PROMOTION OF STUDENT SUCCESS AT THE SCHOOL OF ENGINEERING, UCSC-CHILE

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ABSTRACT

This work presents a proposal of a model of psychoeducational accompaniment aimed at students at the School of Engineering at the Universidad Católica de la Santísima Concepción (UCSC). This proposal responds to the scarce preparation in academic aspects as well as emotional, cognitive, and behavioral features presented by freshmen students when they enter at the engineering programs of this School. This situation affects the evaluation of learning process of the courses (standard 11), which is reflected in low rates of student success in subjects of their curriculum, directly affecting the retention and permanence of engineering students in the University and implicate a review of the integrated learning experiences and active experiential learning methods (standards 7, 8) used today. The model is part of an institutional project in execution in 2020-2021 period, funded by the Chilean Ministry of Education. The model is focusing on first to third year engineering students and contains five phases: 1) Detection of Needs, 2) Search for experiences and good practices, 3) Design and Planning, 4) Implementation, and 5) Evaluation. This paper presents the first three phases. The methodology to develop these three phases consisted in a review of institutional documents and data combined with analysis of some institutional surveys complementing with activities such as focus groups and interviews with internal directors of student service units and academic internships to learn about successful experiences from other universities in this topic. Preliminary results showed internal opportunities for improvement such as the need to articulate internal student services to improve the effectiveness in institutional monitoring and support, and the need to strengthen the academic and social integration of students that will allow to design and planning the extracurricular strategy to implementing the psychoeducational support model and tutoring system that would influence in improving the academic success of engineering students.

KEYWORDS

Student success, higher education, psychoeducational support, tutoring system, engineering, standards: 7, 8, 11.

INTRODUCTION

The challenge faced by Chilean universities in addressing the problem of student permanence focus on retention rate is well known, given that it is a persistent and significant phenomenon that affects them (Donoso, 2010). The promotion of permanence in higher education is related to the adjustment of the student and the institution, based on the acquisition of academic experiences and social integration (Hu and Kuh, 2000). The full integration of the student (social and academic) would indicate a satisfactory transition to university life, so that both forms of integration would be complementary with respect to learning and student persistence (Pascarella y Terenzini, 2005; Corominas, 2001; Huh y Kuh, 2000; Tinto y Goodsell, 1993).

From the psychological perspective, individual factors are associated with failure in university studies, since these are related to the student abilities to manage their own learning processes (Pérez, Valenzuela, Díaz, González-Pienda, & Núñez, 2013). Within the psychological variables related to academic performance and that can be influenced, both by teachers, peers, as well as by support professionals, are the cognitive-motivational variables; causal attributes, academic self-concept, self-efficacy expectations and self-regulation of learning (Bruna, 2020). The latter has a positive effect on the academic performance of students (Valle et al., 2008; Lawanto et al., 2013; Mega, Ronconi and De Beni, 2014; Dörrenbächer & Perels, 2016; Ergen & Kanadli, 2017; Villalón et al, 2017), however, early engineering students present low levels of self-regulation of learning (Vásquez, 2009; Villalón et al., 2017; Nelson et al., 2014).

The reasons that influence student retention corresponds mainly to personal, family and institutional reasons (Donoso and Schiefelbein, 2007). The institutional reasons depend directly on the universities, so this institutions can influence the improvement of this indicator through support processes oriented to: financial aspects, student welfare, academic services, promotion programs and admission, and those who seek to generate improvements in the curricular and pedagogical processes (Pineda, Pedraza and López, 2011), highlighting that these support processes must be present throughout all stages of a student's career (Flanagan, 2017) as a continuum of scope and intensity as the elements that vary and they could be universal, group or individual support (Turnbull et al, 2002).

The School of Engineering through the projects funded by Chilean Ministry of Education USC 0610, FIAC 2 USC 1101, PM 1308 and USC1999 has been addressing the aspects that affect student retention such as the curricular redesign of their careers, empowerment and development spaces for the teaching of engineering, acquisition of equipment and teacher training in active learning methodologies. All according to the standards of the CDIO initiative to which this School belongs since the year 2011 and it assumed as a model of engineering education. Therefore, with the projects already developed, the School of Engineering have been approached from standard 1 to 10 of CDIO. However, considering the freshmen profile of engineering students and their academic success, it is observed that despite the efforts made in the academic field aimed to improving retention rates, these have not experienced significant improvements. Emerging weaknesses related precisely to the freshmen profile of students, such as socioeconomic status and personal characteristics (González et al, 2018).

