, they must access different sections to obtain the information and, even then, they cannot collect all the information proactively.

Results Related to the Impact (decision making) of TrAC Risk

TrAC has enabled school principals to visualize critical points in the curriculum that contribute to academic dropouts and therefore put student continuity at risk. For example: students who tend to take risks with a greater number of subjects taken each semester or students who have difficulties with a particular type of content.

Results of the Perception of the Piloting Process

In general, the activities carried out during the piloting process have been evaluated by the participants in a very positive way, highlighting the proactivity of the model towards the identification and monitoring of students at risk, as well as the appropriate integration with the visualization of their trajectories as a mechanism to verify the proposed risk and to sustain corrective actions at the institutional and individual level.

Summary of Improvement Proposals

During the work sessions with the school directors, proposals for improvement in the visualization of the tool were detected. Below are the improvements that have not been addressed during piloting and that will be addressed in future work:

- The list of students may be prioritized, due to a combination of factors. For example: absences, a long time in the race and little progress
- Determine analysis patterns of students from the interaction of school directors.
- Establish a parameterizable interface of academic dropout risk criteria.
- Integrate academic information generated during the semester to the analysis models.
- Integrate non-academic information as parameters of the analysis model.

On the other hand, during the piloting possibilities for improvement were detected that impact the ease of operation and administration of the tool. Below is a list of the improvements that have been addressed during the piloting:

- Provide greater transparency of the prediction model in the tool.
- Provide the ability to update the prediction model in the tool based on changes in the academic trajectories of students.



4.2 Pilot Projects at Pontificia Universidad Católica de Chile (PUC-Chile)

4.2.1 NoteMyProgress Counselling Tool Pilot Project

NMP is a self-monitoring tool designed to support students' self-regulation strategies in online courses in an automatic and personalized way. Through interactive visualizations, it provides actionable aggregate information about student activity in the online course and their interaction with its contents. The aim is to encourage students to reflect on their learning strategies to motivate them to make informed decisions to improve their performance.

Although the tool was initially designed to be used in Coursera, NMP has an easily adaptable architecture for use in any other Learning Management System (LMS), such as by Moodle, for example, to support traditional or blended learning practices. Specifically, the tool consists of a web platform and a plugin for Google Chrome. The plugin handles collecting the student's activity on the LMS and offers the student the option of taking notes while studying the course. The web platform offers the visualization of the student's activity in a graphic and interactive way to facilitate the monitoring of their activities. This first version includes a notebook so that the student can take notes on relevant content by detecting. These two features also provide support for student learning within the course.

Resources

This section describes project resources to be used in the pilot of the NMP tool.

- **Web server.** A web server is available to host the NMP web application.
- **Google store account.** A developer type user is available to host and distribute the NMP plugin to users (students).
- **Computer technician.** A computer technician oversees providing support to ensure the availability of the tool while the pilot is underway.
- **Research team.** There is a team of 4 people in charge of the collection and analysis of the data collected during the pilot period.
- **Pilot team.** There is a team in charge of piloting the tool.
 1. **Project Coordinator.**
 2. **Specialists in technological infrastructure.**
 3. **Group for training, pilot project support and monitoring.** This team is in charge of preparing and disseminating the material for the training and support of the students during the period of the pilot, preparing the NMP tool with the necessary information about the courses in which the pilot takes place, inviting students to participate in the pilot, sending evaluation surveys, following up after the pilot, making adjustments during the pilot, documenting the process, and extracting data for analysis.
- **Online learning platform.** The pilot was carried out with 3 courses of this platform.
- **End users.** The end users are the students who take the MOOC courses. According to the latest report presented by the Directorate of Engineering Education in April 2019, about 410,000 students had registered and there were over 2,000,000 visits to our MOOC courses.
- **Course lecturers.** Although the MOOC lecturers are not the direct users of the NMP tool, support is offered by the 7 lecturers who design the courses to carry out piloting the tool in their courses.
- **University Ethics Committee.** The process of piloting, collection, handling, confidentiality and storage of data, has been approved by the ethics committee of the PUC-Chile (<http://eticayseguridad.uc.cl/>).



- **Directors.** Support is given by the Head of the Directorate of Engineering Education (DEI) Dr Jorge Baier, as well as support from the team of professionals at the directorate (<https://www.ing.uc.cl/equipos/direccion-de-educacion-en-ingenieria/>).

Methodology and Planning

¡Error! No se encuentra el origen de la referencia. 5 presents the phases, activities, dates, methodologies, efforts, and artefacts for the execution of the pilot project. Although a first prototype of the NMP tool was initially funded by Chile's National Commission for Science and Technology (CONICYT) between 2017 and 2018, its beta version was completed within the LALA framework, when PUC-Chile joined the 2018 project. Thanks to the LALA project, PUC-Chile has had the opportunity to pilot and improve the tool to offer an initial stable and scalable version.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Artefact development	12-01-2018	15-03-2018	Artefact development
	Socialization of the pilot plan with stakeholders	15-03-2018	28-04-2018	Informative message during the first class of the online courses. Expert invitation via email.
Agreement	Agreement with participants	15-03-2018	28-04-18	Read and sign informed consent online.
Training	Definition of requirements and training for technicians	12-12-2017	03-03-2018	Integration of the technician into the NMP development process
	Training for users	15-03-2018	20-05-2018	Self-training by means of installation and use manual, since they are massive courses.
Use	User support	15-03-2018	22-07-2018	Remote support via email
	Socialization of experiences	01-03-2019	31-01-2020	Publication of results in conferences and journals.
	Evaluation	15-04-2018	10-07-2018	Using standardized questionnaires sent by electronic means. Analysis of the logs of the tool and the Coursera platform.
Evaluation and Improvement	General evaluation	08-07-2018	10-07-2018	Analysis of the results of the evaluation process in use phase

Table 14. Counselling pilot project in NoteMyProgress

The development and results obtained after carrying out each of the activities of the phases mentioned are shown in **¡Error! No se encuentra el origen de la referencia.**

Phase 1: Preparation

Processes included in the pilot project

The development of NMP was initially funded by the Chilean National Commission for Science and Technology (CONICYT) between 2017 and 2018. The result of this initiative was a pilot version of NMP, an academic counselling tool designed to support students' self-regulation strategies in online courses in an automatic and personalized way. In 2018, PUC-Chile joined the LALA project and a stable version of the tool was completed to be used and tested in real contexts.

This pilot aims to test and evaluate the tool in real contexts on small and large scales to provide greater support to MOOC students to improve their performance in this type of course.



The NMP tool was launched in 11 different courses (see **¡Error! No se encuentra el origen de la referencia.**), where a total of 1054 students were registered to download and install the tool.

	Course	Enrolled Students	Active students	Teachers
1	Electrons in action	6082	4841	3
2	Management of effective organizations	3395	2335	1
3	Constructivism room	2945	2114	1
4	Towards the excellence in project management	15657	11312	3
5	SMEs management	11056	7890	4
6	Learning to program in Python	12865	10275	4
7	Semantic web	1528	1000	1
	Total	53528	39767	17

Table 15. Number of students who download and install NMP in the different courses.

However, the final analysis of the tool's impact was carried out with a sample of 263 students, corresponding to the group of students who answered all the project's questionnaires. Of these 263 subjects, registered for the courses "Managing Effective Organizations" and "Road to Project Management Excellence", 91 downloaded and used NMP and 172 did not. These two groups will serve as an experimental and control group, respectively.

Table 17 shows the detail of the two courses to which the evaluated population belonged (263 subjects from the total sample of 657, of which 91 used NMP (NMP Group) and 172 did not (NoNMP Group)), the duration in weeks, the number of video-readings in the course, the number of evaluations, and the number of supplementary activities. The supplementary activities correspond to a category used by the Coursera platform to refer to the reading of texts describing activities, case studies, instructions, and welcome messages.

Course	Course content
[MOOC 1] Managing Effective Organizations	7 weeks 42 video-readings 6 evaluations 7 additional activities
[MOOC 2] The road to excellence in project management	5 weeks 26 video-readings 4 evaluations 0 additional activities

Table 16. Description of the MOOCs analysed in the NMP online pilot.

During the pilot they were involved from the enrolment of the student in the MOOC course until it ended.

- The enrolment process for course participants was not changed for the pilot. That is, students can register for free in the courses offered by the university through the Coursera platform.
- Once registered, all course participants will receive an email presenting the NMP tool and explaining the advantages it offers as a complement to the course. In addition, the email includes a link to the tool so that interested participants can download and install it. The installation is voluntary, and



participants will not receive any remuneration for participation in the pilot. The email will be sent during the first and second week of the course, as participants have two weeks to register for the course (see PUC-Chile Annex 1).

- All students who agree to participate in the study must first accept an informed consent form (see PUC-Chile Annex 2). Once their consent has been accepted, they will be redirected to a document with the following information (see information document):
 - A tool installation manual (see PUC-Chile Annex 3)
 - A questionnaire to measure their self-regulation strategies (see PUC-Chile Annex 4). This questionnaire will also be answered on a voluntary basis and is not a requirement for downloading and using the tool.

Current situation of processes included

Since this pilot project does not include comparative measurements between the results obtained during the pilot and previous years, it is not necessary to create a baseline. The evaluation of the usefulness and impact in general and specifically on student performance will be carried out based on the results obtained after the pilot.

Phase 2: Agreements

Description of the pilot population

A total of 19,052 students were registered in the two MOOCs involved in this pilot, of which 1054 downloaded NMP, and 657 of them used the tool in some extent. Of the total number of students registered, 990 students completed the course. Of all the registered participants, only the 263 students who answered at least the self-regulation questionnaire were considered for the pilot study. Of this group, 91 downloaded and used the NMP tool (classified as the NMP Group) and 172 did not (classified as the NoNMP Group). In addition to the participating students, the 27 lecturers and assistants in charge of the courses agreed in advance to use their courses in the pilot.

This pilot, as well as all derivatives with the NMP project, were previously approved by the ethics committee of the PUC-Chile (see PUC-Chile Annex 5).

Table 17 **Error! No se encuentra el origen de la referencia.** shows detailed information of the pilot population, as well as the list of documents sent to participants during the pilot.

Role	Quantity	Unit	Comments
Lecturers (Total: 7)			
"Effective Organizational Management"[MOOC1]	3	School of Engineering, Industrial and Systems Department	In addition to the main lecturer who teaches the course, two teaching assistants participated in the pilot. The main lecturer of the course accepted via email that the course would be used for the NMP pilot.
"The road to excellence in _____ project management"[MOOC2]	4	School of Engineering, Department of Construction Management Engineering	In addition to the two main lecturers of the course, two teaching assistants participated in the pilot. The main lecturer of the course accepted via email that the course would be used for the NMP pilot.
Students (Total: 263; NMP users: 91 Non-NMP users: 172)			
"Effective Organizational Management"[MOOC1]	91 (NMP users: 24; Non-NMP users: 37)	<i>Not applicable</i>	Submitted documents, informed consent forms and questionnaires: - Study invitation email (see PUC-Chile Annex 1). - Informed consent (see PUC-Chile Annex 2).



"The road to excellence in _____ project management" [MOOC2]	172 (NMP users: 67; Non-NMP users: 135)	<i>Not applicable</i>	Participants' demographic information: - Men: 168 (~64%) - Women: 95 (~36%) - Level of studies: 143 (~54.4%) Master's degree; 27 (~10.3%) Secondary education; 4 (~1.5%) Doctoral level
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Table 17. Description of the pilot population and summary of the documents sent during the pilot to the students participating in the study.

Phase 3: Training

Description of the training phase

Given the characteristics of this pilot, only those course participants who volunteered to use the tool were trained. In this case, given that in MOOCs there is no direct contact with students, a digital manual was offered that shows how to install the NMP tool and an explanation of its main functionalities.

The manual (see PUC-Chile Annex 3) was offered via an email that was sent to participants. In addition, a contact email address to answer questions was offered in this email. The doubts received were answered and were mainly related to the installation process.

Phase 4: Use and Impact

The Coursera platform and the NMP tool automatically record the actions that users perform on them. These records have been analysed to determine impact on student participation with course resources.

The analyses used the data sources presented in Table 18. From the data used, a series of indicators are extracted that will allow the use and impact of the tool on student performance to be evaluated.

Data source	Description of data and indicators
NMP logfiles	These logfiles record the actions recorded by the students in each of the functionalities offered by the tool. From these logfiles, the frequency of student interaction with each of the functionalities is calculated: <ol style="list-style-type: none"> 1. Display time indicators (time_vis_interaction) 2. Planning goals (goal_interaction) 3. Create and record notes (note_interaction) 4. Compare one's performance with the performance of one's peers (s_c_interaction) 5. Display general self-regulatory performance indicators (nmp_interaction) 6. Views related to the self-evaluation of study strategies (effect_interaction)
Coursera logfiles	These logfiles record the actions recorded by students with the various resources offered in the course. From these logfiles, a series of indicators are generated to measure students' commitment to the course: <ol style="list-style-type: none"> 1. Interaction with exams: frequency of interaction with course exams. 2. Video lessons started: frequency of interaction with video lessons that students start but do not finish. 3. Video lessons completed: frequency of interaction with video lessons that students begin and end. 4. Supplementary material started: frequency of interaction with supplementary material offered in the course started but not finished. 5. Completed supplementary material: frequency of interaction with supplementary material offered in the course started and completed. 6. Supplementary material interaction: frequency of interaction with the supplementary material offered in the course on a momentary basis, as a way of navigating through the course.
EFLA	Answers to the EFLA questionnaire. The average value of participants' responses for each question and per dimension was calculated for analysis (for details on EFLA, see the description of the materials provided for the pilot in section 1 of this document).



SRL Questionnaire	Answers to the EFLA questionnaire. For analysis, the average value of participants' responses for each question and per dimension was calculated (see the description of the materials provided for the pilot in section 1 of this document for details on the SRL questionnaire).
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Table 18. Description of MOOCs.

Descriptive statistics of use records

¡Error! No se encuentra el origen de la referencia. shows the percentage of interaction with the most frequent NMP tools among the 657 subjects who used NMP. Table 19 offers more detail on the average interactions of the use of NMP by the 91 students who are part of the 263 students that comprise the complete sample that was considered for the impact analysis. Specifically, Table 20 shows the average value of the number of interactions recorded by the participants with the different functionalities.

% of usage of NMP interactions

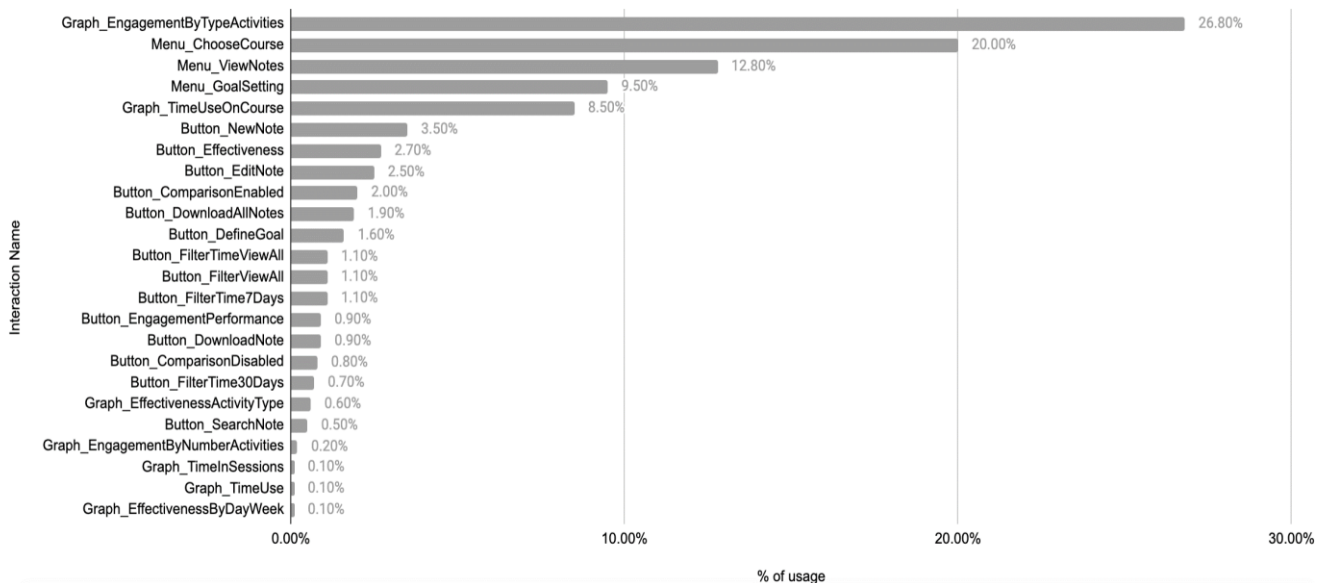


Figure 33. Percentage of the interactions of the 263 subjects who downloaded.

The results of Table 19 show that:

- The most used functionalities of the tool are, in this order: (1) those that show general displays of self-regulatory performance; (2) note-taking functionality; and (3) study goal-setting functionalities.
- There are certain differences in the frequency of interaction with the tool's functionalities between students who pass and those who do not pass the course. Specifically, students who pass the course are seen to use the tool more, and a statistically significant difference is observed with their peers who do not manage to pass the course in the functionality of setting goals and comparing their performance with the rest of the participants.
- Finally, there is also a difference in the final performance of the students in the course, with those who passed the course getting a better grade.



NMP Group	Passed the course		Did not pass the course		t	p
	mean	sd	mean	sd		
Interactions with the note taking functionality (note_interaction)	3,692	7,341	2,584	6,043	0,682	0,499
Interactions with the goal setting functionality (goal_interaction)	1,807	2,154	0,984	1,397	1,802	0.080*
Interactions with the functionalities related to the time of study in the platform (time_vis_interaction)	0,923	4,316	0,307	1,951	0,698	0,490
Interactions with self-regulating performance overviews (nmp_interaction)	20,730	39,536	8,338	14,274	1,558	0,130
Interactions with displays related to strategy self-evaluation (effect_interaction)	0,961	4,902	0,061	0,348	0,935	0,358
Functionality that allows one to compare one's own performance with that of one's fellow students (s_c_interaction)	0,923	2,544	0,030	0,248	1,784	0.086*
Number of students	26		65			
Grade in the course	0,929	0,056	0,322	0,215	21,002	0.0001***

Table 19. This table shows the average frequency of interactions with the different NMP functionalities recorded by the participants. A distinction is made between the group that passed the course and those who did not, also showing the grade obtained in the course (normalized between 0 and 1). Note: *p < 0.1; **p < 0.05; ***p < 0.001.

NoteMyProgress use and utility survey

To evaluate the usefulness of NMP, the EFLA questionnaire was applied (see PUC-Chile Annex 4) and a question was left open. The questionnaire was completed voluntarily by 57 students out of the 91 students sampled for analysis.

The results (see Table 20) show that students consider the tool to be balanced in all its dimensions: in the level of information offered on the data shown (65,367 out of 100); in the level of awareness and reflection on the indicators offered (68,533); and in the level of the tool's impact on students (67,822).

Dimension	Question	Average value	Score for each dimension (0 -100)
Data	P1: The tool clearly displays the information collected.	6,638	65,367
	P2: The tool clearly shows why the data shown is collected	7,128	
Awareness & Reflection	P3: The tool allows me to become aware of my learning situation	7,745	68,533
	P4: The tool allows me to predict my future learning situation given my change (or not) in behaviour	6,681	
	P5: The tool stimulates me to reflect on my learning	7,289	
	P6: The tool encourages me to adapt my behaviour in the course if necessary	6,958	
Impact	P7: The tool stimulates me to work more efficiently	7,630	67,822
	P8: The tool stimulates me to work more effectively	7,577	

Table 20. Average values given to each of the dimensions in the EFLA questionnaire.



Analysing the comments on the open question, "What uses have you made of this tool or how has it served you?", we observe that students value NMP for time management, goal setting and strategic planning, organization of their study and self-evaluation of their progress in the course. For example, some participants comment, in relation to time management, that NMP told them how much time they spent on the course, their waiting time during a study session and when they were most efficient: "This tool has helped me to quantify time in the course versus time in other activities."

Regarding goal setting and strategic planning strategies, participants commented that NMP was useful for planning and organizing activities, as well as for reflecting on their study habits and re-planning their work sessions. One student commented on this: "This tool has helped me to identify my free time during the study session and to create plans to improve the use of time".

Other students valued the note-taking functionality as a support for organizing their work: "This tool has helped me to make summary sheets of the advanced topics." Finally, some students commented that NMP was useful as a self-evaluation, to follow up on their performance, monitor their progress in the course and get feedback on their own activities. For example, one of the students said: "NMP is a great thermometer for assessing whether progress is correct and taking action to ensure timely compliance," while another commented: "This (NMP) has allowed me to concentrate and be more effective in my study."

Impact on student performance results

Table 212 shows the level of commitment to MOOC materials and resources by students who used NMP (NMP group) compared to those who did not (NoNMP group).

The results show that students who used NoteMyProgress:

- Had a greater commitment to evaluations and video lessons
- Completed more video lessons and initiated more supplementary activities
- Scored higher than students who did not use the tool
- The level of self-regulation reported by students is not related to their level of commitment.

Indicators	NMP Group		NoNMP Group		t	p
	mean	Sd	Mean	sd		
Interacted exams (exams_interacted)	3,054	1,688	2,375	1,877	2,986	0.003**
Video Lessons Started (lectures_started)	9,197	6,451	7,075	6,026	2,598	0.01**
Video Lessons completed (lectures_completed)	10,417	6,338	7,589	6,586	3,398	0,001***
Video Lessons interacted during a very short time (lectures_interacted)	19,615	11,189	14,664	11,525	3,381	0,001***
Supplementary material started (suppl_started)	0,505	1,205	0,115	0,492	2,958	0.003**
Supplementary material completed (suppl_completed)	0,703	1,433	0,595	1,638	0,552	0,580
Supplementary material interacted in a very short time (suppl_interacted)	1,208	2,307	0,710	1,882	1,774	0,078
Number of students	91 (100 %)		173 (100 %)			
Passed the course	26 (28.5 %)		30 (17.4 %)			
Did not pass the course	65 (71.5 %)		143 (82.6 %)			



Grade at the end of the course	0,495	0,331	0,358	0,323	3,217	0.002**
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Table 21. Average values of the frequency of interaction of participants with MOOC materials, distinguishing between groups that used the tool (NMP Group) and those that did not (NoNMP Group).

Note: *p < 0.1; **p < 0.05; ***p < 0.001.

Phase 5: Evaluation and Improvement

Description of evaluation and improvement

Based on the use data of NMP collected during the pilot, results were analysed to see if they showed that the initial objective was achieved: **to offer greater support to the students of a MOOC to improve their performance in this type of course**. Based on this evaluation, an analysis is made of possible improvements and transformations to use this tool for other MOOC courses within the institution and to scale up its use in other institutions.

From the results of the pilot, NMP meets the initial expectation of offering a tool to support MOOC students in the performance of their course.

Results related to the utility (adoption) of NoteMyProgress

The results show that NMP can serve as a good complement to MOOC courses. It helps students make decisions about their time management, planning, and organization through note taking. At the time of the pilot, Coursera does not have specific features to help students self-regulate and improve their planning and performance in the course. NMP fills these gaps by providing visualizations and data on student behaviour that allows students to have a more complete picture of their actions related to the content. The results show that the most highly rated features are: (1) strategic planning by students using a weekly goal form; (2) note taking as a meta-reflection exercise on course content; and (3) comparison of one's own activity with that of other students. Students who use the tool value NMP as a useful tool to improve course time management, plan their weekly objectives and goals and become aware of their execution, and to take notes related to the course.

NoteMyProgress impact results (commitment and performance)

Although the characteristics of the pilot study and the participant population do not allow us to extract conclusive results on the direct impact of NMP on student engagement and performance, they do suggest that this tool could be a potential solution to motivate their activity in the course and, therefore an improvement in their performance. The results show that students who used NMP interact more with the different activities of the course compared to those who did not. Results also show that students who used NMP get a better grade in the course and are more likely to finish the course.

Summary of improvement proposals

With the results obtained, some ideas have been gathered to improve the tool and to extend its use to other courses both inside and outside the institution. Some of these are discussed below:

1. **Give more visibility to the functionalities related to setting study goals, taking notes, and comparing one's own activity with that of other students**, because these are the functionalities that are most highly related to course performance.



2. **To offer the tool in a more integrated way in the platform in which it is offered.** Coursera is limited in this aspect, since it does not offer the possibility of integrating tools with the functionalities offered in NMP. However, there are plans to explore the possibilities that the Coursera platform has been offering for the last few months to integrate some visualizations that could help support some of the functionalities that NMP offers today.
3. **Adapt the NMP tool for other LMSs, such as MOODLE, which are platforms open to all.** This would offer the possibility of integrating NMP into many more courses in Latin America, in universities that do not belong to the Coursera group.
4. **To propose summary displays for teaching staff.** One of the aspects that the current NMP tool does not include is a visualization for teaching staff. Currently, lecturers have the visualizations that Coursera offers about student performance of different activities, but Coursera does not offer information like what NMP captures, the time they invest in their study sessions or planning. A summary of this type of information could help the lecturer to make specific interventions to motivate student participation at certain times during the course.

The improvements to points 1, 2 and 3, related to improvements of the existing tool, and the design for the adaptation of the NMP tool to Moodle were worked on with KU Leuven. Specifically, a workshop was held to propose a series of visualizations that should be included in the new tool adapted to Moodle. The NMP Moodle tool is in the process of development and is scheduled for completion in May 2020, to carry out proof of concept with teaching staff during the month of September 2020.