The reasons mentioned above, justified the USC1999 project, that incorporates the design and implementation of a model of psychoeducational support that seeks to complement the dimensions already addressed in the other projects (standards 1, 2, 3, 4, 5, 6, 7, 8, 9, 10). With this, the School of Engineering face the problem of permanence and student academic success, including support psychoeducational programs that strengthen motivation,

adaptation and self-regulation in engineering students involved in the development of CDIO standard 11.

This effort intended to contribute at producing professionals up to the challenges and needs of today's society (Crawley, Malmqvist, Ostlund and Brodeur, 2007) and improving the indicator of student permanence in Universities. For this reason, this work presents a proposal for a psychoeducational accompaniment model that is being implemented by the Faculty of Engineering from the second semester of 2020.

THE NEED FOR PSYCHOEDUCATIONAL SUPPORT DEVICES

Freshmen students of the five programs offered by the School of Engineering (Industrial, Electrical, Computer Science, Geological and Civil Engineering) are characterized by coming mainly from the first three lowest income segment and they come from public and private subsidized schools from the Biobío region. To enter to Universities, the secondary students must take a national test and the average scores obtained by them that applied to the engineering programs of this School of Engineering are around 580 points of the 850 total points, being higher in the case of Civil Engineering and Industrial Civil Engineering and lower in the case of Computer Civil Engineering and Geological Civil Engineering. It is also observed that 70% of our first-year enrollment, enter with a score lower than 600 points and the 40% of them present a score lower than 550 points.

To complement this data, the Heads of Program and academics who teaching at first-year of engineering detect a passive role in freshmen students, playing only a role of information receptors in the classroom that remarks the excessive schooling behavior, low autonomy and low level of self-regulation. In relation to the pass rates of subjects, the percentages of the School of Engineering correspond to 62.39% for the year 2017. That rate is below the average of the University, which was 85.01% for the same year. About the subjects in the second and third year, the 40 subjects most failed at the University level, 24 corresponds to the School of Engineering. Seven of them correspond to the first year, eight to the second year and nine to the third and fourth year, with an average rate of 49.74% failure.

About the retention rate at second year in the University has an average value of 85.6%, year 2018, but the retention percentages in engineering programs it depends on engineering program. For example, Civil Engineering and Industrial Civil Engineering are quite similar to the institutional value. However, for programs of Geological Engineering, Computer Science and Electrical Engineering there is a gap that needs to be improved (see Table 1).

Table 1. Retention Rates of Engineering Programs 2020

Engineering program	First Year retention rate	Third year retention rate
Civil Engineering	78,64%	74,23%
Industrial Engineering	81,58%	67,83%
Computer Science	79,31%	35,38%
Geological Engineering	50,00%	44,44%
Electrical Engineering	63,49%	40,91%

On the other hand, an effort to train teachers in student-centered methodologies was made, to enhance teaching and learning processes within the framework of the adoption of standard 8

of the CDIO Model. However, this improvement has been slow, since teacher training is determined from the Center for Innovation and Teacher Training (CIDD), that has a priority to offer train institutional programs.

Another effort made for the School of Engineering was the expansion of the options to get the professional degree adopted in 2016, showing Industrial Engineering program an average variation from 12.22% for the 2004-2010 cohorts to 24.44% for the 2011 cohort. For Civil Engineering the rate grows from of 3% for the 2004-2010 cohorts to 18.4 % for the 2011 cohort. Computer Science program adopted this curricular innovation one year later, and the rate goes from 1.2% for the 2004-2010 cohorts to 3.75% for the 2012 cohort (DARA-Cubix, 2019).

The University provides to students a support service through the Student Support Department (DAE), the Student Support Center (CEADE) and the Support and Access to Higher Education Program (PACE). However, those services are managed independently, without taking advantage of the synergy between them, generating confusion to students and losing the opportunity to give them a comprehensive care. Thus, the figures about retention at the School of Engineering are clear and the efforts made it are not enough to improve the rates that reflects the academic performance or student success. For that reason, it is necessary an additional effort oriented to implement an articulated strategy with focus on the successful academic performance and social integration of students by the implementation of psychoeducational accompaniment model, aimed to the whole undergraduated students at the School of Engineering.