Post-pilot analysis results

This section presents the **list of lessons learned** from the pilot carried out, to scale up the use of the tool to other courses of the institution or other institutions that also use the Coursera platform.

- **Key roles for the development of the pilot.** Three key roles are required for the organization and execution of the pilot:
 - A **pilot leader** in charge of defining the pilot plan and coordinating the relationship with the rest of the roles. This person should be responsible for the following tasks: (1) planning the pilot and the ethical management needed to be able to conduct the experiment; (2) preparing the informed consent documents for approval by the ethics committee prior to launching the pilot; (3) preparing the content to be included in the course, such as links to the tool and manuals and invitation emails to students; (4) being responsible for coordinating the pilot from planning to execution, data collection and analysis.
 - A **technical person** in charge of adapting the tool for the courses in which the pilot will be carried out and of downloading and updating the data on a weekly basis. As NMP is an experimental tool it is necessary to make (1) an adaptation to the course contents; and (2) a weekly update of the data on the activities carried out by the students in the course. These two tasks must be performed manually by a technician.
 - A **data analyst.** Once the project is completed, a data analyst must oversee collecting and analysing the logfiles collected both through the Coursera platform and through NMP. From this data, an analytical report must be generated to be shared and disseminated within the institution.
- **Instruments for data collection and evaluation.** All questionnaires and instruments needed for data collection must be validated and prepared in advance to avoid user confusion about the terms used.



In addition to the lessons learned, we have identified **some aspects of improvement for the planning of an upcoming pilot**:

- Include an **interview with some of the students** who used the tool. Conducting an in-depth interview with some of the students who used the tool could give clues about aspects of improvement not covered in the questionnaires used in this pilot.
- Include a **meeting to socialize the analyses of the pilot with the teaching staff**. This meeting could offer teaching staff information about their course as an alternative to the information currently offered by Coursera.



4.2.2. Pilot of NoteMyProgress Counselling Tool in a Flipped Classroom Course

The NMP pilot for the flipped course is done by adapting the NMP beta tool described in section 4.2.1 of this document.

Resources

The technological resources used for the pilot are the same as those described in section 4.2.1. of this document. The research team is also maintained. However, in the pilot team, in addition to the technician, includes the lecturer and the 8 assistants involved in the design of the flipped course.

Methodology and Planning

The course was structured for the 11 weeks that a traditional course lasts, starting in August 2018 and ending in November 2018. Each week the students in both groups (control and experimental) had 2 sessions of 1.5 hours each and a series of activities to do at home. In addition, the course had several evaluations for both groups. Table 22 shows the list of evaluations and grades that were considered to establish the final grade of the students in the course.

Evaluation activity	Description	Percentage of the final grade
3 partial exams (E1, E2 and E3)	Two hours of on-site examination on the contents of the course.	20% per exam
Final exam	Replaces the lowest midterm score	20% corresponding to the partial exam that it replaces
Questionnaires at the beginning of each class	Average score of the questionnaires that are reviewed at the beginning of each face-to-face class	20%
Weekly planning	Evaluation of the weekly planning carried out	10%
2 group tasks	Grade obtained in the group task carried out during the onsite classes, and completed, if necessary, after class.	5%
Attendance grade	Average mark given by the lecturer to evaluate the participation of students in debates and face-to-face classes	5%

Table 22. Evaluation activities considered to establish the final grade of the students in the course.

Phase 1: Preparation

Processes included in the pilot project

The main process that was involved for this pilot was the enrolment of students in the MOOC course. To facilitate the process, course assistants were responsible for registering all the students on the course with the MOOC in Coursera before the start of the course. This facilitated training and integration of the platform as another resource in the learning process.

In addition, students completed an adaptation of the informed consent that was used in the first pilot (see PUC-Chile Annex 2). The pilot was part of the set of pilots and therefore the same detailed process took place in Phase 1 of the online pilot.



Phase 2: Agreements

Description of the pilot population

A total of 242 students participated in the pilot, divided into an experimental group with 133 students (who used NMP) and a control group of 109 students (who did not use NMP). The average age of the participants is 21 and the selection of the control group and the experimental group were determined by the lecturer without the students knowing their situation *a priori*. The University's ethics committee approved this pilot (see PUC-Chile Annex 5), as in the pilot detailed in the previous section.

Phase 3: Training

Description of the training phase

In the first class, 15 minutes were dedicated to explaining the methodology and to presenting the MOOC course and the NMP tool (only for the experimental group) to the students who participated in the experiment. The assistants made an interactive presentation showing the students how to access the MOOC and how to register in the NMP tool if they belonged to the experimental group. This was counted as a training phase for the students related to the new methodology and the work environment of the course. All the pilot's students participated in the training. The lecturer and the eight assistant lecturers also participated in a 30-minute training session on the tools to be used: Coursera and NMP.

Phase 4: Use and Impact

For the analyses, the data sources used are presented in Table 23.

Data source	Description
MOOC logfiles in Coursera	Logfiles recording the activity of the students in the control group and the experimental one in the MOOC displayed in Coursera.
NMP logfiles	Logfiles recording the activity of the students of the experimental group in the NMP tool.
Final grades	Students' final grades on the course

Table 23. Data sources used to analyse the impact of NMP on student involvement in the MOOC course.

In order to analyse the impact of the NMP tool on the students' involvement in the course, two analyses were carried out on: (1) performance impact analysis, comparing scores between the experimental and control groups; and (2) impact on student engagement, comparing student interactions in each group with MOOC activities. No usability tests were performed in this case, as the results of the first pilot were taken as a reference.

Performance impact

A t-test was carried out with the average grades of the two groups to compare grades between the experimental and control groups. The results of this test did not indicate a significant difference between the mean scores of the two groups (-1.39, $p=0.165$).

Comparison of student involvement in the MOOC

To make the comparison, we calculated the average number of interactions of each group with each of the MOOC activities week by week. A T-test was then conducted to assess whether there were significant differences between the various interactions. Table 245 shows a summary of these analyses. The results of this table show that, when a week-by-week analysis of the recorded interactions is made, the



experimental group shows a statistically significant higher activity (with a 95% to 99% confidence interval) in the last 4 weeks of the course (week 7, 9, 10 and 11).

Week	Mean experimental group (Number of interactions)	Mean control group (Number of interactions)	T	p
1	707	607	-1.03	0.3049
2	1141	1013	-1.21	0.2271
3	1916	1530	-2.54	0.0119**
4	665	702	0.49	0.6238
5	688	640	-0.66	0.5126
6	573	564	-0.14	0.8888
7	604	118	-8.22	0.0001***
8	1245	923	-2.19	0.0299**
9	309	57	-7.16	0.0001***
10	387	121	-6.18	0.0001***
11	592	360	-3.48	0.0001***
# Students	109	133		

Table 24. Analysis of the mean of interactions with the MOOC during the different weeks of the course.

Figure 34 shows the average interaction of both groups to visually compare the two groups. From this figure, the students in the experimental group show slightly more activity in the MOOC course than their colleagues in the control group. Both show peaks of activity prior to the mid-term exams scheduled in the course.

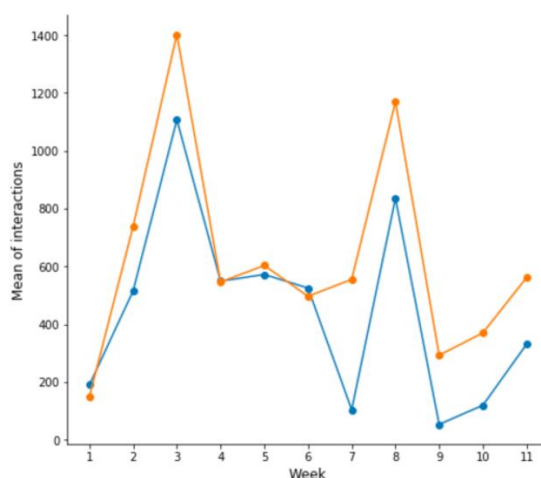


Figure 34. Average of students' interactions in the MOOC week by week of the experimental group (orange) and the control group (blue).

Phase 5: Evaluation and Improvement

Main results

Based on the data obtained in this pilot, two main conclusions have been reached:

1. That the use of NMP helps students to maintain an activity on a MOOC throughout the course, especially in the last weeks of the course, where students usually relax.

2. That the use of NMP, although it does not have a major impact on students' final grades in general, does not place an extra burden on students, but rather can serve as support in flipped learning scenarios, where there is less lecturer support.

Proposals for improvement

Based on the pilot conducted, some of the improvements detected and described in section 4.2.1 of this document are corroborated, and some new ones are detected for the use of NMP in mixed learning environments:

1. **To provide a summary view to the lecturer of what is happening in relation to the weekly planning proposed by the students.** Lecturers' feedback highlighted the need to offer visualizations that allow them to understand how their students plan their course and what their real activity is in relation to their planning, in order to better organize face-to-face classes and adapt the activities to the students' reality.
2. **Provide supportive feedback to students on their weekly planning.** Some of the students commented during the pilot that, if they proposed a specific weekly plan, they would have liked to receive feedback from the assistants and lecturers to improve it and make it better.

4.2.3 Pilot project of the Dropout prediction tool

The Dropout Prediction Dashboard at MOOCs (DaP-MOOC) is a web dashboard designed to detect groups of students at risk of dropping out of MOOC courses early and automatically from student interaction with the course's digital resources. A set of visualizations provides information about students and their number according to the probability of dropout (high, medium, or low risk). The aim of the visualizations is to provide MOOC course assistants/tutors with a list of students classified by their probability of dropping out to offer personalized help messages to each of these groups, in order to retain them and avoid their possible dropout from the course.

Specifically, the tool is composed of a web platform that offers the visualization of the dropout probability of three groups of students classified as follows:

1. Students at high risk of dropping out (probability > 66%)
2. Students at medium risk of dropping out (probability > 33% and < 66%)
3. Students at low risk of dropping out (probability < 33%)

For this purpose, the information is presented graphically. This first version makes it possible to download the student IDs according to the group they belong to, to be able to selectively send personalized messages to each of the groups (see Figure 35).





Número de estudiantes según su probabilidad de abandono



Figure 35. DaP-MOOC dashboard screen

Within each circle, the number of students in each group appears, and the coloured circle around the number indicates the percentage that this number represents respect to the total number of students. Below the circles, there is a table with a description of the main indicators of the students in each group. These indicators include: 1) average time for each working session, 2) percentage of video-lectures completed (with respect to the total), 3) percentage of exercises performed (with respect to the total), and 4) time spent on the platform. Below those indicators, there are two boxes. The one on the left ("Download IDs") is used to download a file in .txt format with the identifiers of the students belonging to each group. When selecting this option, a tab is opened to select the file location and download the file. Finally, the button "View standard messages" on the right displays at the bottom of the screen the text of several possible messages that the instructor could send to his/her students to improve their behaviour.

Even though the tool was initially designed to be used with Coursera's MOOCs, Dap-MOOC has an easily adaptable architecture for use with any other Learning Management System (LMS), such as Moodle.

Resources

This section describes the resources of the project to carry out the pilot of the DaP-MOOC tool.

1. **Web server.** A web server is available to host the DaP-MOOC web application.
2. **Computer technician.** A computer technician oversees providing support to ensure the availability of the tool while the pilot is underway.
3. **Research team.** There is a team of 5 people in charge of collecting or/and analysing the data collected during the pilot period.
4. **Pilot team.** There is a team in charge of piloting the tool.
 - a. **Group for training, pilot project support and monitoring.** This team is in charge of preparing and disseminating the material for the training and support of the MOOC assistants/tutors during the pilot period, preparing the DaP-MOOC tool with the necessary information about the courses in which the pilot is carried out, sending the personalized messages to the students to participate in the pilot, sending evaluation surveys, monitoring the pilot, making adjustments during the pilot, documenting the process, extracting data for analysis.
 - b. **Online learning platform.** PUC-Chile has 24 MOOCs in the Coursera platform(<https://www.coursera.org/ucchile>). In this pilot, one course hosted in this platform is used.
 - c. **End users.** The end users are the assistants/tutors who give feedback to the students in the MOOC courses. According to the latest report presented by the Directorate of Engineering Education in December 2019, more than 500.000 students had registered and more than 2.000.000 visits to MOOC courses had been made. The number of registered students in the selected MOOC for the pilot is 140,590 registered students.
 - d. **Course assistants.** Although the MOOC teaching staff are not the main users of the DaP-MOOC tool, they are supported by the 2 assistants who designed the MOOCs along with the teaching staff to pilot the tool in their courses.
 - e. **University Ethics Committee.** The process of piloting, collection, handling, confidentiality and storage of the data has been approved by the ethics committee of the PUC-Chile (<http://eticayseguridad.uc.cl/>).
 - f. **Directors.** Support is provided by the Director of the Directorate of Engineering Education (DEI), Dr Jorge Baier, as well as the support of the team of professionals of the Directorate(<https://www.ing.uc.cl/equipos/direccion-de-educacion-en-ingenieria/>).

Phase 1: Preparation

Stage 1: Processes included in the pilot project

In this first stage, an analysis was carried out with past data from the three MOOCs that were taken as a reference to extract initial data: "Electrons in action", "Constructivist classroom" and "Management of effective organizations". The objective of this analysis was to verify that a high predictive power can be obtained from the available past data and to draw conclusions about which variables should be used in the predictive models used in the second stage of the pilot. In this case, no process was intervened either during the design or launch of the MOOC, since it is a first pilot for the validation of models.



The detail of the three MOOCs used as a data source is as follows:

- (1) Electrons in Action - A total of 25,706 students are enrolled, but after filtering students, a total of 2,035 students were considered for testing.
- (2) Constructivist Classroom - A total of 18,653 students are enrolled, but after screening of students, a total of 337 students were considered for testing
- (3) Effective Organization Management - A total of 10,576 students are enrolled, but after screening students, a total of 526 students were considered for testing.

In this first stage, an exploration of the models was carried out to predict the success and final grades of the students, as well as their probability of dropping out. The results of this first stage were a series of models that would finally be incorporated into the final tool to be tested in a real course in a second stage. The details of the models used and the previous analysis are described in the first pilot deliverable of this project, as well as in two scientific publications.

Indicator extraction

From this first stage of analysis, the 4 indicators that were used to obtain the probability of dropping out of the students were extracted. These indicators were obtained from the Coursera Logs of the three MOOCs courses used as a reference in this first stage (see Table 26):

- (1) Demographic variables, related to age, educational level, gender, occupation.
- (2) Student activity on the platform (engagement), related to the number of days active on the platform, the total time of interaction on the platform and the number of study sessions for each student.
- (3) Interactions with the videos, related to the number of video-readings completed, started, revisited, the proportion of videos taken whether completed or not, proportion of completed videos, proportion of videos revisited.
- (4) Interactions with exercises, related to the number of assessments completed, initiated, revisited, the proportion of assessments taken whether completed or not, proportion of assessments completed, proportion of assessments revisited.

(1) Variables related to demographics	
(3a) Edu	Educational level
(3b) Age	Age of the learner
(3c) Isfemale	Categorical variable representing whether the learner is male or female
(3d) Emp_student	Categorical variable representing whether the learner is a student (in formal education) or not
(3e) Emp_job	Categorical variable representing whether the learner has a job or not
(2) Variables related to learners' activity	
(5a) Days_Act	Number of active days in the platform
(5b) Time_spent_min	Total time spent interacting in the platform (in minutes)
(5c) Num_ses	Number of sessions
(3) Variables related to learners' interactions with videos	
(6a) VI_complete	Number of times the learner has completed a video
(6b) VI_begin	Number of times the learner has started watching a video without finishing it



(6c) VI_review	Number of times the learner has reviewed a video once completed
(6d) Prop_vlopen	Percentage of opened videos (completed or not)
(6e) Prop_vlcomplete	Percentage of completed videos
(6f) Prop_vlreview	Percentage of reviewed videos
(4) Variables related to learners' interactions with exercises	
(7a) A_try	Number of times the learner has started to do an assessment without finishing it
(7b) A_complete	Number of times the learner has completed an assessment
(7c) A_review	Number of times the learner has reviewed an assessment once previously completed successfully
(7d) Prop_atry	Percentage of attempted assessments (completed or not)
(7e) Prop_acomplete	Percentage of completed assessments
(7f) Prop_areview	Percentage of reviewed assessments

Table 25. List of indicators used in the pilot.

Development of predictive models

To develop the predictive models, a first analysis was made which consisted in analysing the success of the students in one of the courses (in particular, “Electrons in Action”). In this case, the dependent variables were the following: (1) final grade for the course, (2) success defined as obtaining a grade higher than 80% without any restriction regarding viewing a minimum number of videos and (3) success defined as obtain a grade above 80% having seen at least 50% of the videos. To carry out this analysis, five categories of independent variables were taken into account: (1) learning self-regulation strategies (SRL), (2) SRL patterns, (3) demographic variables, (4) variables on student intentions and (5) variables about the student's activity. In addition, three types of students were considered, identified by hierarchical grouping. The first group of students were the “sampling” students, who simply entered the course to “sample” some content and left. The second were the full students, who followed the itinerary designed by the instructor and completed the videos and activities. The third group was the strategic students, who were mainly focused on taking the assessment tests and watched fewer videos. Taking into account the variables and the groups, the prediction was made using regression models for each of the dependent variables and groups.

The results showed that the variables that had a greater relationship with the success or grade of the students were the SRL patterns and the variables related to the student's activity (in particular the time invested). Regarding the regression models for the prediction of the grade, the adjusted R2 for the different groups was 0.80 for the complete students, 0.72 for the strategic students and 0.86 for the group of all students (with p-value <0.001 in all cases). This indicates that the variables can explain a high variability in the model, although to a lesser extent for strategic students, who follow a less common itinerary. The RMSE (Root Mean Square Error) is between 0.12 and 0.18 for all groups, being worse for strategic students. Regarding the prediction of success, an excellent AUC (Area Under the Curve) is achieved (greater than 0.9) in all cases, except in the training set of complete students, which is obtained 0.84 (possibly because the number of samples is lower). However, it is observed that good prediction results can be obtained with SRL and activity variables, although other variables such as demographic or intentions have a worse relationship with the dependent variables.

After conducting the first experiment with a course, the analysis was extended to two more courses (“Constructivist Classroom” and “Management of Effective Organizations”). In addition, the focus was



shifted towards the prediction of dropout. For the definition of dropout, a student was considered to drop out when they were at least 4 weeks without activity on the platform (if they had not completed 80% of the tests and it was considered that they had completed the course). For this analysis, given that the courses had an asynchronous mode of instruction, the time period of each specific student was analysed. In other words, the first week of the course was for each student the first week since they registered, instead of considering fixed dates on the calendar. Bearing this in mind, the groups of variables considered in the prediction of grades and success were used, plus two other sets of variables: video variables and exercise variables.

In a first analysis, the predictive power of the SRL variables was analysed. On the one hand, it was concluded that self-reported SRL variables (obtained through an online questionnaire) did not add value to predictive models. However, the SRL patterns achieved high predictive power (with an AUC greater than 0.95), which implies that the way in which students interact and self-regulation strategies influence dropout. Among the patterns, the one that was fairly common and rated students quite well was the pattern of opening the assessment and then going to the videos. Among other groups of variables, it was concluded that the video variables were also very good predictors, although the variables with the greatest predictive power were the exercise variables. This is sensible as, if a student does not complete the activities, they cannot complete the course, although the failure to keep the activities up to date from the beginning may give a future indication that the activities will not be completed.

Apart from analysing the predictive power, the transfer of predictive models was analysed, and it was concluded that some algorithms such as Decision Tree and support vector machines (SVM) were not consistent when transferring the models. The opposite case was with the Random Forest, in which it was observed that it could transfer the models generated from one MOOC to another MOOC, which is positive for the applicability of the models used in the pilot. Even if data from the same course is used in the pilot, it is also important to ensure that past data from a course can be used for prediction with new students to the same course.

Finally, a temporal analysis was carried out to see from what moment a high predictive power could be obtained in the models. The conclusion was that a good AUC could be obtained from between 25-33% of the theoretical duration of the MOOC (assuming one module per week and an excellent AUC between 43-67% of the theoretical duration of the MOOC. This implies that It is possible to obtain early predictions with sufficient predictive power. Therefore, the objective of the piloting will be to put these models into practice, in such a way that updated predictions are provided according to the weather and their predictive power is improved, although as soon as possible they are reliable enough to have an impact on learning.



Stage1: Processes included in the pilot project

The purpose of this second stage was to carry out an Intervention in the course "Introduction to Programming with Python" using as a basis the predictive models that were developed in the first stage of the pilot. This course is taught on the Coursera platform of the PUC-Chile. It is an asynchronous course and lasts for 6 weeks. However, as students can contemplate it in a longer time (as it is asynchronous), the piloting was carried out for 7 consecutive weeks, between July 2020 and August 2020, to better analyse the evolution. During this period 2,421 were active in the course and represent the analysis group of this pilot. It is noteworthy that these 2,421 students were those who enrolled in the first week of the pilot and who are followed up. Those who entered later were not considered, as their progress could be different at the same point in time.

Throughout these 7 weeks, two teachers had access to the dropout's website, where the risk of dropping out of different groups of students was indicated (<http://dei-lala.ing.uc.cl:8080/dropout/aCourse?prof=7a675883b1c117e267470dce52eba518>). For each group, a set of standard messages was proposed that could be sent to each student profile, in order to encourage them to continue in the course. The standard messages that were shown for each group of students according to their risk can be found in the Annexes part of this report.

Current situation of the processes to intervene

The objective of the pilot was to modify the monitoring process of the course teachers, improving the sending of personalized messages to students according to their risk. The message was sent on Friday of each week by the teacher, based on the data provided by the dropout tool. Messages were sent every week except for week 4, to leave students a week without notification in the middle of the course.

Phase 2: Agreements

The 2421 students mentioned above were active in the course and, therefore, represent the analysis group of this pilot. All students accepted the informed consent offered by Coursera when registering, where it is informed that the course teachers will be able to access the data of the students of the course. We do not have information about the gender or profession of these students, as Coursera does not offer information of this type.

In addition, two teachers (women) participated in the pilot, one who had participated in the generation of the course and one who served as an assistant to the course for follow-up.

Phase 3: Training

For this pilot, training was conducted for the participating teachers. Particularly, training was conducted online, through videoconference, and consisted of:

1. Presentation of the pilot objectives
2. Presentation of the tool
3. Example of sending messages
4. Testing in the tool by the two teachers.

In addition, during the pilot, the professors were assisted by a member of UC3M, who offered support in case of doubt or problems with the tool.



Phase 4: Use and Impact

For the evaluation of the pilot, the activity of the students in the course was analysed in order to detect whether or not the messages sent had had any impact on their behaviour. Specifically, the following data sources were used for the analysis:

- Coursera's "Logfiles". These files store students' activity with the course materials, and they track their activity with each of the offered resources.
- List of students in the different risk groups for each week (excepting week 4). Each week, excepting week 4, the group of active students in the course who belonged to each risk group was computed and registered.

With these data, two analyses were conducted. The first one consisted on calculating the percentage of students in each risk group each week (based on the list of students that belonged to each group) and computing the percentage of students of each group respect to the total.

The second analysis considered Logfiles from Coursera and the lists of students in the different risk groups. Specifically, an analysis of the probability of students in one group to move to another group was conducted week by week.

Percentages of students in the different risk groups

This section analyses the number of students (with their corresponding percentage) in each of the risk groups over the seven weeks of the pilot. Table 27 shows the distribution of students in each risk group and Figure 33 shows the corresponding percentages, considering $N = 2.421$.

The main lessons learners from this table include:

1. Most of the students are classified as at-risk and from the beginning of the course (where there is only 0.8% with no risk). This is a normal result, typical of MOOC courses, where most students do not finish the course.
2. The percentage of students in the medium risk group decreases week by week, with around 45% of students in the first week and 3.3% in the last week.
3. The percentage of students in the no-risk group increases week by week, being 0.8% at week 1 and 14% at week 7, while the percentage of students with medium risk decreases decrease. This could mean that some of the medium-risk students are moving to the group of "no risk".
5. The percentage of high-risk students also increases week by week. In week 1, there are already more than half of the students with high risk of dropout (53.9%) and this number significantly increases week by week until week 5. In the last weeks, this value seems to stabilize.

In summary, most movements between groups are among students who are initially at medium risk and move to non-risk or high-risk groups as the course progresses. Although it cannot be concluded from these results that students have been influenced by the messages, we do observe a positive trend for medium-risk students, who can potentially move to the non-risk group towards the end of the course. With regard to the movement to the high-risk group, as it is a common pattern of MOOCs, it is not identified as an especially negative aspect with respect to other MOOCs. Nevertheless, it would be interesting to see how that evolution of dropout can be influenced by the messages.



Week / demographic variables	No Risk	Medium Rsk	High Risk
(3a) Edu1	Educational level20 (0.8%)	1095 (45.2%)	1306 (53.9%)
(3b) Age2	Age of the learner145 (6.0%)	607 (25.1%)	1669 (68.9%)
(3c) Isfemale3	Categorical variable representing whether the learner is male or female167 (6.2%)	399 (15.5%)	1855 (76.6%)
(3d) Emp_student5	Categorical variable representing whether the learner is a student (in formal education) or not275 (11.4%)	179 (7.4%)	1967 (81.2%)
(3e) Emp_job6	Categorical variable representing whether the learner has a job or not287 (11.9%)	119 (4.9%)	2015 (83.2 %)
Variables related to learners' activity7	338 (14.0%)	80 (3.3%)	2003 (82.7%)

Table 26. List of indicators used in the pilot.

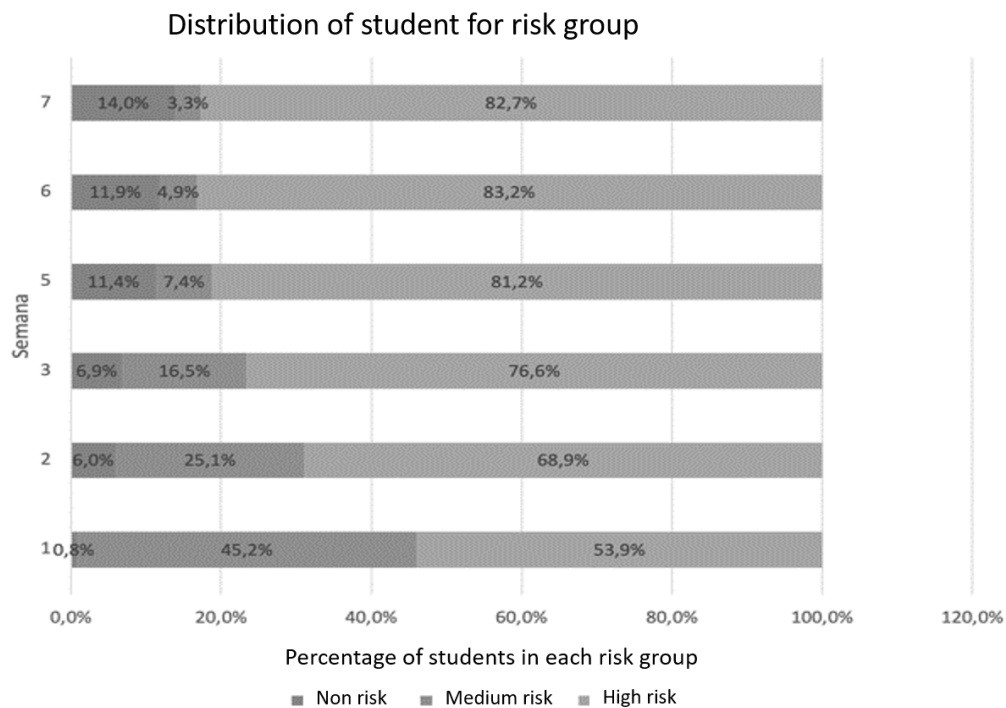


Figure 36. Distribution of students in risk groups.

Students evolution in the different risk groups

Evolution of students in the different risk groups

This section analyses the evolution of students in the different risk groups week by week, considering the activity in the MOOC through the Logfiles and the lists of students that belong to each risk group week by week.

Figures X show the percentage of students who belong to a risk group in a certain week (Y-axis) and the probability of moving to another risk group the following week (X-axis). The darker colours show the students groups with a higher percentage of students. For example, the first figure shows the evolution

of students between week 1 and week 2. In this first figure we observe that 75% of the students without risk in week 1 are going to be without risk in week 2. Moreover, 5% of students of students at risk will continue being at risk and 20% will be in medium risk. However, if we analyse the movements from week 2 and 3, we observe that 7.13% of students who were at risk in week 2 move to other groups in week 2. This increases the overall number of students at risk.

These results show that students who move to the non-risk group continue in this group from week 5 onwards. In addition, medium-risk students mostly move to the no risk group between weeks 3 and 5.

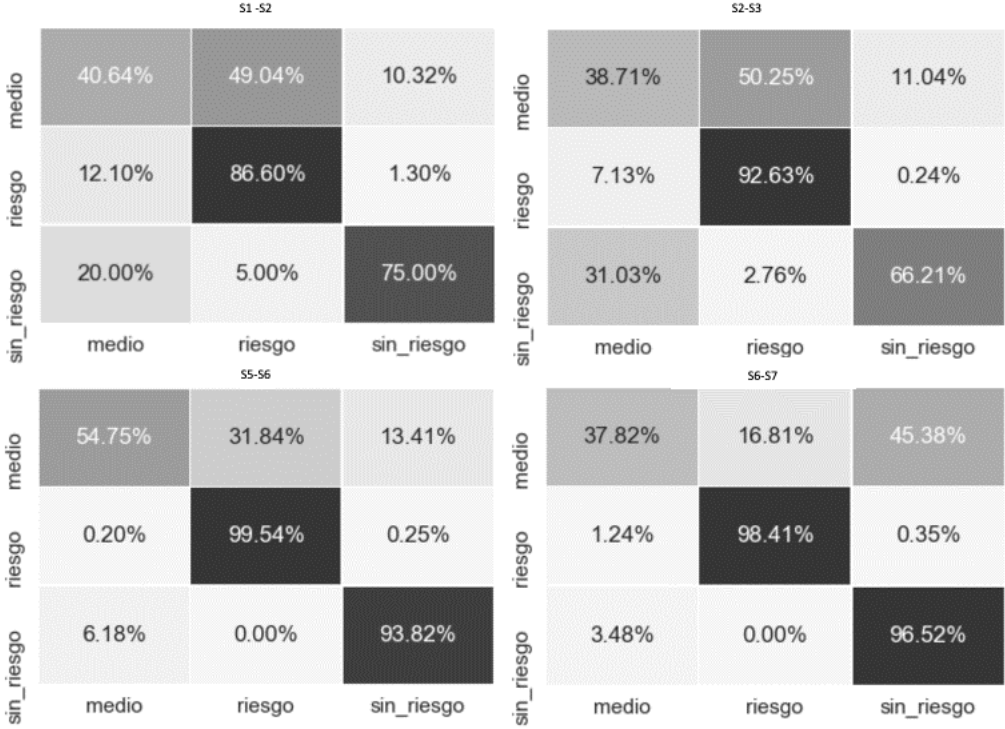


Figure 37. Percentage of students in each group (medio – medium risk, riesgo – high risk, and sin_riesgo – no risk) and the probability of moving from one group to another. Y axis represents the initial week and X axis represents information related to week + 1.



Phase 5: Evaluation and Improvement

Teachers' perception of the tool

This section summarizes some of the aspects highlighted by the two teachers participating in the experiment on the use of the tool. These perceptions were collected through informal interviews and email exchanges that occurred during the pilot experiment.

The teachers highlight different advantages of using the tool. First of all, they appreciate being able to have a clear visualization about the probability of dropping out of students in the course. One of the teachers highlights "Although Coursera already offers several tools to visualize information about the students of the course, a tool was lacking that would show information to guide decision-making. The division into groups that this tool offers makes it easier".

Second, the teachers value the possibility offered by the tool to send personalized messages in relation to their probability of abandonment. One of the teacher's comments "It helped me a lot to be able to classify the students into groups in order to send more personalized messages." The other reiterates "It was very useful to have the list of students by group to be able to send the messages."

Third, the teachers value the examples of emails provided in the tool. The messages were appreciated as a form of communication between the teacher and the data provided, as well as to guide the teachers in sending the tool. One of the teacher's comments: "The example messages helped me to interpret the data and better understand the statistics that the tool shows, in order to later personalize the messages better."

In addition, the teachers suggest some improvements to the tool. First, they highlight the lack of direct integration with the platform. Since Coursera is a closed platform, any complementary tool is external to it, despite the fact that it feeds on the data generated in Coursera. The teachers would have preferred to include the tool in Coursera to facilitate the sending of messages. One of them comments: "It would have been easier to find all the information that the tool offers on Coursera, to be able to directly integrate the sending of messages."

Secondly, the teachers also highlight that the tool lacks a functionality to track the messages sent. Although the teachers had an insight into the messages sent from the Coursera forums, they would have appreciated seeing.

Finally, they also suggest that a visualization could be integrated into the tool to see the evolution of the students throughout the course and observe the impact of the messages. One of the teachers mentions: "I would have liked to see the effect of the messages, that is, how the probability of dropping out varies throughout the course."

Learned lessons

The pilot shows that the tool could be successfully integrated into an existing process of monitoring students in a MOOC, improving the process of sending personalized messages.

Among the lessons learned, mainly 3 stand out.

- In online learning contexts, with information from many students, teachers value having visual information about the evolution of students that allows them to make decisions and carry out concrete actions. The second is that.
- Sending personalized messages is a mechanism valued by teachers, for its simplicity and its direct impact on the teachers' study process.
- Proposing sample messages for each group of students is a useful mechanism to communicate the information from the graphs to the teachers, as well as to guide them in the writing of the messages.

Among the potential improvements, the following lessons learned stand out:

- It is important to integrate the tool within the Learning Management System to facilitate data access and message management.
- The visualizations could include the trajectory of the students throughout the course, to see the impact of the messages.

4.3 Pilot Projects at University of Cuenca (UCuenca)

4.3.1 AvAc Counselling Tool Pilot Project

AvAc was created to enable a lecturer to give recommendations to a student regarding which subjects to take in the new semester, based on a visualization of academic data. This tool is used before the beginning of each semester (by students who need to request to take a subject for the third time or request to add new subjects), and in the middle of the semester (only students with low averages are invited to attend).

The tool was developed using NodeJS technologies with an implementation of two layers of abstraction: the model and the controller, together with configuration files for database connection and information needed for connection to the authorization server. A REST API was created for database access. To analyse the data generated by the tool, instructions were included in the code for the dashboards that enable a feed to a log with all the actions performed by the user (e.g., click, mouse over) and additional information (e.g. subject, display, icon, button).

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool
- Computer technician for service support (tool availability)
- Project researchers for data collection and analysis
- Pilot team
 - Project Coordinator
 - **Specialists in technological infrastructure**
 - **Group for training, pilot project support and monitoring**
- Participants:
 - Users involved in Academic Counselling Dashboard: 4 degree directors, 16 academic committee members or faculty, 2 administrative staff, and 522 students.
 - Users involved in the Evaluation Activity by Subject Results Dashboard: 41 lecturers and 500 students indirectly.



Methodology, Artefacts and Planning

Table 28 presents the phases, activities, dates, methodologies, efforts and artefacts planned for the execution of the pilot project.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Artefact development	15 July 2019	20 July 2019	Prepare LALA Project Presentation and Academic Counselling Unit Proposal Presentation of the characteristics and use of the UCuenca Academic Counselling Tool Adaptation of perception surveys and work on the special application process for subject enrolment and withdrawal (UACH originals) Refine tool use log
Agreement	Agreement with the participants	20 July 2019	20 July 2019	Adaptation of informed consent (UACH originals)
Dissemination	Raise interest in other faculties and engage faculty. Several sessions were required to identify people prepared to commit.	15 July 2019	29 July 2019	Adapting the presentation of the features and use of the Counselling Tool Use of the Academic Counselling Tool with real data Notes: Initially this phase was conceived as training but there was scepticism regarding the use of the tool and the process.
Training	Training for users	20 Sept 2019	2 Dec 2019	Use of the Academic Counselling Tool with real data Knowledge test Pre-test questions (faculty) Guide for Academic Counsellors UCuenca Academic Attendance List
	Training for administrators	4 April, 2020	4 April, 2020	Meetings with the system administrator
Use	Monitoring of activities	22 April 2020	3 May 2020	SUS (System Usability Scale) Knowledge test
		13 September 2020	20 September 2020	Google Analytics
Evaluation and Improvement	Evaluation	7 May 2020	31 May 2020	Post-test questions (faculty)
	General evaluation	18 April 2020 23 April 2020	18 April 2020 23 April 2020	Meeting minutes /emails
	Documentation of improvements (in relation to training)	29 April, 2020	29 April, 2020	Report to the Academic Vice-Chancellor

	Analysis and Documentation of improvements (in relation to use)	21 May, 2020	3 September, 2020	Report to the Academic Vice-Chancellor
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Table 27. Planning of pilot

A description follows of the development and results obtained after carrying out each of the activities in the phases mentioned in Table 28.

Phase 1: Preparation

Processes included in the pilot

At present UCuenca does not provide academic advice to students, although isolated efforts exist, which depend on the organization of the university's different faculties (12 faculties). These efforts are aimed at providing academic monitoring of students. Faculty members in charge of student monitoring are usually members of the academic committee, where, depending on the faculty, they include academic monitoring activities as part of their responsibilities. Faculty members obtain academic information from the university's computer systems. Furthermore, there is no defined academic counselling process, no time allocation for academic counselling activity, and no supporting computer tools.

In 2017 and 2018 a survey of learning analytics needs was carried out at the University of Cuenca as part of the LALA project. As a result of the cross-analysis of data obtained for the four Latin American educational institutions participating in the LALA Project, the following needs were identified:

- Students require quality feedback and data-based support from teaching staff in order to improve their learning outcomes.
- Students require timely support interventions from teaching staff and directors when they are experiencing difficulties that affect their academic performance.
- Teaching staff require timely alerts from directors to provide better support for students facing difficulties that affect their academic performance.

Based on the findings of this survey, it was decided to create an academic counselling tool that supports timely feedback and support to students in order to improve their learning outcomes. Furthermore, with the objective of providing teaching staff with tools that allow them to identify students who might be facing difficulties that affect their academic performance, it was decided to build a tool that allows them to analyse the academic performance of students in the subjects taught.

Consequently, UCuenca is not including a process but rather the pilot will be a first experience of the implementation of the advisory process.

Utility and impact baseline

After an initial design of AvAc, it was released for correction and improvement. Once the corrections and improvements identified in the dissemination sessions had been implemented, the pilot phase began in 4 faculties (Engineering, Chemical Sciences, Economic and Administrative Sciences, Hospitality Sciences) and baseline surveys were applied (see UCuenca Annex 1 and Annex 2). The artefacts used were adaptations of those provided by UACH. In the baseline study, those participating (degree directors, teaching staff, administrative staff) were asked about the current amount of work involved in requests for



enrolment for special courses (see Figure 32), and their perception of the support available to carry out the process (see Figure 35).

The results reveal that 16 of the 29 participants who responded positively to the question (3 of the 32 did not respond) consider it important for the university to offer students a face-to-face support service during the application process, improving support for the resolution of enrolment and withdrawal requests (Figure 35).

According to Figure 36 (which reflects the amount of work related to special requests), of the 19 people who responded (out of 31), 7 people consider the number of requests for enrolment for special courses to be 50 or more per term; 5 people consider the number of requests to be between 26 and 50; and the remaining people consider the number of requests to be less than 26 per term. In addition, the survey providing the data for Figure 32 establishes that each request takes between 2 and 5 minutes. In this survey (amount of work for special requests), 12 people out of 31 did not respond because their activities do not include dealing with special requests for subject enrolment or withdrawal.

In general, survey participants agreed that displaying student academic information as a dashboard is better than browsing through different reports. However, some participants expressed concern that there would be additional workload due to the need to adopt both a process and a tool for academic counselling.

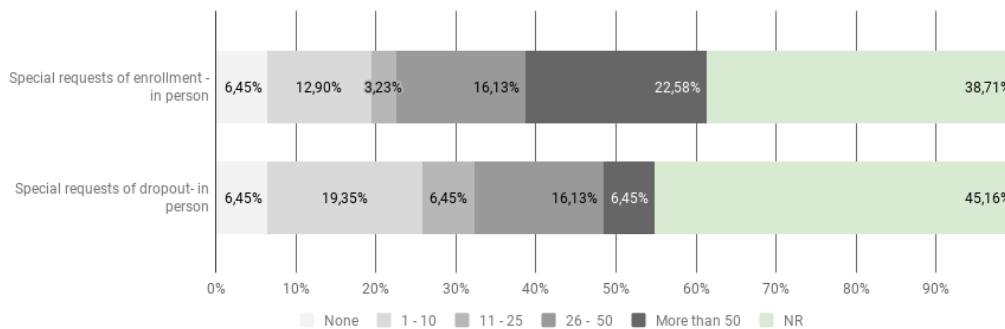


Figura 38. Number of special requirements per semester.

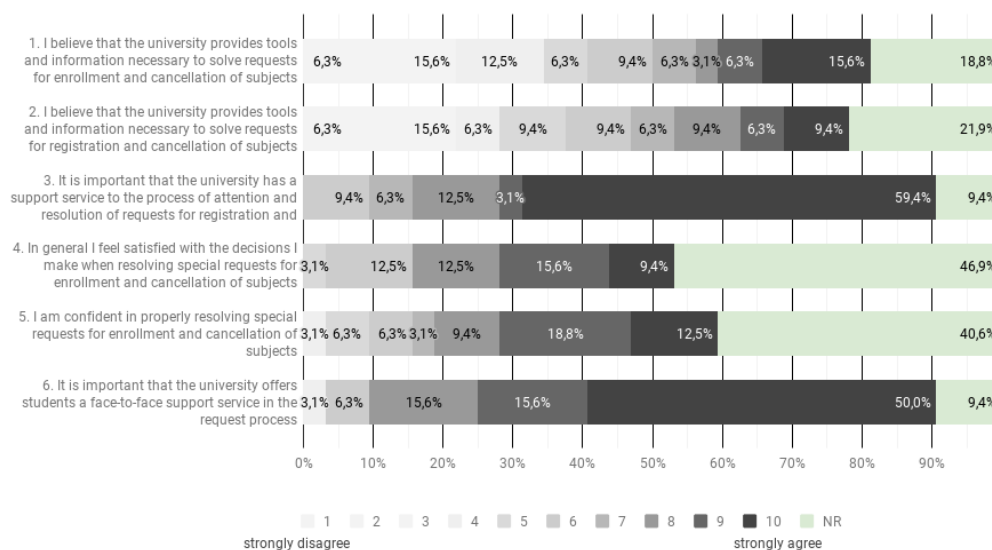


Figura 39. Perception of support received from the University regarding the task.



Phase 2: Agreements

As of the date of writing of this report, 16 participants have signed the declaration of consent corresponding to the Academic Counselling system, and Table 29 shows their distribution by unit. The artefact used is an adaptation of the agreement document provided by UACH (see UCuenca Annex 3).

As will be seen below, although 16 participants have signed the agreement, the tool has been made available to all training attendees who have requested it (45). This is why the number of active users (see Phase 4: Use) is greater than the number of people who have signed the agreement.

Unit	Quantity
Chemistry Science	4
Administrative and Economical Sciences	3
Hospitality Sciences	6
Engineering	3
Total	16
Distribution by gender	
Women 11 (69%)	
Men 5 (31)	

Table 28. Participants who signed the agreement.

Phase 3: Training Report

Description of the training phase

The training sessions lasted two hours and took place in separate sessions for each different faculty. To this end, the deans of each faculty invited teaching staff from their respective schools. During these sessions, people who had not previously filled out the baseline surveys (during the previous dissemination sessions) did so, and the teaching staff who requested access to the tool were given participation agreements (45).

The following activities were carried out during the training session:

- Project LALA was presented, and the dashboard visualizations were explained.
- Participants used the Beta version of the tool, but it was fed with real data. Specific student cases were analysed. To this end, participants were requested to bring the identification numbers of students who wanted to analyse their academic situation to the training session.
- Using an online form, the teaching staff provided feedback on the training (not all accessed the online form).
- Teaching staff who signed the informed consent were provided with a guide for academic counselling.

Description of participants in the training phase

79 people were trained (degree directors, members of the academic commission, lecturers, administrative staff).

Unit	Quantity
Chemistry Science	16
Administrative and economical sciences	39
Hospitality Sciences	6
Engineering	14

Architecture and urbanism	4
Total	79
Distribution by gender	
Women	42 (53%)
Men	37 (47%)

Table 29. Participants in the training sessions.

Evaluation of satisfaction of participants in the training phase

A 10-item Likert scale survey was created (see UCuenca Annex 4) with eight questions, both open and closed, regarding training and confidence in the use of the tool. 21 lecturers completed the survey, and their results indicate that most teaching staff would recommend the training, feel confident that they can start using the tool and know where to go in case of problems. Figure 40 shows these results.

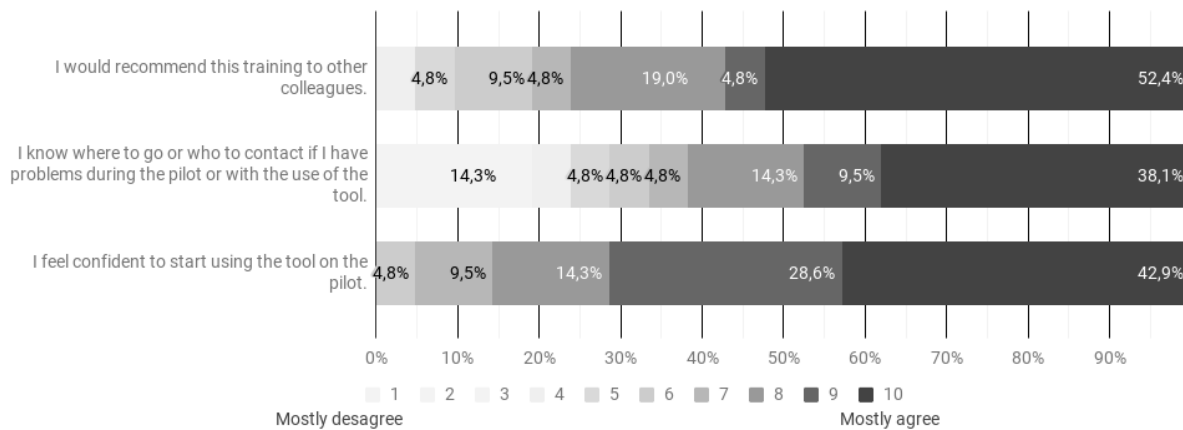


Figure 40. Training satisfaction survey results.

Phase 4: Use Report

Descriptive statistics of use records

The Avac tool has a system that records the actions that users perform on it. According to these usage records, the Academic Counseling Dashboard is being actively used by 48 professors (of the 74 to whom the agreement was delivered) involving 1873 students. This activity is expected to continue to increase, as the necessary changes have been made to AvAc so that other faculties, with a different qualification structure, that were not part of the piloting, can use it. In Figure 41 you can see statistical values in a general way about the piloting carried out, including the total number of teachers who used the tool, the



averages of actions carried out, times taken for said actions, as well as an average of the number of students who the teachers reviewed the information, with and without their presence.

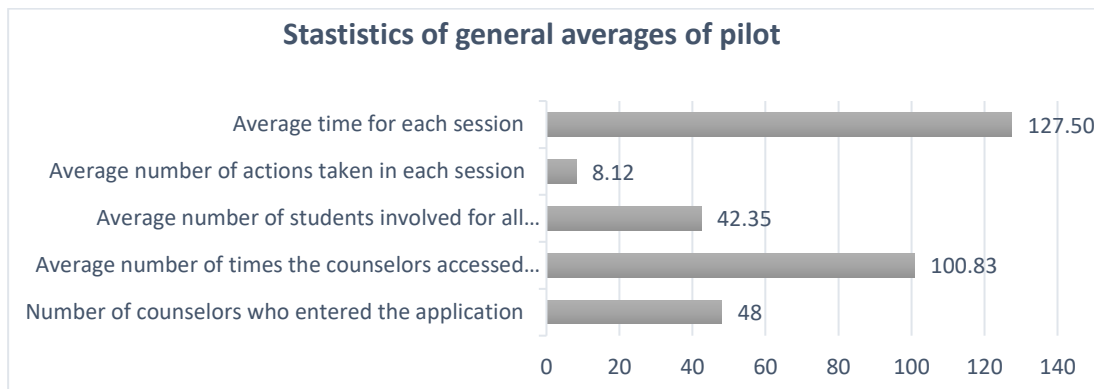


Figure 41. General pilot statistics

In addition, in *Figure 42*, we can observe an average of both period of time and number of times that some of the actions considered most important for the analysis were carried out.

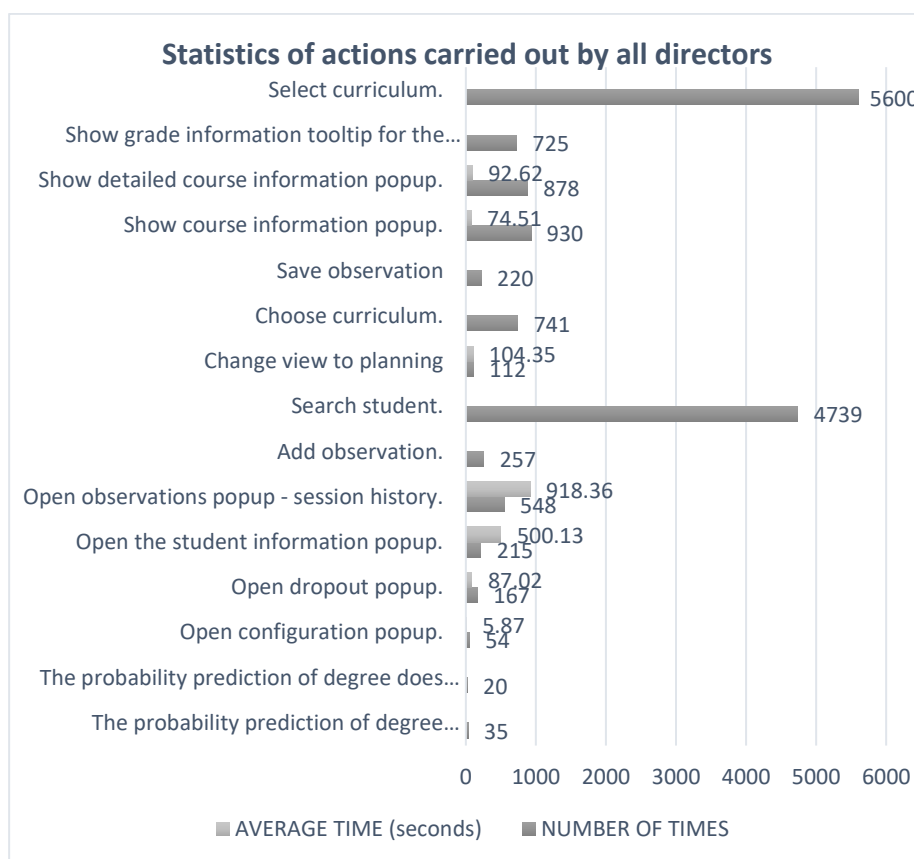


Figure 42. Statistics on actions taken by all counsellors.