MODEL PHASES

To put in practice the model it was necessary to follow five phases 1) Detection of Needs, 2) Search for experiences and good practices, 3) Design and Planning, 4) Implementation, and 5) Evaluation. As we mentioned above, this article is concentrates in the first three phases. The detection of needs was made by surveys to students, a review of institutional documents and data as we showed above, combined with analysis of some institutional surveys and complementing with activities such as focus groups and interviews with internal directors of student service units. The search of good practices was made by academic internships and literature review about abandon, autoregulation, permanence, tutoring, vocational adjustment and psychoeducative accompaniment. Finally, the design and planning were made by the inputs obtained in the two first phases.

MODEL DESCRIPTION

The model is based on dialogical learning (Flecha, 2009), the methodology of peer tutors (Gomez, 2013; Alzate-Medina y Peña-Borrero, 2010) and the principles and techniques of educational psychology with different and complementary modalities to the clinical approach, that seeks to prevent, remedy and enrich the educational experience of students (Banz and Valenzuela, 2004; Mozó, 2016). It focuses on the cognitive-motivational mechanisms of self-regulation of learning (Bruna, 2020), to confront the academic stress (Jimenez, 2017) and vocational adjustment (Casanova-Cruz, 2018), as protective factors of mental health.

The model has three articulated components to promote an adequate adaptation to the university life and the permanence of the students, promoting the development of personal

resources and learning strategies that allow them to face their academic progression in an autonomous and collaborative way (see Diagram 1)

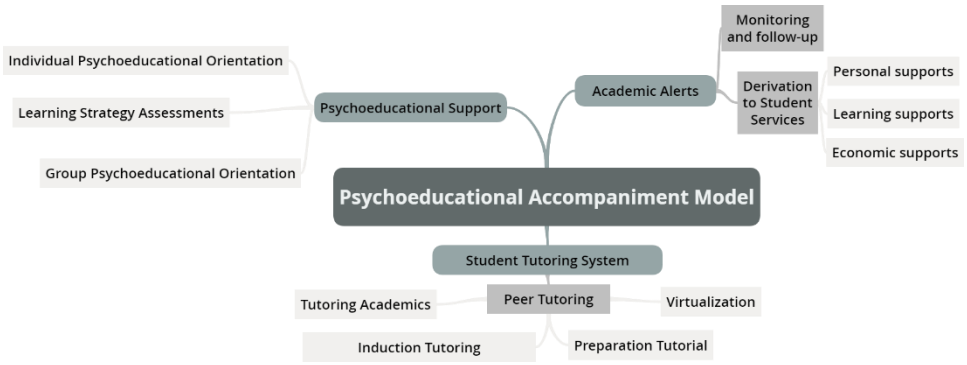

Diagram 1. Psychoeducational Accompaniment Model.

The first component is Psychoeducational Support that corresponds an extracurricular device that seeks to promote the development of personal resources and learning strategies that allow students to face autonomously and collaboratively the transition to university life, their academic progression and their learning. The second component is the Academic Alerts that is a device that allows the identification, monitoring and follow-up of the academic performance of students who delayed in their curricular progression, who will receive an alert at the end of the semester according to the dates of the academic calendar and then follow up with the objective of orienting and referring to the network of institutional support. The third component is the Student Tutoring System that is the accompaniment and advising system in various areas, such as academic support, delivery of information on regulatory aspects, administrative procedures, resources and services available from the university, study techniques and time planning, accompaniment and psychosocial and motivational guidance, social skills and identification of special cases that require specialized psycho-pedagogical support for referral. In addition, it provides information on the institutional and academic culture to which the student is inserted. This accompaniment is carried out by a student tutor for higher courses, who advises and guides students. In Table 2 there is a description of activities of each model component.

The aim of this model is contributing to the transition to university life and permanence of students in the School of Engineering of the UCSC. The strategy focuses undergraduate students at the School of Engineering enrolled in one of their five programs. The students get in the components that the model presents derived by teachers, by head of the program, by some service of the Student Support Office or by themselves. Also, it is possible to include students reported by the academic alert system.

The psychoeducational team to implement the model at the School of Engineering are composed of three professionals (two educational psychologists and a teacher with specialization in psycho-pedagogy) who will work in coordination with the professionals of institutional student support services.