The statistics described above correspond to the use made of it by the teaching staff involved in the pilot phase and who have monitored the academic progress of the students who are taking a subject for the



second or third time. To this end, the deans were provided with a list of students ordered according to their performance and a guide for the execution of academic counselling (see UCuenca Annex 8). In addition, they were requested to invite students they felt would benefit to attend academic counselling meetings. The data was recorded in logs, which show that 1873 different students have been monitored. 344 of these students were invited to a face-to-face counselling session and 184 attended on their own initiative.

The logs record that a total of 30 counsellors used the "*student's overall academic information*" display within AvAc, i.e., overall averages in terms of passing, failing, or repeating subjects, as well as the student's overall grade point average for the degree. This was performed for a total of 50 students with and without their presence.

In addition, a total of 29 counsellors used the subject planning view for the following semester for a total of 74 students, of which the majority was done without the presence of the student. The maximum time of use of this view was 5 minutes and 49 seconds.

Regarding all the actions that the counsellors have carried out on the counselling tool, both with and without the presence of the student, they stand out, review the information of the subjects, that is, they select the subject and observe the histogram that shows the distribution of students' grades in a course and the location of the analysed student's grade relative to their classmates. As well as detailed information on the subject, which shows the grades in the different contributions (exams, suspension, etc.) and review the general academic information of the student in the interface of "Student Information". According to Figure 35, the action that the counsellors have taken the most is "Choose curriculum", an action that allows viewing academic information about other curricular networks or careers in which the student has taken a subject. The high number of executions of this action is since at the university there was a process of redesign of careers, which caused many students to have to change the curriculum. From this it can be inferred that AvAc is providing support for academic advisers to analyse the academic situation of the student before they have changed courses.

Only 17 counsellors have also used "add observation to counselling session" functionality involving 185 students (more than one observation for some students). This has taken them between 10 and 17 minutes. Many of these observations indicate why the student repeated or failed a subject, as well as the suggestion that the student was given to attend the next period.

AvAc use and utility survey

In order to collect information on the use or practices supported by the AvAc tool during the counselling process provided by teaching staff to students, each lecturer was requested to ask the student to respond to a survey after using the tool in each counselling session (see UCuenca Annex 5). It consisted of 10 questions regarding the usefulness of the tool. The purpose of this meeting was to obtain feedback from the students and to improve the tool for future piloting and counselling sessions. The first question simply indicates whether or not the student observed the counsellor using the AvAc tool for the session, while the remaining 9 questions indicate the student's perception of the tool. They could select an answer from 1 to 10 for each question, with 1 indicating complete disagreement and 10 indicating complete agreement. The results of these surveys are discussed below.



AvAc use and utility survey results

The analysis of the answers obtained in the survey sheets mentioned above, show that 25 students participated in this evaluation. 22 of the 25 participating students state they saw the AvAc tool on the lecturer's computer at the time of the session. In addition, most (18, answers with scores 9 and 10) say that it was easy to see that they were looking at their academic history in the tool. In addition, students would like to be able to access it from their homes, as 17 of them indicate that this helps them reflect on their academic situation. In *Figure 40*, these results can be seen in more detail

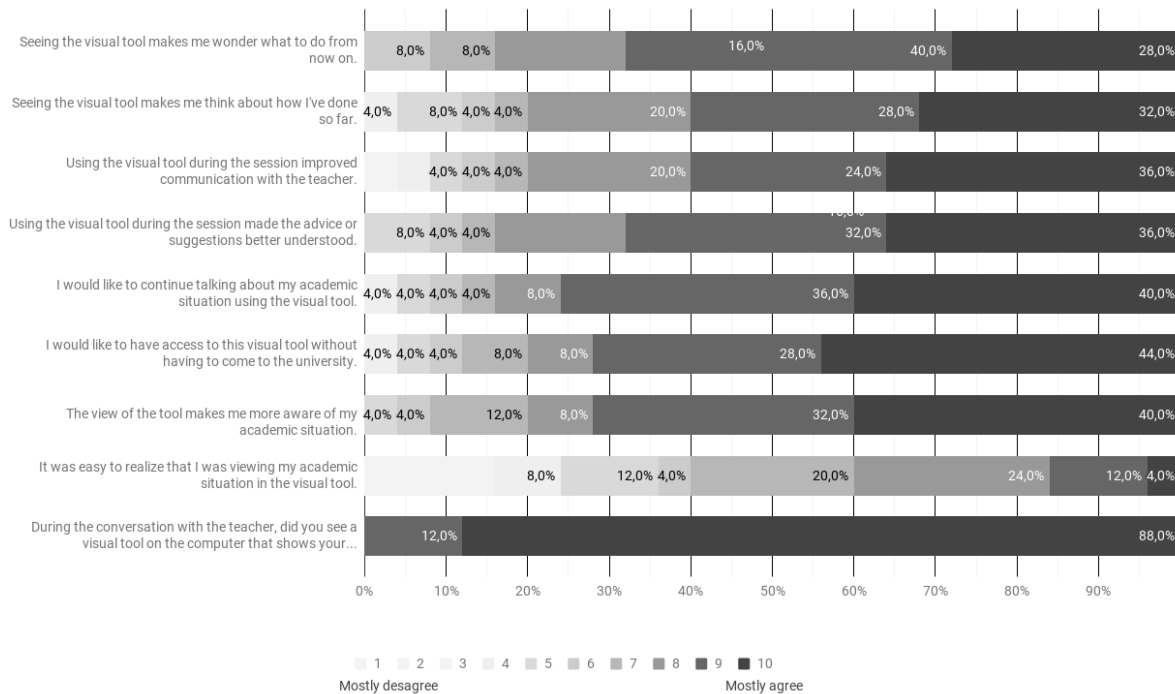


Figure 43. Usefulness survey results.

Impact on student performance results

To verify whether the AvAc tool had a positive influence on academic performance, only academic information from students who attended an academic counselling session supported by AvAc was taken into consideration.

The performance of the 240 students involved in the piloting during the March 2020 period was compared with their performance in the March 2019 and September 2019 periods. All the students included in this analysis belong to one of the races in which the piloting was carried out. This career, prior to registering the subjects for the period of March 2020, invited its students to an academic counselling session supported by AvAc. In the two previous periods, students did not have an academic counselling session prior to registration.



The academic data analysed were: grade averages, subjects taken, subjects failed, and subjects cancelled during the academic period. According to the data in Table 31, and based on the academic period March 2020, it is necessary to:

- The average grade obtained by students during March 2020 (where AvAc was used) was higher. Increasing by 6.44% compared to the previous academic period.
- The average percentage of failed subjects in March 2020 with respect to the total of subjects taken was 28.80%, being higher compared to previous academic periods (28.06% and 28.02% respectively).
- The average percentage of subject cancellations was lower than in previous academic periods. However, it shows that even though in the academic counselling sessions students were suggested the subjects to take in the period March 2020, these suggestions were not accepted by the students.

Result of academic counselling			
Description	Before using AvAc		after AvAc
	March-2019	September-2019	March -2020
Calcifications average	70.63	73.76	80.20
Percentage of increase in grades compared to the previous semester	-0.32%	3.13%	6.44%
Average number of subjects taken	5.38	4.92	5.40
Average percentage of failed subjects	28.06%	28.02%	28.80%
Average percentage of subjects cancelled	22.78%	21.33%	19.80%

Table 30. Result of the analysis of the academic performance of the students by semesters.

Figure 44 shows these variations in student academic performance by semester.

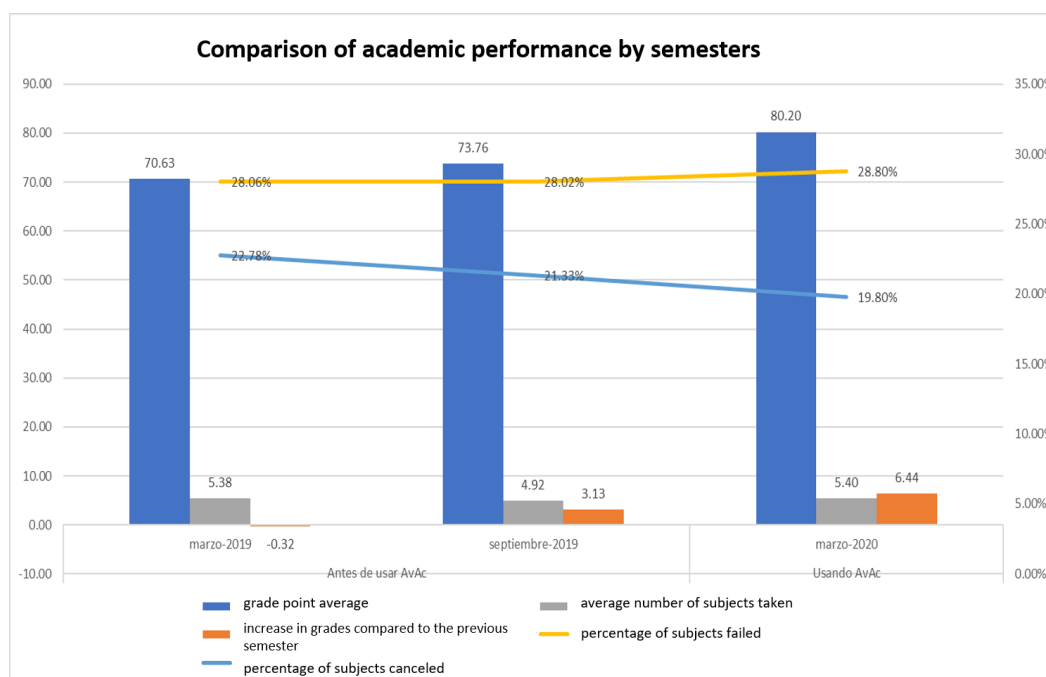


Figure 44. Comparison of academic performance by semesters.

Even though the results do not show a significant impact on the academic performance of the students, especially in the reduction of the percentage of failed subjects, AvAc has been accepted by academic counselors. They have stated that AvAc facilitates their work, and like what was stated by the students, it allows them to have a clear vision of the academic trajectory of the students.

Phase 5: Evaluation and Improvement

According to what was planned, an evaluation of the AvAc tool was carried out to validate its usability (ease of use) through the knowledge acquired by the participants who used it, this was done through surveys (see UCuenca Annex 6), which it resulted in a total of 32 users who responded to the survey, with the majority indicating that they would like to use the system more frequently, which means that the tool is a good support in terms of academics. The following figure shows the responses to the survey by users in detail:

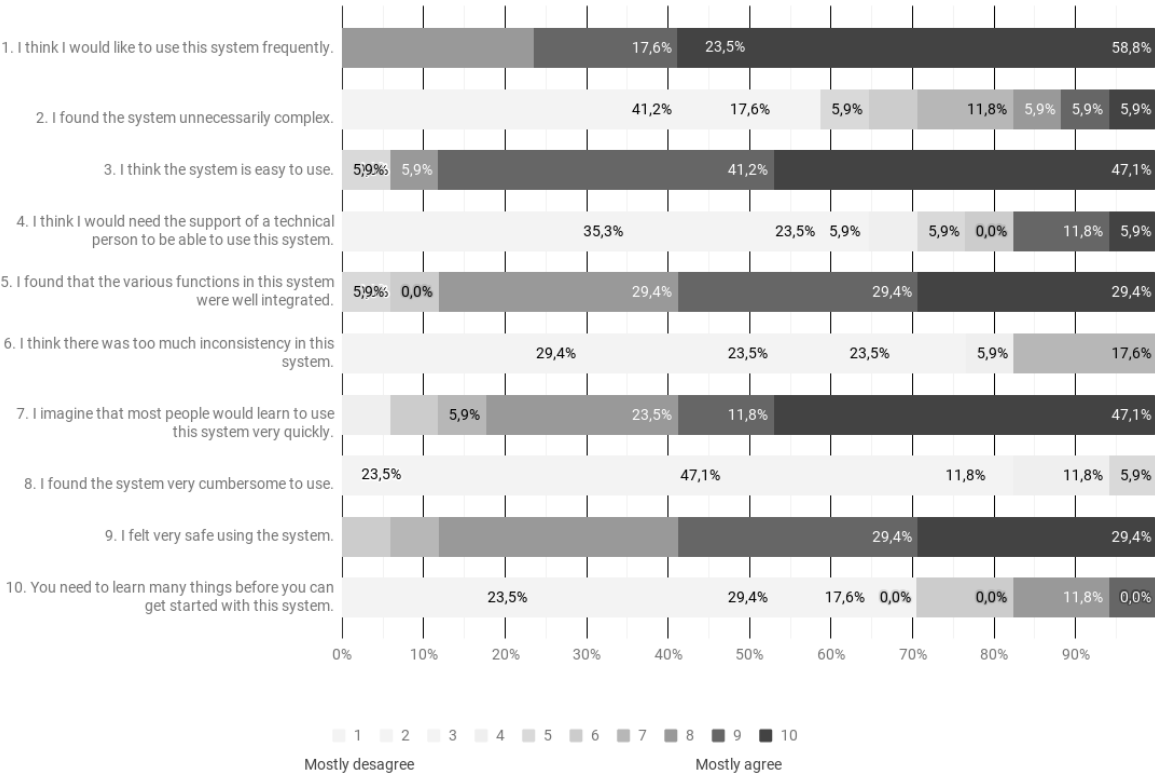


Figure 45. Usability survey results.

Post-pilot analysis results

It has been possible to identify some lessons learned during this process. These lessons are listed below and are intended to guide other institutions in their piloting process when adopting AvAc or another LA solution.

With respect to obtaining the support of authorities or internal sponsors for the project, especially in institutions that do not have previous experience with LA, it is important to be able to clearly communicate what is expected from this type of project. Inexperienced institutions may not be clear on either the type of deliverables expected from this type of project, or the applicability of these deliverables. It is important



to hold workshops that show examples of tools designed for similar educational contexts, also including processes and results of their application. This is in order to motivate institutions to adopt LA.

With respect to obtaining requirements and designing the visualization tools, it is of great importance that the stakeholders collaborating in the process are not limited to experts in the academic domain, ensuring the participation of technical personnel who work with the institutional databases. In our case, this resulted in an important contribution because not only did we get the commitment of the IT department, but in the process of obtaining information requirements, the existence of data that could provide the required information was quickly and easily identified. In addition, the tools should be socialized early with the authorities of the institution and different faculties/degrees/units to detect possible conflicts with the policies of the institution and different ways to execute the processes depending on the faculty/degree/unit.

With respect to the piloting activities, a careful selection of the participating units should be made as their internal policies, allocation and monitoring mechanisms may be different from one another and therefore affect the performance of the pilots. It is recommended that criteria be defined that will satisfy the units participating in the pilots and to carry out a prior verification of their compliance before committing to them.

4.3.2 Dropout Prediction Tool Pilot Project

The dropout prediction tool was designed to alert teaching staff to the possible early dropout of students. This alert is intended to enable the lecturer to detect the possible reasons for each student dropping out and to intervene in time to prevent possible dropouts. Like the AvAc tool, the dropout prediction tool is used before the beginning of each semester, when all students must attend counselling sessions, and in the middle of each semester, when only students with low averages must attend counselling sessions.

The visualizations for the dropout prediction tool were developed using two different technologies for the frontend. The first technology used is ReactJS, a framework that allows writing both html and JavaScript code together using typescript, facilitating the creation and design of complex components; and the second technology used is D3JS, which is a library that, besides allowing manipulation of the DOM in real time, allows the design of graphics of any kind in svg format, providing functions that facilitate each of these tasks. For the backend, NodeJS technology was used with an implementation of two layers of abstraction: the model and the controller (sequelize), together with the configuration files for the connection to the database. In addition, a REST API was created for database access. To analyse the data generated by the visualization of the risk of degree dropout, instructions were included in the dashboard code that enable a feed to a log with all the actions performed by the counsellor (click, mouse over, mouse out, etc.), and additional information (subject, visualization, student, counsellor, etc.). Lastly, in the frontend, a file in json format was included, which contains all the texts that explain in detail each of the variables shown in the display of the dropout risk utility when the cursor is moved over these variables.

The processing of the academic data and its analysis, the creation of the models, and the prediction algorithms were programmed in the Python programming language and using libraries such as Pandas and the free software from the Scikit-learn library. This open-source library implements many machine learning algorithms with which the different predictive models were made. Different tests were done with the following algorithms: Random Forest, Decision Tree, Support Vector Machine (SVM), Multi-Layer Perceptron (MLP) and Gradient Boosting among others.



Resources

This section describes the project resources for the piloting of the dropout prediction tool.

- Project coordinator: 1
- Support group: 2
- Infrastructure: 2 servers
- Collaboration with UC3M for the development of the prediction algorithms
- Users involved in Academic Counselling: 4 program directors, 16 academic committee members or faculty, 2 administrative staff, and 290 students
- Users involved in the Evaluation Activities by Subject Results: 40 lecturers and 500 students indirectly

Methodology and planning

The steps followed are the same as for the counselling tool. Table 32 shows the phases, activities, dates, methodologies, efforts and artefacts for the execution of the pilot project.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Tool development	25-11-2018	22-10-2019	Preparation of the necessary data Development of the tool Refining tool use log
	Socialization of the pilot plan with stakeholders	15 July 2019	20 July 2019	Preparation of LALA Project Presentation and Academic Counselling Unit Proposal Presentation of the characteristics and use of the UCuenca Dropout Prediction Tool. Adaptation of perception surveys and work on the special application process for subject enrolment and withdrawal (UACH originals)
Agreement	Agreement with participants	20 July 2019	20 July 2019	(Same phase as with the counselling tool) Adaptation of informed consent (UACH originals)
Dissemination	Raising interest in other faculties and engaging faculty. Several sessions were required to identify people prepared to commit	15 July 2019	29 July 2019	Adaptation of the presentation of the features and use of the Counselling Tool Use of the Academic Counselling Tool with real data Note: Initially this phase was conceived as training but there was scepticism regarding the use of the tool and the process.
Training	Training for users	20 Sept 2019	2 Dec 2019	(Same phase as with the counselling tool) Use of the Academic Counselling Tool with real data Knowledge test Pre-test questions (teaching staff) Guide for Academic Counsellors UCuenca Academic Attendance List
	Training for administrators	4 April 2019	4 April 2019	Meetings with the system administrator
Use	Monitoring of activities	22 April 2019 13 September	3 May 2019	SUS (System Usability Scale) Knowledge test Google Analytics



			20 September 2019	
Evaluation and Improvement	Evaluation	7 May 2020	31 May 2020	Post-test questions (teaching staff)
	General evaluation	18 April 2020 23 April 2020	18 April 2020 23 April 2020	Meeting minutes /emails
	Documentation of improvements (related to training)	29 April 2020	29 April 2020	Report to the Academic Vice-Chancellor
	Analysis and documentation of improvements (in relation to use)	21 Ma 2020	3 September 2020	Report to the Academic Vice-Chancellor

Table 32. Pilot planning

Phase 1: Preparation

Processes included in the pilot project

In the case of the dropout prediction tool, this report is shared with the AvAc tool and can be found under Phase 1: Counselling Tool Baseline Report.

The prototypes generated by other partner institutions were used as materials for the focus groups explained in the previous point. In particular, the prototype made by ESPOL was used as a starting point. As a result of the design, high-fidelity prototypes of the dropout prediction visualization were obtained.

The high-fidelity prototypes served as input for building the corresponding Beta versions. We proceeded to disseminate the academic counselling tool in faculties (three) that did not participate in the design (Chemical Sciences, Economic and Administrative Sciences, and Hospitality Sciences) with the aim of gaining their commitment to participate in the pilot phase, receiving feedback to improve it. During these sessions, participants analysed the real academic records of students in their degrees.

Baseline

As in the previous section, the baseline of the dropout prediction tool was drawn up according to the AvAc tool. All the information can be found under Phase 1: Baseline report in the Baseline section.

Phase 2: Agreements

The visualization of the dropout prediction tool is integrated in the counselling dashboards so the agreement report is the same as for the other tools and can be found under Phase 2: Counselling Tool Agreement Report.

Phase 3: Training

The training for the prediction tool took place at the same time as the AvAc tool and the process followed can be seen in the section Phase 3: AvAc Tool Training Report.

Phase 4: Use and Impact

Descriptive statistics of use records

According to the information obtained in the logs during the pilots carried out on the dropout prediction tool, the following information has been obtained:

Action	Number of Teaching staff	Number of Students
Able to use the tool	74	
Making use of the AvAc tool	48	1873*
Going to counselling	25	344**
Asking for advice	19***	184
Making use of the dropout prediction tool	48	135

Table 31. Number of actions in the tool

*Students analysed with or without their presence in counselling.

** Includes students who were invited to a counselling session and students who requested a session.

***Number of counsellors who have received requests for counselling

As can be seen in Table 29, out of a total of 1874 students only 135 have received counselling based on the results of predicted dropout. These results are largely since in the last larger pilots carried out the dropout prediction could not be available for the new faculties, but it represents a significant improvement with respect to the previous pilots, in which it had to only 13 teachers reviewed the dropout prediction for just 18 students.

Even so, in all cases where students decided to go to counselling sessions of their own free will, before the session lecturers made use of the dropout prediction tool to prepare their observations and advice for these students and to recommend the subjects they should take in the following period.

A total of 48 counsellors were interested in checking the student's overall academic information, i.e., overall averages in terms of passing, failing, or repeating subjects, as well as the student's overall grade point average for the degree. This was performed for a total of 1873 students with and without their presence.

In addition, of these 74 counsellors, as mentioned above, the 48 observed the risk of dropping out of the students without their presence, and, according to the analysis carried out in the logs, the maximum time that one of these counsellors was analysing the risk of dropping out of a student is 4 minutes and 38 seconds. It could be deduced that he or the student has a fairly high risk of dropping out of the career and therefore, the teacher had to carefully analyse each of the variables for which the student presents that percentage of risk of dropping out of the course. career.

Based on the tool's use logs, it has been concluded that most counsellors carried out a careful review of the student's academic status through the student's curriculum, focusing on the grades he/she had obtained in each of the subjects and those of his/her classmates, as well as the subjects the student failed. In addition, they continued to review the student's academic progress after reviewing the dropout rate.



Also, according to the logs obtained from the tool, there has been an increase in the use of the dropout risk tool, which means that decision makers give importance to the student's grade probability to provide the necessary advice the same.

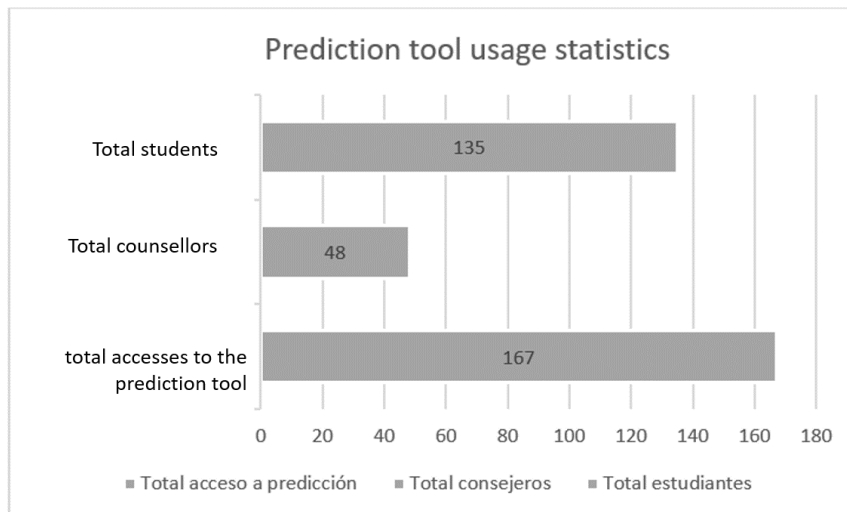


Figure 46. Results of the use of the dropout risk tool.

In addition, according to the feedback from users on whether or not they agree with the prediction they see, we can conclude that the prediction still needs to be improved, since, although the majority indicate that they agree with the prediction about the student that you are analysing, there is a high number of users who indicate that they do not agree, therefore, it is necessary to review the cases in which users do not agree, based on this, to find a solution.

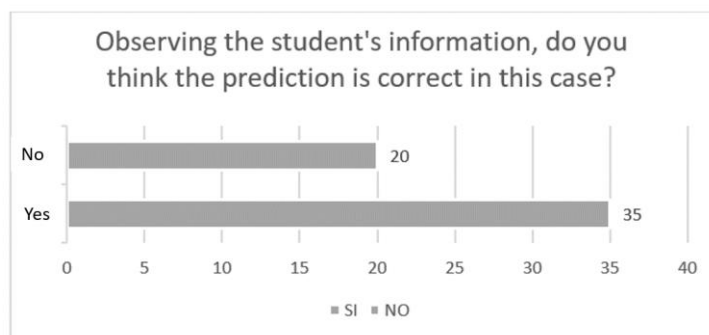


Figure 47. Feedback results for the dropout risk tool.

Academic counseling sessions will continue once the intermediate and final grades for each semester are available in order to increase teacher and student participation.

Phase 5: Evaluation and Improvement

After conducting the training phase for counsellors, some suggestions were received regarding the tool in a first attempt to improve the tool and its visualization. After collecting these suggestions, a first modification of the dashboard was made and more data was included, such as the variables used for the calculation of the probability of dropout, and some explanations regarding these.



Because a high level of probability of dropout (close to 100%) caused alarm in teaching staff, it was decided to limit this probability to a maximum of 90%. However, at the University of Cuenca, the data used for predicting university dropout only refers to student academic performance, since no other type of data is yet available. For this reason, depending on the socio-economic situation or the behaviour of the student in the face of setbacks during their degree, the probability of dropping out may differ from that provided. Therefore, it was decided to provide a warning message to the counsellors before showing the probability of dropout of those students with a high probability. The message shown is as follows:

“The probability of dropping out has been calculated solely by using academic data pertaining to the student's curriculum path. The student's socio-economic and personal data have not been considered, so the probability of dropout may be lower than that shown below.”

Another modification made to the preliminary version was the incorporation of the prediction algorithm's hit rate. It was necessary to provide this information to the counsellors so that they could observe the probability of success of the algorithm, and although it is not possible to offer an algorithm reliability for each student, it was decided to offer the success rate of the algorithm by the student's degree and current semester.

The survey, together with the use logs, allowed for a more extensive analysis of the tool and the usefulness and impact it has had on the institution. In addition, this analysis served to further improve the visualization, explanations, and prediction models.

4.4 Pilot Projects at Escuela Superior del Litoral (ESPOL)

4.4.1 SiCa Counselling Tool Pilot Project

The SiCa counselling tool allows teaching staff to give recommendations to students regarding which subjects to take in the new semester.

The tool aims to improve the existing process and institutional counselling tool by means of three new visualizations based on academic, personal, psychological and other data. This tool is used before the beginning of each semester (all students must attend counselling sessions), and in the middle of the semester (only students with low averages must attend).

The tool was developed using NodeJS technologies with an implementation of two layers of abstraction: the model and the controller, together with configuration files for database connection and information needed for connection to the authorization server. However, the implementation of an API implies that a security and authentication protocol is in place to prevent unauthorized applications or users from accessing the data. For this purpose, the use of the OAuth 2.0 protocol was chosen, which defines the flow of authorization protocols according to the implementation design of the application, thus allowing access to data in a secure manner. It was decided to create a REST API for the consumption and loading of data from the main application. Google Analytics is used to analyse the data generated by the tool.

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool
- Computer technician for service support (tool availability)
- Project researchers for data collection and analysis
- Pilot team
 - Project Coordinator



- Specialists in technological infrastructure
- Group for training, pilot project support and monitoring
- Participants. The target audiences to be reached within the university are:
End users: ESPOL teaching staff who have counselling responsibilities, and undergraduate students in all degrees and levels.

Planning

Table 34 shows the phases, activities, dates, methodologies, efforts and artefacts for the execution of the pilot project.

Phase	Activity	Start date	End date	Methodology
Preparation	Artefact development	March 2019	April 2019	Artefact development
Agreement	Agreement with the participants	April 2019	April 2019	Project meeting
Training	Training for users	April 2019	April 2019	Training workshop for users
	Training for administrators	April 2019	April 2019	Training workshop for administrators
Use	Monitoring of activities	April 2019 and 2020 September 2019	May 2019 and 2020 September 2019	Online activity analysis
Evaluation and Improvement	Evaluation	May 2019	May 2019	Filling out a Likert survey
	General evaluation	18 April 23 April 2019 09 January 2020	18 April 23 April 2019 09 January 2020	Meeting with Vice Chancellor, Student Welfare, Undergraduate Office, GSTI
	Documentation of improvements (in relation to training)	29 April 2019	29 April 2019	Documentation of improvements
	Analysis and documentation of improvements (in relation to use)	21 May 2019	3 September, 2019	Documentation of improvements

Table 34. SiCa counselling pilot planning

A description follows of the development and results obtained after carrying out each of the activities in the phases mentioned in Table 34.

Phase 1: Preparation

Processes included in the pilot project

Since ESPOL already has a process and a system for academic counselling, the pilot focused on analyzing how the implementation of new visualizations in the system affects the use and acceptance by the faculty advisors, as well as comparing its impact against the last semester where these new visualizations did not exist.

Current situation of processes included

At ESPOL, academic counselling is provided using a system in place since 2013 with the objective of: "Supporting students in their overall educational process, detecting their academic strengths and needs, providing effective solutions, through timely and appropriate support by the Academic Counsellors. This support and monitoring process is carried out from the student's admission through to graduation." Counselling takes place twice during each semester: one week before enrolment and the week following the first evaluation (mid-semester). Each session lasts 15 minutes.

In 2017 and 2018 a needs assessment was carried out in relation to learning analytics at ESPOL as part of the LALA project. The result showed the need to improve the current counselling system. After the technical requirements survey that involved approximately 40 lecturers in an iterative process for designing the tool, 3 new visualization windows were developed.

Utility and impact baseline

To evaluate the usefulness of the visualizations, the baseline was created using a survey with a closed and an open question. In addition, an analysis of the academic situation of the students who come to the counselling centers was carried out for the evaluation of the students' performance.

The current indicators of the aspects to be evaluated in the pilot project are the following:

1. Counsellors' perception of the 2018 counselling system:

175 lecturers out of 341 completed a Likert scale question ranging from 1 (strongly disagree) to 5 (strongly agree) regarding their satisfaction with the current counselling tool. The answer was qualitatively sound.

- a. The wording of the question was: "The information (e.g. tables, graphs) currently provided by the counselling system is sufficient to make sound decisions to guide the student"

175 respuestas

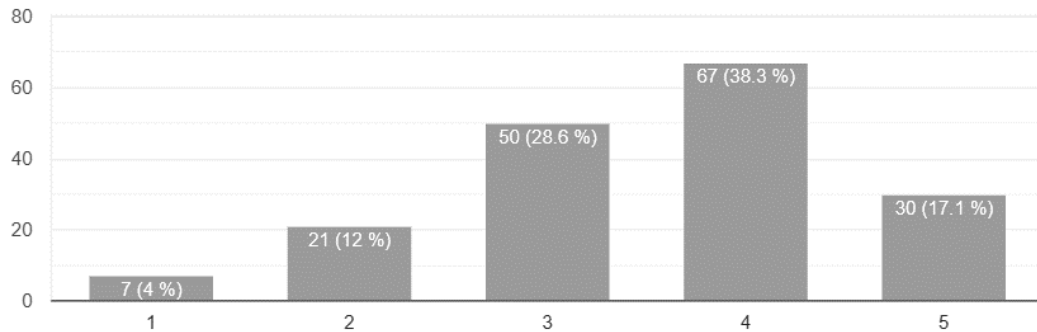


Figure 48. Pre-test results

In *Figure 48* it can be seen from the variety of responses that satisfaction with the current counselling system is not complete. The percentage of "strongly disagree" to "neither agree nor disagree" (44%) is higher than "strongly agree" (17%). The following are some comments on why the dissatisfaction is occurring.

"Sometimes you have to check the academic system because not all the information is up to date in the counselling system."

"It is difficult to interpret and relate to the data presented by the student and the information available on the platform."

"The tables are not so user friendly. You can't just quickly look at subjects passed and grades in previous years, you have to enter another section in the system."

"The information is usually very generic, and often does not fit the student's situation."

2. **Academic Average:** Additionally, the students' academic average was obtained in the first semester of 2018 before the new visualizations were incorporated. The average grade for students who received counselling was 7.60 while for those who received counselling it was 7.72.

Phase 2: Agreements

Description of the pilot population

A total of 152 trained lecturers signed the consent agreement. The agreement was distributed to the teaching staff electronically (see ESPOL Annex 1) and was signed in the same way. The agreement mentions what use will be given to their data during and after the training and who will have access to it. *Table 35* shows the participants.

Because the counselling process already existed at ESPOL, the new visualizations were made available to all counsellors. As will be seen below, the tool has also been used by other counsellors who did not sign the agreement or attend training.

Department		Number
Faculty of mechanical engineering and Production Sciences		17
Faculty of Social Science and Humanity		25
Faculty of Electrical Engineering and Computer Science		34
Faculty of Maritime Engineering and Marine Sciences		7
Faculty of Natural Sciences and Mathematics		26
Faculty of Engineering in Earth Sciences		12
Faculty of Art, Design and Audiovisual Communication		18
Faculty of Life Sciences		12
Library Information Center		1
Total		152
Distribution by gender	Distribution by role	
Female 59 (39%)	Administrative 1 (1%)	
Male 93 (61%)	Conselor 134 (88%)	
	Coordinator 17 (11%)	

Table 32. Results of the participants.

Phase 3: Training

Description of the training phase

Sixteen training workshops were held. These were held between 9 and 12 April. The goal of the workshops was to provide instruction that would allow ESPOL teaching staff to understand how the SiCa tool supports the process of selecting subjects for students through the new visualizations developed.

The following activities were carried out during the training:

Activity 1

- Trainer's explanation of the visualizations, referring to the LALA project.

Activity 2

- The lecturers completed a knowledge test to see if they had learned how to use the tool.

Activity 3

- The lecturers completed a satisfaction survey based on the System Usability Scale (SUS) questionnaire.

Description of participants in the training phase

The workshops brought together a total of 187 teaching staff, and Table 36 describes the participants:

Unidad	Cantidad
Faculty of mechanical engineering and Production Sciences	24
Faculty of Social Science and Humanity	28
Faculty of Electrical Engineering and Computer Science	43
Faculty of Maritime Engineering and Marine Sciences	7
Faculty of Natural Sciences and Mathematics	34
Faculty of Engineering in Earth Sciences	16
Faculty of Art, Design and Audiovisual Communication	21
Faculty of Life Sciences	13



Library Information Center	1
Total	187
Distribution by gender	
Men	115 (61%)
Women	72 (39%)
Distribution by role	
Administrative	2 (1%)
Academic counsellor	166 (89%)
Degree coordinator	19 (10%)

Table 33. Participants of the training sessions

Evaluation of satisfaction of participants in the training phase

To ascertain each participant's assessment of the training, a satisfaction survey was carried out in an online format (see ESPOL Annex 4). It consisted of 10 items for which satisfaction was evaluated from 1 to 5 in relation to the new visualizations (sections) within the counselling system. 183 lecturers completed the survey. The results indicate that most lecturers find the modules implemented easy to navigate, access and visualize.

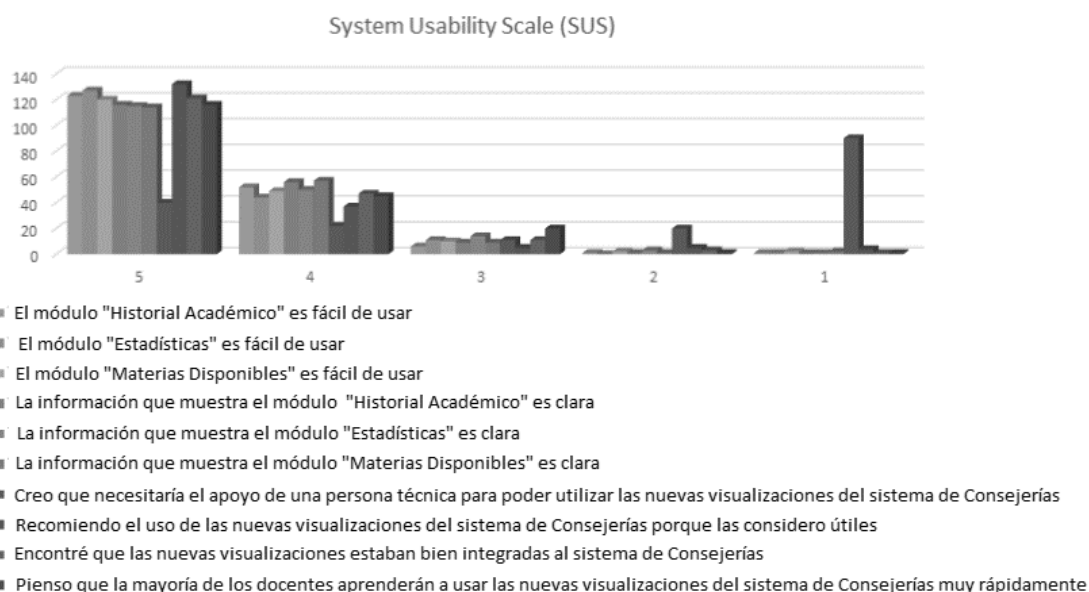


Figure 49. Satisfaction with the usability scale (SUS) results

An open question was also added for comments on system improvements. Among the comments, the following stand out:

"Internship hours should automatically appear and not have to be logged by the user."

"It would be good to make some educational videos about the use of the platform."

"Counselling offices should not be closed; they have to be open so that we can counsel students throughout the semester without interruption."

"Have a report automatically generated at the end of the counselling for all students with statistics to help visualize their use."

Evaluation of learning achievement of participants in training phase

To evaluate learning achievement, participants were asked to solve an open-ended 3-item test where they were assessed on their use of the tool. An example of an item was "Statistics window": How many subjects that were not suggested by the counsellor, were taken by Juan during the 2017-2S semester? (See ESPOL Annex 3). It can be seen from Figure 42 that most lecturers answered the 3 items correctly. This enabled us to confirm the usability "learning" principle in the area of interaction. In other words, we measured that the lecturers remembered where the functionalities of the new tool were.

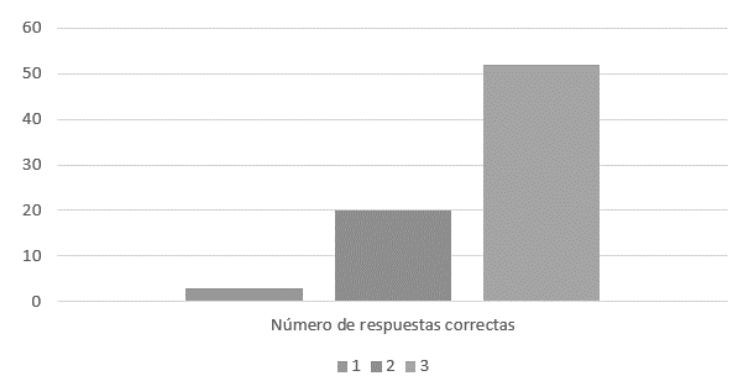


Figure 50. Knowledge test results

Phase 4: Use and Impact Report

Descriptive statistics of use records

The SiCa tool has a system that records the actions performed by users on it. Statistics show that users have been actively involved, and this is reflected in the 287 lecturers who have consulted the new visualizations at least once the tool, which impacted 3655 students during the first semester 2019, and 151 lecturers during the second semester 2019, which impacted 532 students.

In relation to 2020, there is a change. 3 modules from the "Statistics" window were added to the main window of the system (Academic evolution, Wellbeing monitoring, and the retention module). Due to this, an increase in accesses to the new visualizations is reported since all teachers must see the main window. Thus, this equates to 297 teachers (3,822 students) who gave counseling in the first semester of 2020 and 292 teachers (2906 students) who gave counseling in the second semester.

Stripping out the number of lecturers and students who repeat, the final numbers show that, **between the first and second semesters of 2019 and 2020, 416 lecturers accessed the new visualizations, representing 9485 students.** In Figure 37, the results are broken down by lecturers and students involved:

Type of use	Teachers	Students	Period
Counselling in general	315	7714	2019 1S
Used all 3 windows	177	1035	2019 1S
Used 2 out of 3 windows	250	2201	2019 1S
Used 1 out of 3 windows	287	3655	2019 1S
Counselling in general	322	4850	2019 2S
Used all 3 windows	91	227	2019 2S

Used 2 out of 3 windows	132	416	2019 2S
Used 1 out of 3 windows	151	532	2019 2S
Counselling in general	297	3822	2020 1S
Used all 2 windows	102	500	2020 1S
Used 1 of the windows	249	2736	2020 1S
Counselling in general	292	2907	2020 2S
Used all 2 windows	108	627	2020 2S
Used 1 of the windows	250	2492	2020 2S

Table 34. Results of the use of the tool.

As mentioned, the counsellors used the visualization of Available Subjects most, followed by Academic Records, and the least used was the visualization of Statistics (10.60%); the same use trend is shown during the second semester of 2019 and 2020.

Figures 51, 52 and 53 describe the access number to the different windows in the different semesters that the piloting lasted. Once again it is reiterated that the values fall in 2020 in all the views due to the context of the pandemic. The counseling was optional because not all students had access to the internet to have a counseling session during a synchronous video conference session

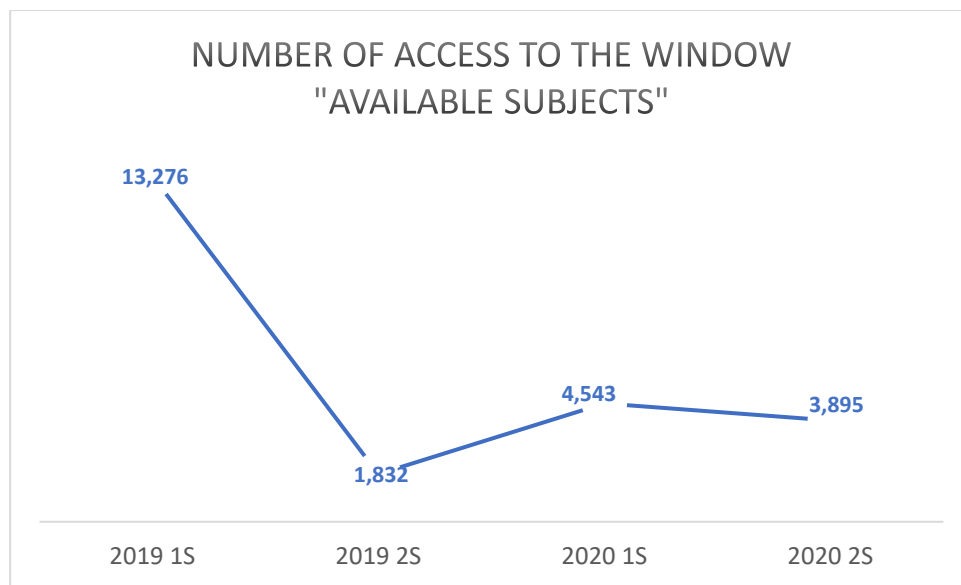


Figure 51. Number of access to the Available subjects window

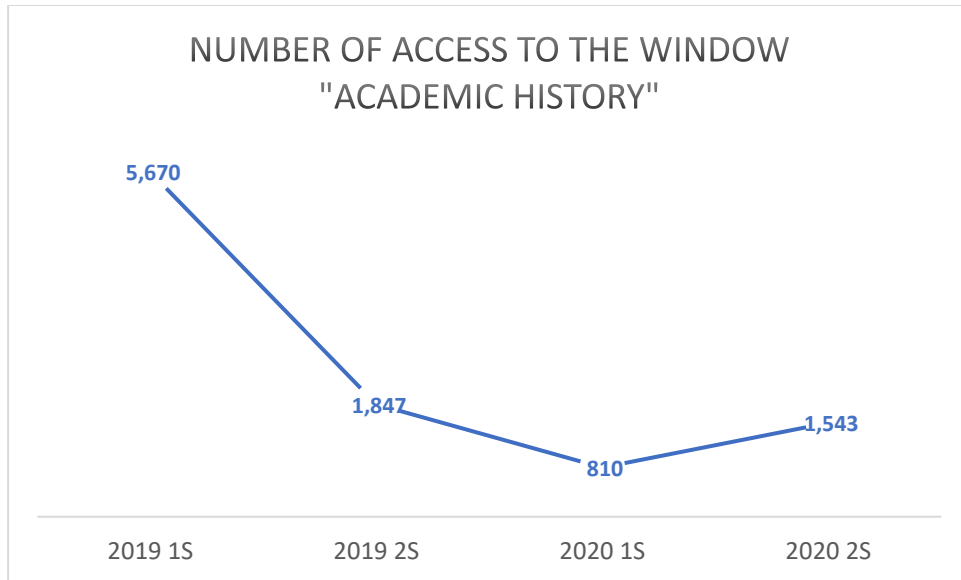


Figure 52. Number of access to the Academic history window

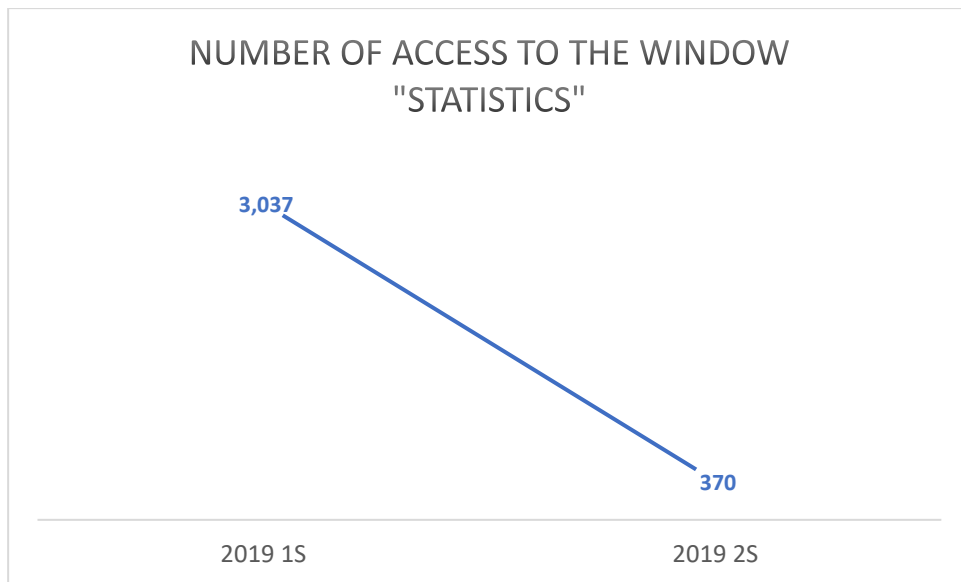


Figure 53. Number of access to the Statistics window

SiCa use, utility and impact survey

In order to collect information on the use of the SiCa tool during the training, a post-test survey was conducted for which 128 lecturers completed the question: "The information (e.g. tables, graphs) currently provided by the counselling system is sufficient to make sound decisions to guide the student" with a Likert scale between 1 and 5 on satisfaction with the new visualizations (see ESPOL Annex 2). The answer is qualitatively sound, and its results are discussed below.

SiCa use and utility survey results

It can be observed that most of the comments focus on a high degree of satisfaction with the use of the counselling system due to the new visualizations.

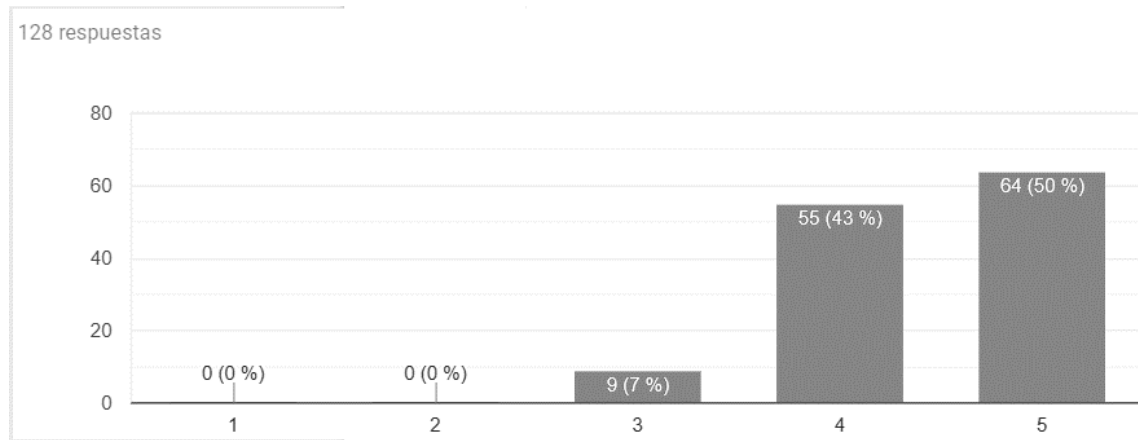


Figure 54. Post-test satisfaction survey results

Among the qualitative comments, the following stand out:

"The student's information and academic record is very complete."

"The information is clear and better organized."

"The charts allow me to better orient students in the subjects to be registered."

"The information you have is pertinent to good counselling of students."

The following figure shows the comparison between the initial and final evaluation of the tool's satisfaction survey.