Table 2. Model Components and Activities

Component	Activities
Psychoeducational Support	• Learning Strategy Assessments: group session where students analyze strengths and weaknesses of their learning process, are oriented and referred to OPI and OPG, and student services as appropriate. • Individual Psychoeducational Orientation (OPI): individual personalized session where a psychoeducation professional accompanies the student to identify his/her current situation regarding his/her study, academic motivation, vocational exploration and/or coping with academic stress. • Group Psychoeducational Orientation (OPG): theoretical-practical group session in a workshop format that addresses self-regulation strategies for learning. All workshops have the use of technological tools and applications.
Academic Alerts	• Institutional Report. Through the Admission and Academic Registry Office, a report is managed on the state of curricular progress and/or accumulated grade point average of students in the first, second and third years, with the objective of identifying those students who are behind in their curricular progress. • Contact with students: Citation to individual interviews. • Individual interview / referral to student services: Interview to evaluate academic situation together with the student through a standardized interview guideline. Commitments are established, referrals are made to institutional support and deadlines are set for evaluation in a follow-up interview. • Student Services: address students' needs (personal support, learning support, and financial support) • Follow-up interview: follow-up interview according to standardized interview guidelines with the students interviewed in activity 3. • Adherence report: The psycho-educational team prepares an adherence report for students in an academic alert situation.
Student Tutoring System	• Academic Tutoring: Weekly reinforcement through tutorial groups linked to subjects identified as critical (high failure rate) is carried out through a methodology of peer tutors. • Induction Tutoring: Affirmative actions that promote the social and academic integration of the new students of the five engineering programs through vocational-motivational workshops, executed by peer tutors and articulated with the introduction to engineering subjects of each career. • Preparation Tutorials: Massive instance of content review prior to a round of contests during the semester. It will use pedagogical resources from previous exams in guide format with focus on critical subjects. • Virtualization: Implementation of a tutorial video library and a note center in collaboration with the tutors of the Student Tutoring Program. In addition, it includes the purchase of digitizing tablets for the peer tutors, for the implementation of distance tutoring.

PRELIMINAR RESULTS

Among the preliminary results, we can point out that in first phase of needs detection a survey was designed and applied to know the psychoeducational needs of the students. It was answered by 147 students. In addition, a focus group was held with 6 teachers of critical subjects and another with 6 voluntary students from different levels of curricular progress in their respective engineering programs. From this process, it was concluded that given the context of online classes, the students had problems in their homes related to space difficulties for study and internet connectivity difficulties and motivation to class participation. These

reasons affected their routines (physical/social activity, food and sleep hours, study time, etc), and trigged needs of social-emotional support and academic accompaniment to confront the deregulated context they live in. For example, some of the students decided freezing their studies during 2020.

On the other hand, 22 critical subjects were detected with high rates of failure in areas engineering sciences and specialty subjects. Regarding the process of searching for experiences and good practices in student support, academic internships were carried out in four national universities, and articles and/or reports on institutional strategies to support students were reviewed. It was concluded that the student supports in other institutions are extracurricular type linked to strategies of promotion of learning self-regulation, study techniques, vocational adjustment, techniques of coping with stress, and peer tutoring in diverse modalities according to each institution.

As for the design and planning phase, we coordinated with professionals from the institutional strategies (CEADE, DAE, PACE). A tutor from higher courses were selected and trained. As a result, 11 academic tutorials from critical subjects were implemented as a pilot in second semester 2020. In addition, articulation meetings were held with teachers of engineering introduction courses to incorporate the induction tutorials in these courses as Tutoring System component in the Psychoeducational Support model established. About the virtualization activity website was constructed and 25 digitizing tablets were acquired. Also, it was needed more ZOOM licenses and other web applications to serve the students in the on line context.

CONCLUSIONS

The implementation of this model as a strategy to improve the evaluation of learning process of the courses (standard 11) is an assumed challenge to the School of Engineering to improve the successful academic performance and social integration of engineering students.

The COVID-19 context adds an additional difficult to implement this strategy because online context to give the support to students and it was necessary to extend the duration of the second semester 2020 until January 2021.

The development of this model has allowed the different institutional service units to work together to take advantage of existing synergies and generate those that do not yet exist. This situation reflects the necessary changes in organizational and social structures proposed by the inclusive education point of view that allows to provide spaces for learning and fair development for all students (Gallardo, Lorca, Morrás, Vergara, 2014; Terigi, 2014; Echeita, 2008; Tinto, 2008).

Regarding future work, we are aiming to incorporate impact evaluation of the strategy.

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