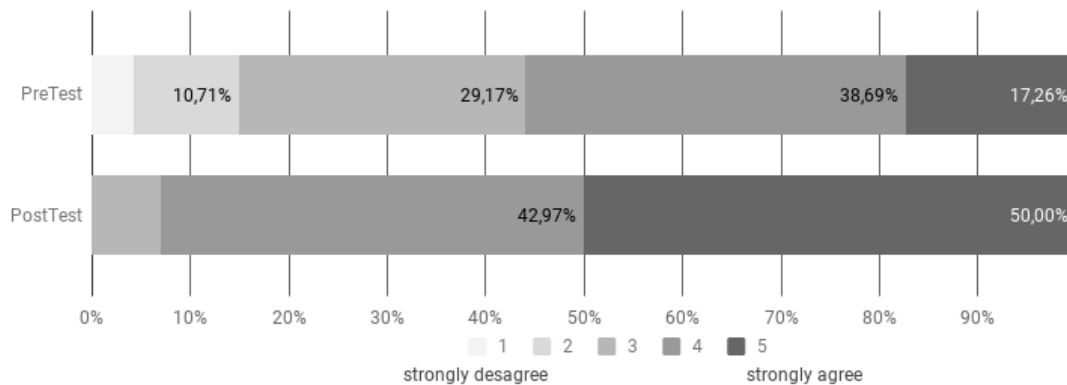


Figure 55. Pre-post-test satisfaction survey results

Impact results (time spent on new visualizations vs. lecturer satisfaction on visualizations)

As can be seen in *Figure 56*, according to the Likert scale from 1 to 5, those lecturers who scored that they were most satisfied with the new visualizations in the post-test were those who used it the most (on

average 6 minutes), compared to those who scored the lowest (on average 2.5 to 4.5). This indicates a direct relationship between use and time spent.

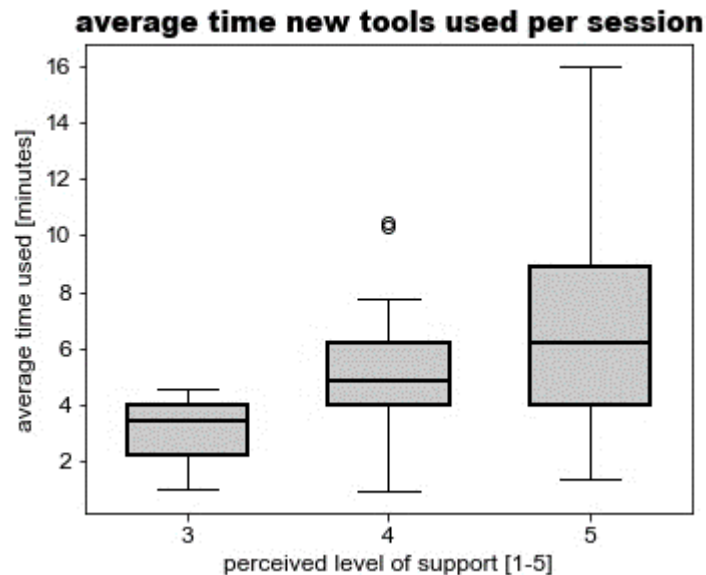


Figure 56. Average time spent by lecturers according to the satisfaction scale.

Impact on student performance results

The students' academic average was obtained in the first semester of 2019 when the new visualizations were incorporated. The average grade for students who received counselling was 7.63 while for those who received counselling it was 7.67.

In *Figure 57*, we can see the difference between the academic average in 2018 (first and second semester) when the new visualizations were not in place vs. 2019 (first and second semester) when they were already incorporated. There is an improvement, although not significant, in the average grade of students who received counselling in 2019.

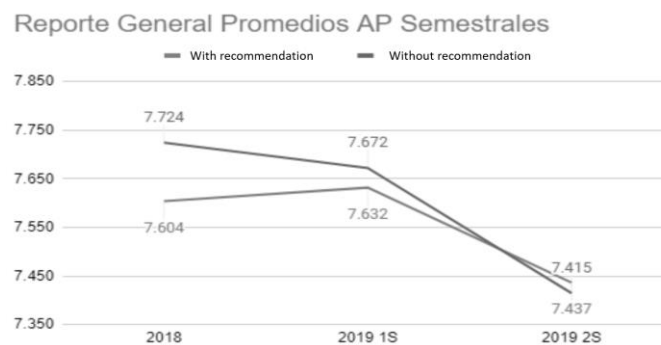


Figure 57. 2018 average academic results vs. 2019

Results of the impact on the workload between the suggested subjects and the subjects taken by students in 2018 and 2019

Figure 58 shows that in 2019 both in the first semester and in the second semester with the new visualizations, students began to listen more to their counsellor, because the averages are closer, compared to 2018 when there were no new visualizations. This indicates that, at the student level, the counselling using the new visualizations did have a positive effect, leading them to pay more attention to the recommendations.

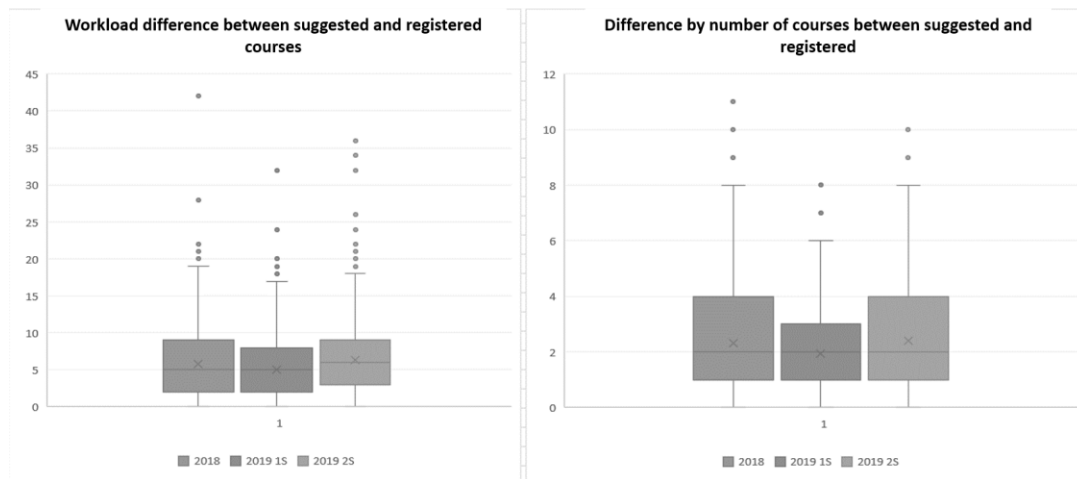


Figure 58. Results of impact on workload 2018 vs. 2019

Phase 5: Evaluation and Improvement

Description of evaluation and improvement

To determine the aspects requiring improvement, the information gathered during the pilot has been analysed, that is to say:

- Post-training evaluation: Based on the oral and written feedback (SUS) that the teaching staff mentioned in the training sessions, a first improvement report was made to present to the competent authority (Academic Vice-Chancellor's Office).
- Evaluation at the end of the semester: Based on the pre-post test results and logs, an improvement report will be made to present to the competent authority (Academic Vice-Chancellor's Office). This report is currently being written.

SiCa utility results

The analysis of the data collected is shown in *Figure 59*. Here it can be seen that most of the comments focus on a high degree of satisfaction with the use of the counselling system because of the new visualizations. This is more evident when compared to the initial assessment.

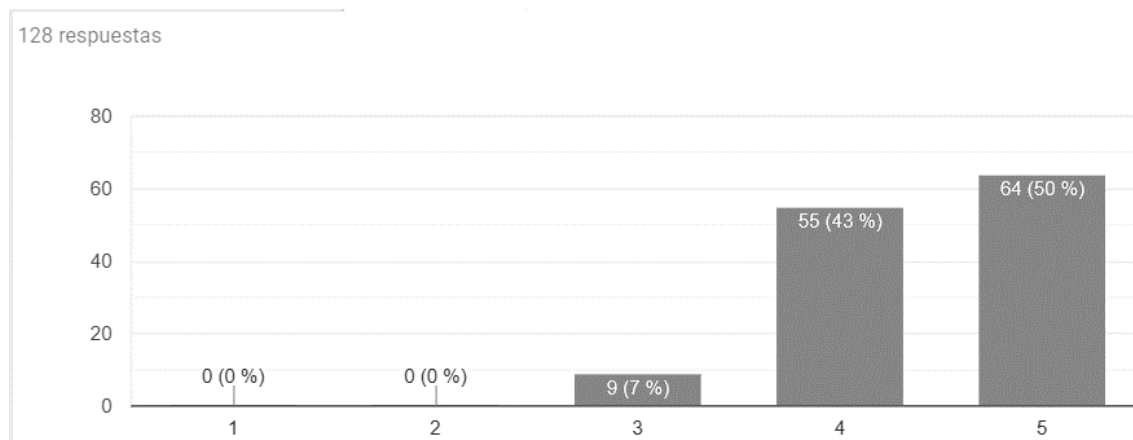


Figure 59. SiCa use by lecturers

Based on the written feedback (SUS) and the post-test, an improvement report was made to present to the competent authority (Academic Vice-Chancellor's Office).

Among the main improvements, the following were mentioned:

- Change the colours of the bars in the degree comparison chart.
- Indicate additionally the number of students per cohort and all students.
- Indicate the level of the subject on the mouseover of the "subjects available" combo.
- Add the credits to the subject and have this displayed when the mouse passes over the subjects and in the total weekly workload.
- Automatic generation of the internship hourly workload.
- Display UBEP (Polytechnic Welfare Unit) information not only when the counsellor refers the case, but also when the student goes on his/her own. This change will depend on the Director of UBEP.
- Indicate what the counsellor sends in the email when referring to UBEP.

Summary of improvement proposals

Given the approval of the reports presented to the Vice-Chancellor's Office, the system will be improved in relation to visualizations and additional information for the term 2020 - 1S. These improvements include moving the "statistics" window modules to different parts of the system because the logs showed few visits.

Post-pilot analysis results

The pilot experience left the following lessons learned, which we believe should be taken into consideration when implementing LA tools in Higher Education institutions.

1.- Institutional support: The whole piloting process will flow as long as you have the support of the institutional leaders. In our particular case, it was more manageable, for example, to plan the training of the lecturers with the approval of the Academic Vice Chancellor. The centre in charge of teacher training was asked to handle all the logistics of convening the teaching staff, choosing the location, advertising the event, among others. As researchers, we only focused on providing the training.

2.- Prior preparation: It is extremely important to plan in advance what you want to measure with the pilot: usability? Acceptance of the system? The instruments to be developed will depend on this. The guide developed by the university coordinating the piloting stage (UACH), helped to ensure clear guidelines of what to do before, during and after the pilot.

3.- Involve technical staff: It is necessary to have personnel who know how to visualize the information from academic databases, logs, and surveys. That way you can "see" the impact the pilot has had and make changes if necessary.

4.- Work in progress: We must be aware that a system can always be improved. That is why constant changes in system improvement must be taken into consideration, based on the feedback received from the system's users. In our case, the qualitative feedback helped to identify what we need to improve in the system in order to present it in the new 2020 version.

4.4.2 Dropout Prediction Tool Pilot Project

The dropout prediction tool in ESPOL was designed to alert teaching staff to the possible early dropout of students. This alert is intended to enable the lecturer to detect the possible reasons for each student dropping out and to intervene in time to prevent possible dropouts. Like the counselling visualization tool, the dropout prediction tool is used before the beginning of each semester, when all students must attend counselling sessions, and in the middle of each semester, when only students with low averages must attend counselling sessions.

The visualizations of the dropout prediction tool were developed using two different technologies for the frontend. The first technology used is ReactJS, a framework that allows writing both html and JavaScript code together using typescript, facilitating the creation and design of complex components; and the second technology used is D3JS, which is a library that, besides allowing manipulation of the DOM in real time, allows the design of graphics of any kind in svg format, providing functions that facilitate each of these tasks. Regarding the backend, NodeJS technology was used with an implementation of two layers of abstraction: the model and the controller (sequelize), together with the configuration files for the connection to the database. In addition, a REST API was created for database access. To analyse the data generated by the visualization of the risk of degree dropout, instructions were included in the dashboard code that enable a feed to a log with all the actions performed by the counsellor (click, mouse-over, mouse-out, etc.), and additional information (subject, visualization, student, counsellor, etc.).

The processing of the academic data and its analysis, the creation of the models, and the prediction algorithms were programmed in the Python programming language and through the use of libraries such as Pandas and the free software from the Scikit-learn library. This open source library implements many machine learning algorithms with which the different predictive models were made. Different tests were done with the following algorithms: Random Forest, Decision Tree, Support Vector Machine (SVM), Multi-Layer Perceptron (MLP) and Gradient Boosting among others. For the current version of the prediction model, the Random Forest algorithm was used since it is the one that provided the best results.

Resources

This section describes the project resources for the piloting of the dropout prediction tool.

- Server to host the tool
- Computer technician for service support (tool availability)



- Project researchers for data collection and analysis
- Collaboration with UC3M for the development of the prediction algorithms
- Pilot team
 - Project Coordinator
 - **Specialists in technological infrastructure**
 - **Group for training, pilot project support and monitoring**
- Participants. Users involved in Academic Counselling: 316 ESPOL teaching staff who have counselling responsibilities and 8437 undergraduate students in all degrees and levels

Methodology and planning

The steps followed are the same as for the counselling tool. Table 39 shows the phases, activities, dates, methodologies, efforts, and artefacts for the execution of the pilot project

Phase	Activity	Start date	End date	Methodology
Preparation	Artefact development	March 2019	April 2019	Artefact development
Agreement	Agreement with the participants	April 2019	April 2019	(Same phase as for the counselling tool) Project meeting
Training	Training for users	April 2019	April 2019	(Same phase as for the counselling tool) Training workshop for users
	Training for administrators	April 2019	April 2019	(Same phase as for the counselling tool) Training workshop for administrators
Use	Monitoring of activities	April 2019 and 2020 September 2019 and 2020	May 2019 and 2020 September 2019 and 2020	Online activity analysis
Evaluation and Improvement	Evaluation	September 2019	September 2019	Filling out a survey
	General evaluation	18 April 23 April 2019 09 January 2020	18 April 23 April 2019 09 January 2020	Meeting with Vice Chancellor's Office, Student Welfare, Undergraduate Office, GSTI
	Documentation of improvements (in relation to training)	29 April 2019	29 April 2019	Documentation of improvements
	Analysis and documentation of improvements (in relation to use)	21 May 2019	3 September 2019	Documentation of improvements

Table 35. Prediction tool pilot planning

Phase 1: Preparation

In the case of the dropout prediction tool, this report is shared with the counselling tool and can be found under Phase 1: Pilot Baseline Report detailed in the previous section.



Phase 2: Agreements

The visualization of the dropout prediction tool is integrated into the counselling dashboards so the agreement report is the same as the other tools and can be found under Phase 2: Pilot Agreement Report detailed in the counselling tool section.

Phase 3: Training

The training for the prediction tool took place at the same time as the counselling tool and the process followed can be seen in the section Phase 3: Counselling Tool Training Report.

Phase 4: Use and Impact

Descriptive statistics of use records

According to the information obtained in the logs during the pilots carried out on the dropout prediction tool in October 2020, the following information has been obtained:

Type of use	Number of Lecturers	Number of Students	Semesters
Counselling in general	299	2393	2 nd semester 2019
Having the dropout prediction panel enabled	213	678	2 nd semester 2019
Accessing to see more information about the prediction	10	17	2 nd semester 2019
Counselling in general	297	3822	1 st semester 2020
Accessing to see more information about the prediction	26	56	1 st semester 2020
Counselling in general	292	2906	2 nd semester 2020
Accessing to see more information about the prediction	12	13	2 nd semester 2020

Table 36. Number of actions in the tool

As can be seen in the table, out of a total of 2393 students only 17 received counselling based on the results of predicted dropout. These results are largely due to the positioning of the dropout prediction panel. This panel is located under the Statistics tab which was used by only 26 lecturers and which contains many panels. In the short time available to the counsellors, 15 minutes, it was practically impossible for them to review all the functionalities of the dashboard and therefore we decided to move the dropout prediction panel to the main screen of the advisory tool for the 2020 pilots.

Furthermore, the table shows that even when this prediction module was moved to the main window of the system, where all counsellors have access, the accesses increased slightly (from 10 to 12 for counsellors) who access to see more information about the system. Once again, it can be inferred that the little use is because counsellors have only 15 minutes for the counselling session with the student. It is difficult to access all the information that the system has in that limited time.

Phase 5: Evaluation and Improvement

In the first version to be piloted, in the second semester of 2019, the visualization shown in Figure 4 was used. Due to inconsistencies in the dropout probabilities, on the fourth day of counselling it was decided to hide the dropout probability panel and proceed with an improvement in the prediction algorithms.

Once the predictive models were improved, a more conservative visualization was displayed, showing the panel if the student had a dropout probability higher than 50%. In this case, a button was enabled that

when clicked displayed a panel showing brief explanations about the variables that most influenced the results.

Work is currently being done on the final version of the dropout probability visualization. This visualization will be shown on the main screen of the counselling tool from the first half of 2020 onwards, where the risk of dropout will be shown on a colour scale and not as a percentage, as counsellors were alarmed by a high probability of dropout. This groups the students by colour and does not show such exact information about the student's status. In addition, the most influential variables in the prediction will be shown and clicking on each one of them will display an explanation about it.

Surveys, and use logs, allowed for a more extensive analysis of the tool and the usefulness and impact it has had on the institution. In addition, this analysis will serve to further improve the visualization, explanations, and prediction models.

4.5 Summary of Pilotings in Universities External to the Consortium

4.5.1 Pilot of NoteMyProgress counseling tool at Universidad de Chile (UChile)

The NMP pilot at the University of Chile was done by adapting the NMP beta tool described in section 4.2.1 of this document. This pilot followed the same phases and strategies as the first pilot in PUC-Chile (described in section 4.2.1). However, since the tool was adapted for use in another institution, the main changes that took place in this pilot are highlighted below.

Resources

The resources related to the deployment of the tool were the same as described in section 4.2.1. of this document. However, in this case, two main agents from the Center for Teaching and Learning of the School of Economics and Business of the University of Chile were involved. Specifically, the center's director and the systems manager collaborated, coordinating with each other and two teachers.

- **Web server.** A web server is available to host the NoteMyProgress web application.
- **Google store account.** A developer type user is available to host and distribute the NoteMyProgress plugin to users (students).
- **Pilot team.** There is a team in charge of piloting the tool.
 1. **Coordinator of the pilot project,** in this case, the director of the Center for Teaching and Learning of the School of Economics and Business of the University of Chile.
 2. **Technicians in technological infrastructure,** in this case, one of the researchers/developers at the Pontificia Universidad Católica de Chile and the systems manager of the Teaching and Learning Center of the School of Economics and Business of the Universidad de Chile.
 3. **Training, support and monitoring group.** This team oversees preparing and disseminating the material for the training and support of the students during the period of the pilot, preparing the NMP tool with the necessary information about the courses in which the pilot takes place, inviting the students to participate in the pilot, sending evaluation surveys, following up the pilot, making adjustments during the pilot, documenting the process, extracting data for analysis. In this case, the role was played by a researcher/developer from the Pontificia Universidad Católica de Chile.



Methodology and planning

Unlike the previous pilot, this pilot was carried out over 4 months. The preparation phase, the agreement of the participants and the training took place in the first month, following the same methodologies established in the previous pilot. It was carried out during the start and end dates of the courses (see section 4.1.3) and the evaluation and improvement were carried out in relation to the events reported during the pilot, in order to understand the problems derived from the adoption of the tool by a third university. The different phases are described below.

Phase 1: Preparation

Intervened Process in the Pilot

In this case, four courses were defined by the Director of the Teaching and Learning Center of the School of Economics and Business of the University of Chile. The Table 37. Courses involved in the pilot with the University of Chile. For each course, the start and end dates of the pilot, the duration in weeks, the number of students registered in each course and the number of students who downloaded the NMP tool and used it throughout the course are indicated. shows the courses, with the start and end dates of the pilot, as well as their weeks of duration, the number of students and the number of students who used the NMP tool.

Name of the course	Dates	Duration in weeks	Registered Students	NMP students
The challenge of innovation in higher education	9/2/2019 -14/10/2019	5	284	41
How does technology change us?	8/26/2019 -02/12/2019	13	186	6
How to cope with the first work experience	09/09/2019- 11/11/2019	8	144	4
General Marketing	8/26/2019 -23/09/2019	3	638	44
Total			1252	95

Table 37. Courses involved in the pilot with the University of Chile. For each course, the start and end dates of the pilot, the duration in weeks, the number of students registered in each course and the number of students who downloaded the NMP tool and used it throughout the course are indicated.

Current situation of the processes to be intervened

In this case and given that the objective of the pilot was to test the adaptation of the tool for use in a third institution, the installation and adaptation of the tool, which had not existed at the institution until now, was established as a baseline.

Phase 2: Agreements

Description of the pilot population

In this case, the intervened population is divided into two groups: (1) the actors involved in the installation and adaptation of the tool (the director of the Teaching and Learning Center of the School of Economics and Business of the University of Chile, and the systems manager of the center), and (2) the participants in the courses in which the tool was used (a total of 1,252 students were contacted, of which 95 downloaded and used the NMP tool).



Phase 3: Training

For this pilot, the systems manager of the Teaching and Learning Center of the School of Economics and Business of the University of Chile was trained. To this end, two meetings were held where the tool was demonstrated, with instructions on how to adapt it to the institution's courses, as well as a meeting to launch the pilot. The PUC contact group then exchanged several emails to check that the tool deployment was correct.

Phase 4: Use and Impact

For this pilot, unlike the one described in section 4.2.1, only the impact of the tool on the course students was analyzed in relation to the use of NMP, and the focus in this case was on the process of adapting the tool. For this purpose, the exchanges produced in the meetings between the PUC team and the systems manager of the Teaching and Learning Center of the School of Economics and Business of the University of Chile were analyzed in order to understand: (1) the difficulties in adapting the tool within the institution, and (2) the difficulties associated with deploying it in courses.

Phase 5: Evaluation and improvement

Main results

95 of the 1,252 registered students installed the tool. Among those who downloaded it, an analysis of the most used functionalities was made (**¡Error! No se encuentra el origen de la referencia.**). Of these, the most widely used functionalities were displays of interaction with the various activities (37%) and graphs related to time use (33.8%).



Figure 60. Percentage of use of the different NMP functionalities among the 95 students who downloaded it.

Based on the analysis of the actions carried out for the adoption and deployment of the NMP tool at the Teaching and Learning Center of the School of Economics and Business of the University of Chile, the following conclusions are drawn:

1. The process of installation and configuration of the NMP tool for the adaptation of the different courses requires coordination between the two institutions, to ensure that the tool is used correctly.
2. A system manager is required at the university where the tool is applied to ensure its proper functioning and to send messages to students to inform them of its use.

3. The final coordination of the project requires the involvement of systems managers and researchers if similar conclusions to those of the first pilot are to be drawn. In that case, it is proposed that the methodology of analysis explained in chapter 4.2 of this document be followed.

Proposals for improvement

From the pilot carried out, some improvements to be incorporated in different versions of the tool were identified:

1. **Offer an automatic system for the adaptation of the tool to the different courses.** In this case, the adaptation of the tool to the different courses was carried out with the support of one of the researchers/developers of the PUC. However, this process could be automated by creating a type of system indicating the characteristics of the course to be uploaded and loading its contents automatically. In the case of working with a Learning Management System such as Coursera, this process can be complicated, as there is no access to the course database. However, in other systems such as Moodle, this problem would be solved.

Provide support to course managers in sending messages. The sending of messages to inform students about the tool and its potential is done from messages in Coursera sent by the course manager or their teachers. This process could also have been automated from the start to leave information messages for students. Currently Coursera integrates a system to plan the message sending, so this could be solved from the beginning of the pilot. However, at the time this pilot was developed, this option did not exist.

4.5.1 Pilot project of counseling and prediction tool at Universidad Politécnica Salesiana (UPS)

The SCA grade counseling and forecasting tool supports the teacher in having personalized conversations with students. The tool aims to improve the academic counseling process through visualizations based on academic, personal, and scholarship data, among others.

The tool was developed using NodeJS technologies with an implementation of two layers of abstraction: the model and the controller, along with configuration files for database connection and information needed for connection to the authorization server. However, the implementation of an API implies that a security and authentication protocol is in place to prevent unauthorized applications or users from accessing the data. For this purpose, the OAuth 2.0 protocol was chosen, which defines the flow of authorization protocols according to the implementation design of the application, thus allowing access to data in a secure manner. For the consumption and loading of data from the main application, the creation of a REST API was chosen.

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool
- Computer technician for service support (tool availability)
- Project researchers for data collection and analysis
- Pilot Team
 - Academic Vice-Rectorate Team
 - Guayaquil Vice-Rectorate Team
 - Psychology Degree Program
 - Student Welfare



- Technicians in infrastructure and technological support
- Group of training, support for the pilot project and tracking
- Participants. The target audiences to be reached within the university are:
 - End users:** UPS professors who voluntarily decided to support the pilot of this project and undergraduate students from all degree programs and levels.

Planning

Table 42 presents the phases, activities, dates, methodologies, efforts, and artifacts for the execution of the pilot project. It should be noted that because SCA integrates the advisory and forecasting dashboard, planning includes both pilots.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Development of the tool	October 2019	December 2019	Artifact development
Agreement	Agreement with the participants		April 2020	Project meeting
Training	Training for users	May 2020	May 2020	User training workshop
Use	Monitoring of Activities	May 2020	September 2020	Online activity analysis
Evaluation and Improvement	Evaluation	May 2020	May 2020	Filling out a Likert survey
	General evaluation	September 2020	September 2020	Meeting with Rectors and Vice-Rectors.
	Documentation of improvements (In relation to training)	September 2020	September 2020	Documentation of improvements

Table 38. Planning of SCA counseling pilots

The development and results obtained after the execution of each of the activities of the phases mentioned in Table 42 are described below.

Phase 1: Preparation

The UPS did not have an academic counseling process, so the pilot conducted at the Guayaquil headquarters during the pandemic was the start of learning from the experiences in the use of the tool, as well as to receive the suggestions presented by the teachers during the academic counseling pilot in which they promoted tutoring programs in the subjects that have academic performance problems.

Phase 2: Agreements

Within the agreements at the Guayaquil headquarters, 17 undergraduate degree programs joined the project with 119 teachers, distributed as follows.

Degree Program	Number of Teachers
Business administration	59
Accounting and auditing	41
Industrial engineering	38
Computing and system engineering	36
Electronic engineering	36
Electrical engineering	32
Automotive engineering	17
Mechatronic engineering	9
Communication and social communication	8
Psychology	7
Telecommunications	7



Biotechnology	5
Early education	4
Environmental engineering	4
Civil engineering	4
Basic schooling	3
Economics	2
Total	119

Table 39. Distribution of Professors by Degree Program

Phase 3: Training

Description of the Training Phase

Sixteen one-hour training workshops were held. They were carried out in the month of May 2020. The goal of the workshops was to provide instruction that would allow UPS teachers to understand how the SCA tool supports dialogue between teachers and students.

The following activities were carried out during the training:

Activity 1

- Presentation of the Academic Counseling Tool "SCA" "Table 2", referring to the LALA project.

Activity 2

- The professors completed a usability survey.

Training Phase Participant Satisfaction

39 professors out of 119 completed the Likert scale questions between 1 (completely disagree) and 10 (completely agree) on usability with the current counseling tool. The answer was qualitatively sound.

It can be seen from the professor survey that a higher percentage of professors estimate that they will use the tool often as well as that the tool has a user-friendly and intuitive interface.

Below are some graphs with the details of the survey results:

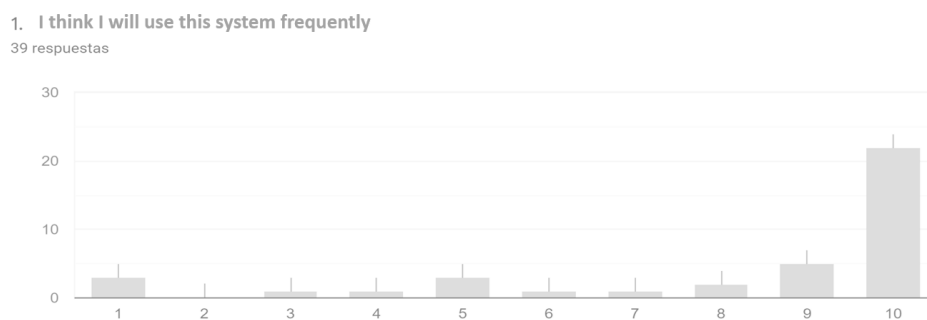


Figure 61. Usability Survey

2. The system is unnecessarily complex
39 respuestas

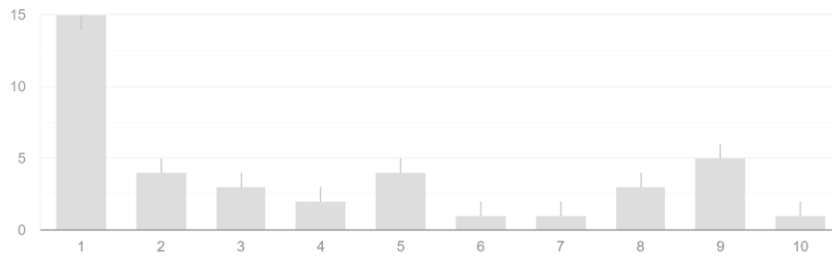


Figure 62. Usability Survey

3. The system is easy to use
39 respuestas

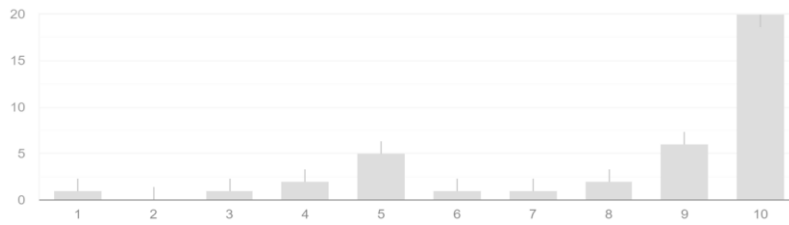


Figure 63. Usability Survey

4. I would need the support of a technical person to be able to use the system a.
39 respuestas



Figure 64. Usability Survey

5. The different functions of the system are well integrated
39 respuestas

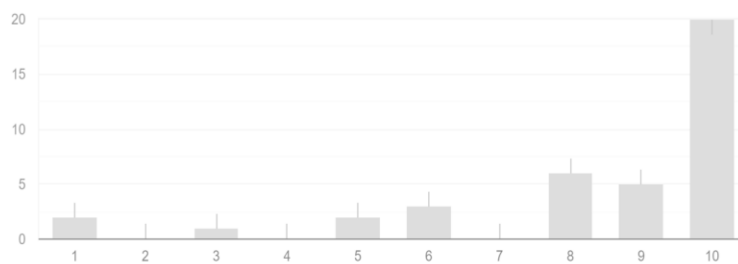


Figure 65. Usability Survey



6. **There is too much inconsistency in the system**
39 respuestas

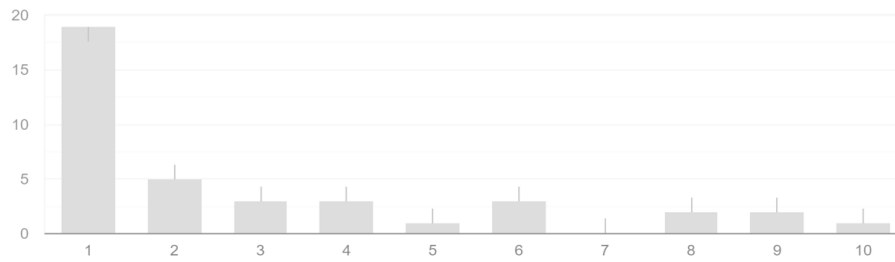


Figure 66. Usability Survey

7. **Most people would learn to use the system very quickly**
39 respuestas

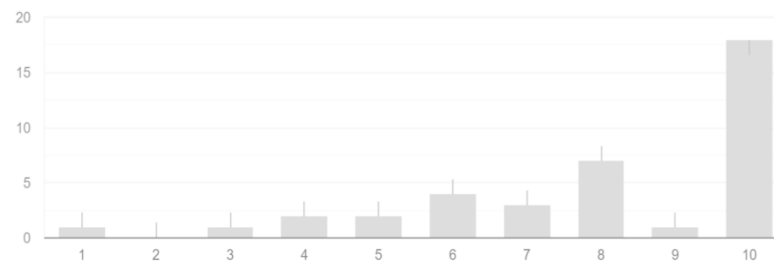


Figure 67. Usability Survey

8. **I found the system very cumbersome to use**
39 respuestas

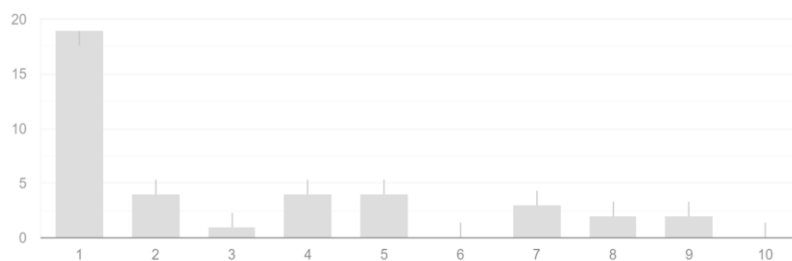


Figure 68. Usability Survey



9. I felt safe using the system

39 respuestas

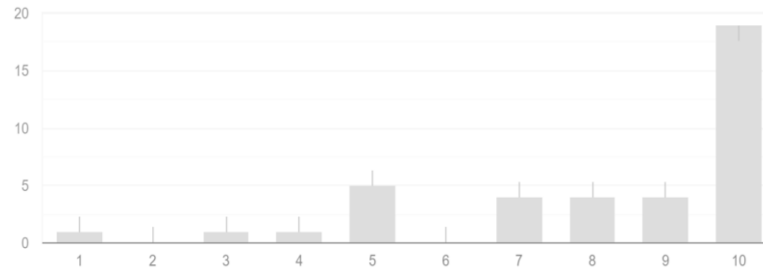


Figure 69. Usability Survey

10. I need to learn many things before I can start using this system

39 respuestas



Figure 70. Usability Survey

Phase 4: Use and Impact

Descriptive statistics of usage records

The SCA tool has a log record that stores the actions performed by users in it. Statistics show that users have been actively involved, this is reflected in 119 tutors who have consulted the tool, the system records observations of 3668 students and also shows that a total of 4652 students were searched. Table 36 shows the number of observations recorded per degree program.

Students who received academic counselling	
Degree program	Total
Business administration	863
Accounting and auditing	661
Industrial engineering	572
Electricity	359
Psychology	326
Computer science	201
Communication	178
Electronics and automation	157
Automotive engineering	92
Environmental engineering	80
Civil engineering	74
Mecatronics	36
Early education	21
Basic schooling	16



Telecommunications	15
Economics	14
Biotechnology	2
Mechatronic engineering [unified]	1
General total	3668

Table 40 Total Students Approached.

Table 45 shows the results of the logs obtained from the LALA project

Action	Count
Search for student.	4,652
Open comment popup	3,689
Add observation	3,668
Open student information popup.	511
Open dropout popup.	87

Table 41. Log Register

Phase 5: Evaluation and Improvement

The following results were obtained through surveys of students at the end of the academic year.

Which of the following ways were you contacted about your personal situation?	
Zoom	38.28%
Call to cell phone	25.83%
WhatsApp Message	19.64%
WhatsApp Call	7.57%
Institutional mail	5.22%
Conventional phone call	3.47%

Tabla 42. Means of contact to offer counseling.

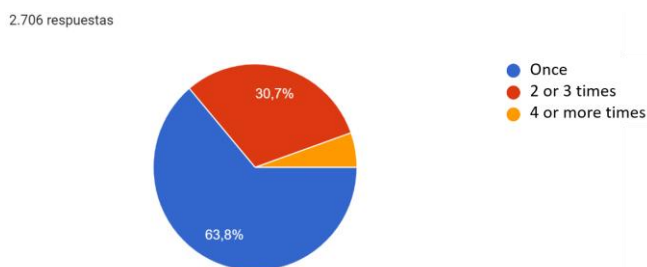


Figure 71. How many times did university contact you to know about your personal situation?

What topics were covered in the conversation with the teacher who contacted you?	
Academics	2363
Entrepreneurship	19
Spiritual	16
Family	1
Financial	237
Psychological	19
Health	2

Table 43. What topics were covered during the academic counseling session?

4.5.3 OnTask pilot at Universidad Federal Rural de Pernambuco (UFRPE)

OnTask is a tool with functionalities to enable the interaction between students and instructors through the provision of personalized feedback. The feedback generated using OnTask is reusable and potentially reduces the overload of the instructors. The main objective of the tool IS to improve the academic experience of students through the delivery of timely, personalized and actionable student feedback throughout their participation in a course.

Resources

The resources used for the execution of the pilot project were as follows:

- Server to host the tool.
- Computer technician for service support (tool availability).
- Project researchers for data collection and analysis.
- Pilot Team
 - **Project Coordinator**
 - **Specialists in technological infrastructure**
 - **Group for training, pilot project support and monitoring**
- Participants. The target audiences to be reached within the university are:
 - End users:** instructors of Computing department.
 - Students:** undergraduate student from computer science program.

Planning

Table 48 presents the phases, activities, dates, methodologies, efforts, and artefacts planned for the execution of the pilot project. During the execution of the project, these phases were adapted to various emerging situations, such as the rescheduling of academic activities.

Phase	Activity	Start date	Termination date	Methodology
Preparation	Artefact development		08/2019	Development of agreement and survey.
	Tool Setup		08/2019	Instantiation of a server with OnTask with access for the instructors of UFRPE
Agreement	Agreement with the participants		08/2019	Project meeting
Training	Training for users		09/2019	Training session to present the tool and relevant concepts about how to provide feedback.
Use	Accompanying users	08/2019	12/2019	Face-to-face support
Evaluation and Improvement	General evaluation		12/2019	Evaluation by survey
	Staff evaluation		12/2019	Informal interviews with instructors

Tabl6 44. OnTask counselling pilot planning

A description follows of the development and results obtained after carrying out each of the activities in the phases mentioned in Table 48.



Phase 1: Preparation

Processes included in the pilot project

UFRPE has low completion rates of undergraduate programmes. Students at UFRPE have frequently complained to the course coordinators about the lack of interactions with the instructor outside the classes. Although it is recognised that feedback plays a crucial role in learning success and the overall learning experience, the teaching staff are generally overwhelmed with teaching and administrative activities, which are time consuming and demanding.

To tackle this issue, we held conversation with academics, to try to identify the points in the course and the type of messages they would like to convey, and then how to personalise them to the students. We detect elements in the course design that would provide the evidence used to that personalisation, and, finally, we identify the data sources you need for that personalisation.

Current indicators for intervention processes

At UFRPE, it is not a common practice to provide written feedback in face-to-face courses. In general, students receive oral feedback in-class. As indicated earlier, students have made complaints about the lack of written feedback. In addition, there is no formal instrument to measure student satisfaction with the feedback process. Therefore, we introduced OnTask to address the issue considering the ability of the tool to provide personalised feedback to large cohorts efficiently. We developed a survey which contains 17 items that measure the following aspects:

- How important students perceive feedback, and
- How well OnTask has performed in terms of providing effective feedback.

Among these items, thirteen of them also measure 'impact' and 'usefulness':

- Impact: impact on decision-making and self-regulated learning
- Usefulness: the tool meets the learning needs

For more details, please see Section 'Phase 4: Usage report' - Results from the observation instruments.

Current situation of processes included

Since this pilot project does not include comparative measurements between the results obtained during the pilot and previous years, it is not necessary to create a baseline. The evaluation of the usefulness and impact in general and specifically on student performance will be carried out based on the results obtained after the pilot. In particular, we assess the impact by measuring the effect on student decision-making and self-regulated learning and the usefulness by measuring how OnTask meets the learning needs.

Phase 2: Agreements

Description of the pilot population

A total of 3 instructors signed a letter as an agreement to participate in this pilot. In addition, 112 students agreed to participate by consent document. Table 49 shows detailed information of the pilot population.



Role	Unit	Amount of time performing the role	Age range	Gender	Comments
Instructors	Computing department (UFRPE)	6-8 years	30-38	Male: 67% Female: 33%	* The three instructors taught the following courses: 1) Text mining (Mineração de texto) (Student number: 52), 2) Introduction to virtual learning environments (Introdução à ambientes virtuais de aprendizagem) (Student number: 43), 3) Software Engineering (Engenharia de software) (Student number: 17)
Students	Computing department (UFRPE)	N/A	17-45	Male: 83% Female: 13% Other: 4%	The initial population of students.

Table 45. Description of the pilot population

Phase 3: Training

Description of the training phase

As the initial pilot was focused on three instructors, the training session was performed in one day. During this training session, we presented concepts of feedback and provide step-by-step tutorial on writing feedback using OnTask ([Detailed tutorial](#) created by the OnTask research team). Due to the number of people involved, the training session was more informal, without presentation and materials. The main goal was to provide a [tutorial](#) on how to use the OnTask tool. Moreover, we provided the material that we had used for the LALA project.

It is important to highlight that we focused on how to personalize emails using the tool, and tips on how to provide useful feedback.

Evaluation of satisfaction of training phase participants

OnTask is meant to assist instructors in the process of providing feedback, i.e., saving time. There was no plan to evaluate learning outcomes. In general, the OnTask functionalities used during the training were easily understandable by the participants and they were able to reproduce the activities without any problem. Questions were answered during the session. It is important to highlight that the participants have a background in computer science, and hence the operation of the tool was not difficult to learn. After the training session, the participants indicated that they were confident to use the tool in a real scenario.

Phase 4: Use and Impact

Descriptive statistics of use records

The instructors have used the tool to provide feedback on a weekly basis. According to the logs of the tools, the instructors who used OnTask usually prepare feedback messages three days before sending them to students. On average, the weekly emails required 3-4 sessions of preparation for instructors, and

each session lasted for 30-40 minutes. However, once a personalised email applying rules of computational logic is completed, it only took 5 minutes on average for instructors to send it to the whole cohort. The instructors also used the dashboards (a statistical summary of different inputs of data about learners) provided by OnTask on a weekly basis when constructing feedback even though this functionality was not particularly highlighted during the training. On average, each instructor accessed the tool 10-15 times per week.

The tool was used on a weekly basis to send feedback to students. However, the tool was also used to create the rules and text for the feedback at least a couple of days before sending the email. In short, the feedback was usually sent on Friday, but the instructor would have to start using the tool on Wednesday each week. During the piloting period the participants had 2 meetings for technical assistance (e.g., how to apply rules to the email content).

Only two out of three instructors continued to use the tool throughout the semester. The instructor that didn't use the tool said that it was due to methodological reasons (i.e., course activities that were not directly compatible with OnTask – open questions), and not because of technical difficulties.

Phase 5: Evaluation and Improvement

Description of evaluation and improvement

After training and making the tool available for use, an assessment was made of whether participants perceive an improvement in the application resolution process. This improvement was measured by informal conversations with instructors to assess the overall satisfaction of the instructors. We also assess the student perception by a survey. The result of this evaluations was discussed below, and as will be seen below, they show a positive impact that meets the expectations for the tool and for the pilot project.

Results related to utility in instructors and students

Regarding Instructors using the tool, the usefulness, in general, was high, especially in saving time and providing feedback in a higher frequency/timely manner. For instance, one of them had a class session with 56 students, which is a large cohort of students in our context. This instructor indicated that the effectiveness of the feedback provided could be noticed by the increase in students' classroom interactions after the use of OnTask. Instructor B found the tool useful in freeing up time to focus more on constructing the content of effective feedback. Moreover, she/he stated that several students expressed their appreciation of the feedback received.

Regarding the students, overall, students were quite positive about the feedback received through OnTask, especially the 'feed-up' and 'feed-forward' elements (working towards desired goals and adjusting learning strategies). However, the students were comparatively less positive about the 'feedback' element, which is being able to identify their strengths and weakness with the feedback. The results show areas where we can strengthen the training for teachers in terms of constructing effective feedback using OnTask.

Results related to impact, performance and usefulness in students

We sent out a survey to students at the end of the semester (December 2019) to measure the performance of OnTask. Students were asked to use 7-point Likert scale to rank how 'important' they perceive the important aspects of feedback and how well the feedback provided using OnTask has achieved each aspect. The survey is accessible [here](#).



A total of 48 students answered the survey (response rate=42.8%)

- Importance: All the statements received average scores higher than 6 (baseline 6.08), showing high appreciation of all the important aspects of feedback.
- Performance: All the statements received average scores higher than 5 except for the statement, “The course feedback that I have received shows that my instructor understands my strengths and weakness” (M=4.85), showing that students were generally satisfied with the feedback received through OnTask.

The largest gap between student perception of ‘importance’ and the performance of OnTask is observed in the following statement: “It is important that course feedback identifies the learner’s strengths and weakness”.

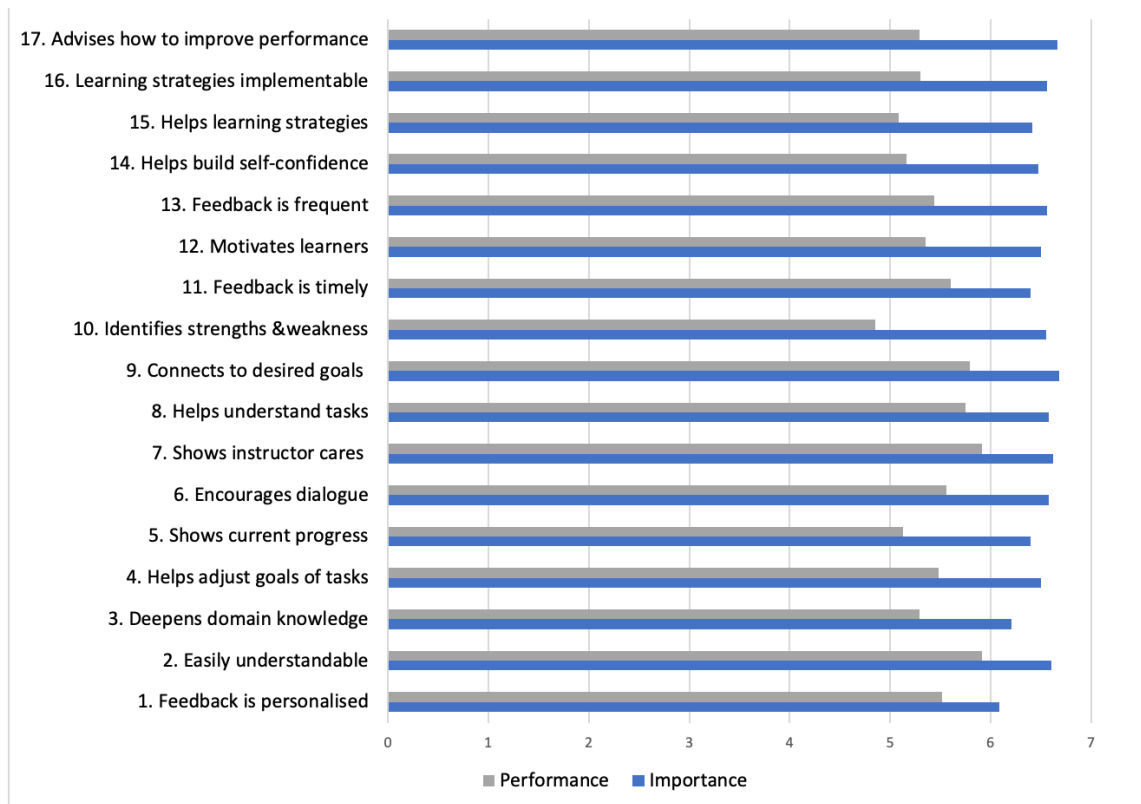


Figure 72. Perceptions of feedback elements and OnTask performance

13 of the 17 ‘performance’ statements can be used to evaluate the impact (Table 50) and usefulness (Table 51):

- **Impact (I):** The tools serve as an example for new ideas and implementations. Decision-making based on data, etc.
- **Usefulness (Us):** Counselling and guidance by teachers is more oriented to the needs of each student, based on their data and the data of previous students.



Impact: informs decision-making
The course feedback that I have received deepens my domain knowledge.
The course feedback that I have received helps me adjust my own goals of the course tasks.
The course feedback that I have received makes me feel that my instructor cares about me.
The course feedback that I have received helps me understand the course tasks better.
The course feedback that I have received motivates me to work towards a desired goal.
The course feedback that I have received helps build my self-confidence.
The course feedback that I have received helps me develop and adjust my learning strategies.

Table 46. Items that indicate the impact of OnTask

Usefulness: meeting the needs
The course feedback that I have received shows me my current progress.
The course feedback that I have received encourages dialogue between me and the instructor.
I can connect the course feedback that I have received with the desired goals (standards) of my course tasks.
The course feedback that I have received is timely.
The frequency of the course feedback is appropriate.
The course feedback that I have received gives advice on what I can do to achieve the desired performance.

Table 47. Items that indicate the usefulness of OnTask

The responses to these items are presented in the following two bar charts. Medians are denoted by the red solid red lines, boxes represent interquartile ranges (IQR), whiskers are 1.5 IQR, and data points are marked with grey dots. Answers to N/A are not counted).

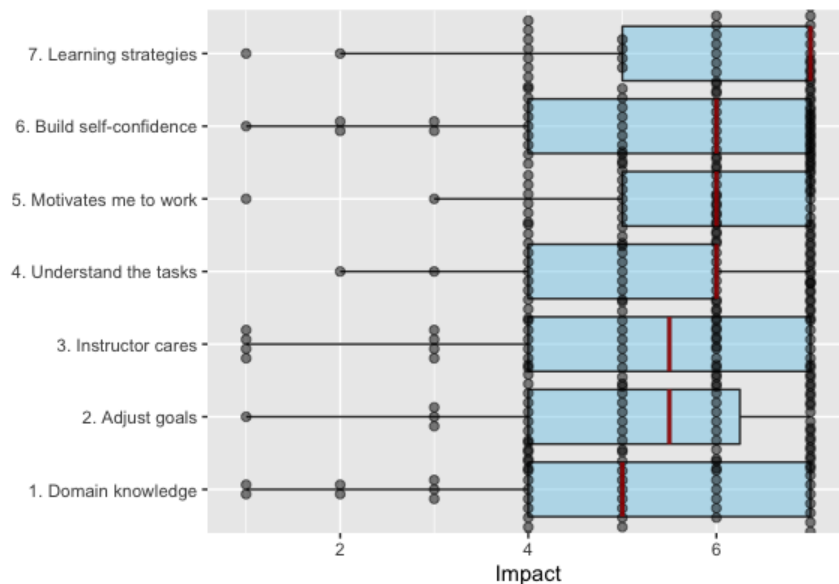


Figure 73. Impact Results



The plot of **impact statements** shows that students tended to agree strongly with the following statements:

- The course feedback that I have received helps me develop and adjust my learning strategies.
- The course feedback that I have received motivates me to work towards a desired goal.

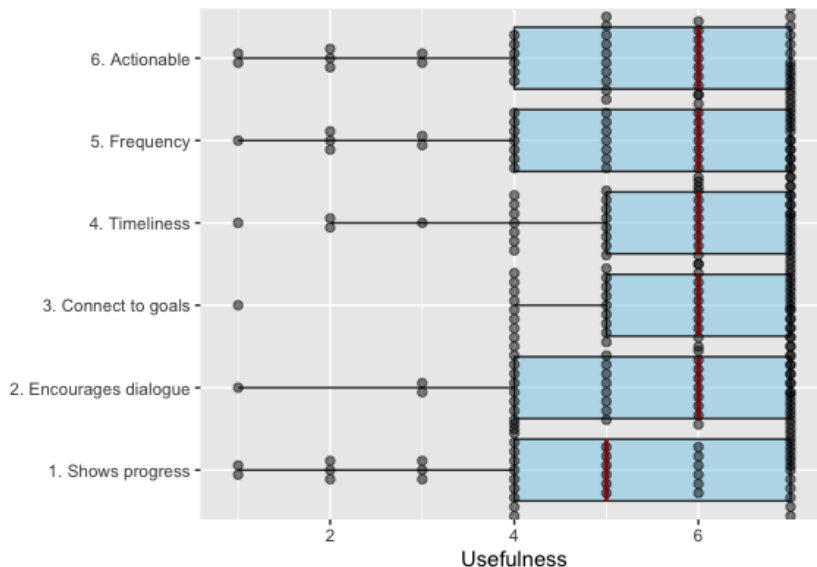


Figure 74. Usefulness result

The plot of **usefulness** statements shows that students tended to agree strongly with the following statements:

- The course feedback that I have received is timely.
- I can connect the course feedback that I have received with the desired goals (standards) of my course tasks.

Summary of Improvement Proposals

We intend to recruit more teaching staff to use OnTask in the next semester. Besides, we were using an English version of the tool, but we intend to adapt it to Portuguese before the next semester.

Post-project analysis results

The pilot showed that we need to provide more workshops to highlight the importance of the feedback process in the learning process. As mentioned before, it is not usual for Brazilian teaching staff to provide written feedback in a face-to-face context. However, the experience during the pilot could motivate more people to get involved in the next round.

Moreover, the computing department of UFRPE is keen to encourage instructors to adopt tools that enhance students' experiences. To do so, this department will propose a series of workshops and tutorials about different tools; one of them is OnTask. We expect to reach a broader population of people with these workshops and to promote OnTask.

In the next pilot, we intend to carry out interviews to gain a deeper understanding of instructors' experience using OnTask to provide feedback and students' experience receiving feedback through OnTask. Finally, we will personalize the OnTask interface using Portuguese, and possibly to reduce the number of features available, to make the tool easier to understand.

Lessons learned:

Regarding the process of piloting OnTask is important to first engaging with end-users by identifying what are the points in their course where they would clearly benefit from "talking" to the students to head conversation with end users, try to identify the points in the course and the type of messages they would like to convey, and then how to personalise them to the students. Detect elements in the course design that would provide the evidence used to that personalisation. Finally, we identify the data sources you need for that personalisation. If the data sources don't exist, the next stage in the conversation is to consider potential adjustments to the course design to set up this data.

Regarding evaluation: If you have student surveys at the end of the course, see if you have a question that asks explicitly about feedback. Compare the results with those from previous years.

If you don't have any question about feedback but you can insert just one question in this survey, see if you could include something like "the feedback given to me during the course helped me to learn". You may also consider organising focus groups at the end of the course with the students.

4.5.4 Pilots with the prediction tool at Instituto Tecnológico de Zitácuaro

The dropout prediction tool designed at Instituto Tecnológico de Zitácuaro is a tool to detect students at risk in different degrees of the university. The objective of this tool is that it can provide the probability of completing the degree of each student (in a range from 0 to 1, with a value of 1 for those who complete the degree). For the implementation of this tool, other tools for academic prediction implemented within the LALA project were taken as a base, and an adaptation of these tools to the contexts and needs of Instituto Tecnológico de Zitácuaro was made. The code of the tool was implemented in Python 3.8, using the Anaconda distribution. This distribution was used to facilitate the use of data analysis and machine learning libraries in the implementation. The current version of the tool is designed to work in command line.

For the development of the code, the first elements to consider are the data from the institution. In this case, four files were used for the adaptation. These files can be directly obtained from the academic database. These files contain the following information:

- Students. It contains the general data about the students, including the degree they study, the first enrollment year, current data about their progress and demographic information.
- Progress: It includes the results of each student in each of the courses for each semester.
- Degrees: It includes details about the degrees, including the academic plan and the total number of credits, which can be combined with the previous information.
- Courses: It is a catalog with detailed information about the courses that are taught in the different degrees.

In these files, the information used for the adaptation is as presented in the following table:

Variable	Description
Students file	



numero de control	Student identifier
periodo de ingreso	Indicates the period when the student was first enrolled in the degree. For example, 20161 means that the student first enrolled in the first semester of 2016
identificador de carrera	Identifier of the degree students are doing
semestre actual	Indicator of the number of semesters students have taken
estado	Indicator of whether or not the student is active. Students may not be active if they have finished their degree or they are on leave or on furlough
creditos aprobados	Indicator of the number of credits students have passed
Progress file	
numero de control	Student identifier
materia	Identifier of the course the student has taken
calificación	Grade of the students in the course. Grade is expressed in a range from 0 to 100, with a passing rate of 70
creditos	Indicator of the number of credits that can be achieved with the course
tipo de curso	<p>Categorical value that indicates the number of attempts the student has done for each course. In Instituto Tecnológico de Zitácuaro, a course can be taken 3 years at most, and a course can be attempted twice each year at most. This way, this variable can take the following variables:</p> <ul style="list-style-type: none"> - Evaluación Ordinaria Primera Vez (Ordinary Evaluation First Time, 1st attempt in the first year) - Evaluación Ordinaria Segunda Vez (Ordinary Evaluation Second Time, 2nd attempt in the first year) - Evaluación Regularización Primera Vez (Regularization Evaluation First Time, 1st attempt in the second year) - Evaluación Regularización Segunda Vez (Regularization Evaluation Second Time, 2nd attempt in the second year) - Especial Cursado (Special Taken, 3rd year) <p>Moreover, there are some special values such as Evaluación Extraordinaria Primera Vez (Extraordinary Evaluation First Time), Convalidación (Convalidation) or Equivalencia (Equivalency) to reflect courses that are incorporated into the student record from other degrees and/or institutions.</p>
periodo	Indicator of the period when the course is taken. It has 5 digits: the first four indicates the year and the last one indicates the semester, which can be 1, 2 or 3. For example, in 2020, possible values are 20201, 20202 and 20203. The first period is taken from February to June, the second period is taken from July to September and it is used to regularize some courses the students have pending, and the third period is taken from September to December
Degrees file	
carrera	Identifier of the degree
total de creditos	Indicator of the total number of credits the degree has. Generally, Bachelors' degrees have a value of 260 (260 credits) and Masters' degree have a value of 100 (100 credits)
Fichero materias	
identificador de materia	Identifier of a course that students can take
clave de la materia	Internal notation/identifier of the course, according to the educational program
nombre completo de la materia	Detailed name of the course
creditos de la materia	Number of credits the course has
carrera	Identifier of the degree the course belongs to
reticula	Indicator to identify the temporal validity of the course for a specific academic plan

Considering the presented information, the tool carries out several filters to retrieve students' information after their first semester, after their first two semesters, and so forth until their first five semesters. This way, this filtered information can be used to better train the models. For example, if the model has to predict dropout for a student who has only taken one semester, that prediction should be



done based on a model trained with data of a single semester. Additionally, there is a set of data which includes all students' information from the beginning.

From the aforementioned data, variables are computed to be used in the models. These variables include the rate of passed and failed courses, the average grade of the courses (i.e., GPA), considering only passed courses, and considering both passed/failed courses. Moreover, there are some variables related to the number of courses the students are repeating, as they can indicate some risk of dropout. Furthermore, it is necessary to determine whether or not a student has dropped out the degree in order to train the model. In order to do that, the following rules are considered:

- If a student is not enrolled in any course for one year, it is considered as dropout. For example, if a student enrolled for the last time in 2019, but he did not enroll in 2020, it is automatically flagged as dropout (0).
- A student is considered as a completer (not dropout) when s/he completes 90% of the credits at least. This is done to increase the training data, as there are many students in the last stage of their degree. This assumption is reasonable as most of the students who complete 90% of the credits finish their degree.

With these data, the algorithm firstly detects who are the students that are currently studying the degree (to assign them a value of 2 in the dropout variable). These students do not have neither the dropout condition (0) nor the completion condition (1). For example, a student who have enrolled in the last possible semester (but s/he has not finished the degree yet) would be a student currently taking the degree (with value of 2). These students are removed for the training phase of the algorithm as their label (0 or 1) is unknown. The rest of the students are used to train the models, which are developed using *ensembling* techniques. After the models are developed, predictions are carried out for those students whose label is unknown. Finally, a file is generated. This file contains the predictions for all the students (identified with a control number). Therefore, for each student, there is a value between 0 and 1 with the probability of finishing the degree. For students who have already finished or have already dropped out, a 0 or 1 is indicated in a separated column, but their predictions are empty as their status is known beforehand (no predictions are needed).

Moreover, in order to help instructors, some variables are also presented. The aim is that these variables help to understand students' situations. These variables are the variables that are calculated to be used in the model, and they have been presented earlier. As a complement for these variables, the number of semesters the student has taken is also given so that this information can give an idea about if the good/poor achievement is at the beginning of the degree or there is some continuity over time. This fact may also affect dropout as students who have taken several semesters may be less likely to drop out.

Considering the aforementioned system and the predictions, the tool aims to support program directors to identify students who have a higher probability of dropout. This information can be used to take specific corrective measures. For example, one variable considered in Instituto Tecnológico de Zitácuaro is the maximum number of credits a student can take each semester. If a student has a high probability of dropout, this maximum number could be decreased to avoid that the student takes many courses and fail them. Moreover, counsellors could improve their tutoring sessions based on the information of the tool, so that they could improve the efficiency of these sessions so as to reduce dropout rates.



Resources

This section describes the resources of the project to carry out the pilot of the dropout prediction tool.

6. **IT equipment.** Several laptops (those used by the researchers) with the Anaconda distribution (for Python) are used to execute the tool.
7. **Research team.** There is a team of 4 people in charge of collecting and analyzing the data collected during the pilot period.
8. **Pilot team.** There is a team in charge of piloting the tool.
 - a. **Project Coordinator.**
 - b. **Specialists in technological infrastructure.**
 - c. **Group for training, pilot project support and monitoring.**
 - d. **End users.** The end users will be the program directors of the 10 degrees (5 people) that are piloted. Nevertheless, the pilot is actually carried out with 6 professors that teach in these 10 degrees.

Phase 1: Preparation

Processes included in the pilot project

The purpose of this pilot is to carry out an evaluation of the tool with students of 10 degrees of Instituto Tecnológico de Zitácuaro. These degrees involve: Bachelor's Degree in Administration, Public Accountant, Business Management Engineering, Computer Systems Engineering, Industrial Engineering, Food Industry Engineering, Sustainable Agricultural Innovation Engineering, Architecture and Civil Engineering.

All degrees have a duration of 10 semesters (5 years), although students may take more or less time depending on their performance in the courses, considering that they can only take the same course for 3 academic years.

During this pilot, the aim is to obtain dropout predictions for those students who have enrolled from 2014 onwards at Instituto Tecnológico de Zitácuaro. From these predictions, the aim is to validate the accuracy of the tool and to obtain some feedback from the stakeholders on its usefulness. This way, this pilot will serve to improve the tool in the future so as to make the tool as useful as possible for the counsellors.

Current situation of processed included

The objective of the pilot is to obtain feedback of the tool to maximize its efficiency and efficacy for its use by program directors. Currently, there is an institutional tutoring program. In that program, students receive technical counselling during the first half of their degree at least. This way, program directors can better guide their students. In order to improve the tutoring program, this tool aims to provide further and better information to the directors about dropout and related indicators. This way, the monitoring process can be improved. In this line, this pilot aims to validate the tool by the stakeholders.



Phase 2: Agreements

Description of the pilot population

The pilot used data from Instituto Tecnológico de Zitácuaro from 2014. Particularly, data from 10 degrees were used. These data included registers from 2,128 students in the aforementioned period. These students represent the analysis group for this pilot.

Moreover, eight professors participated in the pilot. These professors were selected so that there was at least one professor who taught in each of the 10 degrees involved in the pilot. This way, professors knew the context and the profile of the students in each degree, and they could provide valuable and appropriate information about whether or not students were likely to drop out.

Phase 3: Training

For this pilot, training was conducted for the participating professors, and they were explained the tasks they had to do throughout the pilot. In particular, professors were provided with the data containing the results of predictions, together with a column in which they were asked whether or not they believed students were going to drop out the degree. Professors had to fill that column with a 0 (dropout) or 1 (completion) for each of the students based on their experience, their knowledge about the students, or the information of the indicators that appeared with the predictions.

Phase 4: Use and Impact

For the evaluation of the pilot, eight professors were asked to indicate whether they believed students were going to drop out the degree or not. This process was done with about 7.5% of the students. Because of that, in this pilot, the tool was used on a subsample of 159 students. These students were classified in two groups to analyze different groups of students:

- Group 1: It included random students of the sample. This group was used to validate the overall performance of the tool. There were 89 students in this group.
- Group 2: It included students with a status different than ACT (active). This means that it included students who had actually dropout, they were on a furlough, etc. The objective was to verify how the performance was for these special cases. There were 70 students in this group.

For the evaluation of the pilot, results obtained with the tool were compared with those obtained in the pilot (by the professors involved). Results showed a precision of 72% for those students that were randomly selected (group 1, with 89 students). Moreover, the tool showed a precision of 71% for those students with status different than ACT, active (group 2, with 70 students). Finally, when both groups were considered together, the tool showed a precision of 72%. This means that the tool can provide predictions with a moderate performance. Nevertheless, it is possible to refine the model to improve it, and there is a plan to do it in the next months.

The main comments received by the professors in relation to how the tool works are as follows:

- In the table of results, there are some students who are taking their professional internship. This course is carried out in the last stage of the degree and most of the students pass it and complete the degree without issues. This fact should be included in the next versions of the model.



- It is desirable to include more irregular students, as they will be useful to improve dropout predictions.

In summary, this pilot has served to validate the overall performance of the dropout tool developed at Instituto Tecnológico de Zitácuaro. Currently, the tool is potentially available to provide predictions of more than 2,000 students and it has been tested with 159 students. The tool has a moderate precision, and the pilot has served to identify some points for improvement. These improvements are planned to be done in the coming months, as this tool is considered very relevant in this context, considering the existing problems with dropout, recently accentuated with the pandemic.

5. Summary of Results

The execution of the pilots detailed in this document provides evidence that the incorporation of LA tools in the considered institutions of Latin American, when aligned with institutional needs and focused on impact in decision making, has positive effects. These effects are evident in terms of institutional capacity building, support for improved student performance and user satisfaction. Perhaps most importantly, their incorporation has established a starting point for encouraging LA adoption at participating universities.

In summary, ESPOL implemented new learning analytics in an existing tool used in the academic counselling process already in place throughout the university. Counsellors positively evaluate the new features to support decision-making during student counselling sessions. In the case of UACH, a new tool was implemented, separate from the existing academic information system, to be used by counsellors (school directors) to support the decision on a special request for enrolment or dropout. Counsellors indicated that TrAC makes their work easier, saves time and allows them to better support their decisions. UCuenca implemented a new tool and a new counselling process. Enthusiastic teaching staff were motivated to begin the academic counselling process; although the process has not been without resistance from lecturers, both they and the students consider the tool to be useful and to facilitate understanding of the recommendations provided by the counsellors. The case of PUC-Chile differs from the above-mentioned cases in that it is oriented towards improving student engagement and performance in digital learning environments (MOOCs). The students value the tool positively and how it stimulates reflection, efficiency and effectiveness in the way they work during the courses.



In Table 52, the summary of the results obtained during the piloting is listed, following the order of the indicators described in Table 1. Although some of those involved have actively used the tools (Assets column), they are enabled for a much larger number of decision makers and students (enabled column).

Indicator	Overall Result	Institution	Results by Institution	
			Active	Enabled
A total of 300 decision makers are involved in the pilots (counselling and dropout tools)	650 decision makers participated in the pilots and 839 are enabled to do so.	UACH	22 decision makers (21 counsellors and the Undergraduate Director)	43 decision makers (42 counsellors and the Undergraduate Director)
		PUC-Chile	17 lecturers (NMP)	30 lecturers (NMP)
			3 lecturers (DaP-MOOC)	11 lecturers (DaP-MOOC)
		UCuenca	56 lecturers	74 lecturers
		ESPOL	416 counsellors	641 counsellors
		UChile	4	No information
		UPS	119	No information
		UFRPE	3	No information
UZ	10	40		
At least 5000 students in total involved in the pilots (counselling and dropout tools)	19.067 students in total were involved in the pilots and are 40.011 enabled to do so.	UACH	464 students	9085 students
		PUC-Chile	790 students (657 NPM online and 133flipped)	1.296 students (1054 NPM online and 242 flipped)
			2.421 students (DaP-MOOC)	5.319 students (DaP-MOOC)
		UCuenca	1.873 students	8.300 students
		ESPOL	9.485 students	12.631 students
		UChile	95	1252
		UPS	3668	No information
		UFRPE	112	No information
UZ	159	2128		
There are at least 8 institutions in Latin America that regularly use Learning Analytics tools to make informed decisions	8 universities have carried out the pilots. 4 of them are part of the consortium and another 4 are external to it.			
There are positive differences in the performance of students who receive counselling through the tools developed as a result of the project	There were positive effects on the performance of students who received counselling with LA tools. However, these improvements can be attributed to multiple factors, including the incorporation of LA tools	UACH	The tool helped the students involved to place in a higher position with respect to the ranking of their cohort	
		PUC-Chile	The tool helped the students involved to complete the courses	
		UCuenca	To be measured by the end of the semester	
		ESPOL	The tool helped students improve their grades and better balance their academic workload	
The advice and guidance of lecturers is more focused on the needs of each student, based on their data and that of previous students.	Users have stated that they are satisfied with the tools and that they are highly usable. The tools have helped users to be more confident in	UACH	100% of the counsellors involved in the pilot project have used the tools, registering more than 7000 actions in them	
		PUC-Chile	The tool was downloaded by 1054 students and in the online pilot users made 43,491 visits to the course materials	



Institutions use tools to predict or estimate outcomes based on mathematical/statistical/machine learning models and academic data.	explaining the decisions they make, to better guide students in planning their coursework and to use their time more efficiently. The use logs show that the users involved have actively used the tools	UCuenca	62% of counsellors involved in the piloting have used the tools, registering 22.707 actions in them
		ESPOL	90% of the counsellors have used the new visualizations and it was consulted 23.546 times
The tools serve as an example for new ideas and implementations	The pilots have improved the tools (TrAC, AvAc, SiCa, Note My Progress and DaP-MOOC) and led to the design of new ones	UACH	TrACE was designed, a tool similar to TrAC but intended for students to plan the courses to enrol in
		PUC-Chile	It is expected that lecturer visualizations will be implemented that summarize what is happening in relation to the students' weekly planning and to support the students in this planning
		UCuenca	Two visualizations will be implemented to complement AvAc
		ESPOL	The data set for the calculation of the prediction was expanded and the visualizations of the prediction have been improved to incorporate explanatory information
Evidence-based decision-making is part of the culture of the universities in the LALA Community.	<p>The results of the surveys and the use logs analysed at the 4 universities show that there is interest in continuing to use the tools after the pilots.</p> <p>As specific evidence of the cultural change promoted by this project, the authorities have allocated resources for the institutionalization of the tools</p>	UACH	The resources were requested as part of TI's annual budget and supported by the Undergraduate Director. Progressively, new departments are being added that want to use the tools.
		PUC-Chile	The piloted tools are part of an institutional modernization initiative supported by the director of the School of Engineering.
		UCuenca	Resources were allocated from the adaptation of the tool and continue to be allocated for improvements to be implemented. In addition, new faculties have been progressively added.
		ESPOL	The results of the deployment of the tools in SiCa were received positively by the Vice-Chancellor's Office and their institutional use will be encouraged

Table 48. Results by indicator

Although the results obtained in the pilots are not generalizable to every institution, because the adaptations and pilots were adjusted to the different contexts, they can be applied to similar contexts. In fact, the cases of UACH, Cuenca and ESPOL represent a wide spectrum of different realities with respect to academic counselling processes and tools in Latin America. In addition, the case of PUC-Chile serves as an example for those universities that wish to strengthen their initiatives in MOOCs. Table 42 shows the main lessons learned that have been collected during the pilots.



Effectiveness

The effect of the tools on the effectiveness of students is a difficult phenomenon to measure as it depends on multiple factors and isolating them is not a trivial task. Furthermore, for each institution the effectiveness of the students can be interpreted and measured differently. For example, in the UACH the effects of TrAC on the effectiveness of the students were measured using the ranking of the cohorts. It was concluded that the students who received counselling with TrAC, the following semester were in a better position in the ranking of their cohort with respect to their peers who did not receive counselling with TrAC. In the case of PUC-Chile, an experiment with a control group was designed to measure the effects of NoteMyProgress on students. This experiment allowed to observe a positive correlation between the active use of the tool and the completion of the MOOCs. In the case of UCuenca and ESPOL, effectiveness was measured through the difference between grades and the students' academic load balance, positive differences were obtained in both metrics. In summary, there were positive effects on the effectiveness of students who received advice with the LA tools. However, these improvements can be attributable to multiple factors, among which the incorporation of ML tools is considered.

Usefulness

The usefulness of the tools was measured through questionnaires, focus groups and / or interviews. In some of the universities, several of these strategies were used to triangulate the information. In all the universities the results were positive. In particular, users value the design attributes of the tools, their ease of use and, above all, their impact on their daily work. For example, some users mentioned that thanks to the tool they use their time more efficiently and that the information presented in the tools has helped users to explain the decisions they make with greater confidence. In addition, the tools have made it possible to better guide students when planning their dedication to courses. The logs of use of the tools are concrete evidence that users have actively used the tools by performing multiple actions on them.

Institutional Impact

This aspect can be considered the most challenging. All the universities participating in the pilots presented difficulties at obtaining the commitment of the university authorities to actively participate and allocate resources in the institutionalization of the tools; materialize the exchange of data between existing applications in the university; support in the management of dilemmas related to data management, the possible interpretations of them and their impact on the intervened processes (counselling and self-monitoring). However, the project also raised awareness in the authorities regarding the importance and benefits derived from incorporating ML. This is materialized in various concrete actions, for example, at the UACH the Undergraduate Director supported the request for resources as part of the annual IT budget for the institutionalization of TrAC. In PUC-Chile, the piloted tools are part of an institutional modernization initiative supported by the director of the School of Engineering. In UCuenca, the rectory assigned resources for the adaptation of the tool and they continue to be assigned to improve implementations and gradually add new faculties. At ESPOL, the results derived from the use of SiCa were positively received by the vice-rector and its institutional use is encouraged.

Data and processes

All the pilot experiences highlight the importance of introducing an LA tool that is fed by existing learning data (e.g. academic records). While multiple ideas for designing the tools emerged during the



needs assessment activities, restricting the pilots to the data currently captured by the institutions allowed for more effective execution and piloting. Likewise, the universities that introduced LA tools into existing more mature processes had to face less resistance in comparison with institutions with incipient or completely new processes such as UCuenca.
Team
The formation of a multidisciplinary team, which allows the promotion of socialization and involvement of key stakeholders in universities is essential to the success of the project. Therefore, it is recommended that stable teams with technical and management skills and with knowledge of the educational and institutional context be created.
Pilot preparation
A strategy used in most of the universities participating in the pilots has been to establish strong and trustworthy links with enthusiastic users, in order to spread the use of the tool among peers. These bonds of trust are strongly related to the quality of the tools and information provided. Consequently, it is recommended that the data and results delivered by the tools be analysed prior to any intervention with end users. In addition, it is crucially important to carefully define the messages and recommendations delivered with the tools.
User support
The design of tools with the active involvement of users allows for a considerable reduction in training efforts. However, during the pilot projects efforts should be made to provide the necessary guidance for users to make effective use of LA tools. In this way, possible biases can be avoided, and users can transform information into decisions and/or actions that positively influence learning and consequently the institution.
Socialization
At the beginning of the pilots, the importance of socializing and communicating the results obtained in the pilots within each university was underestimated. Therefore, it is recommended to continuously socialize and disseminate the results of the pilots with users and university authorities.
Adaptability
Due to the volatile Latin American social context, where strikes and social conflicts are frequent, it is essential to create the necessary adaptive capacity to address changing institutional priorities and/or needs for tool updates. Therefore, it should be kept in mind that the need to address changes in context (educational and social) and previously planned objectives must be reconciled.
Importance of piloting
The piloting of an LA tool is more than an experiment, it is a key activity for the adoption of the innovations. By means of a pilot project, the foundations are laid for effective adoption, during which the true applicability of the tools and the specific uses that stakeholders make of them can be understood. You can even identify the culture of the institution, its functioning, its needs and the changes that need to be encouraged to incorporate a process of improvement in data-based academic decision-making.

Table 53. Lessons learned from the piloting

