THE Management of Learning Process in the Context of Modernization of Undergraduate Programs at Universidade do Vale do Rio dos Sinos (UNISINOS)'S Polytechnical School

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THE MANAGEMENT OF LEARNING PROCESS IN THE CONTEXT OF MODERNIZATION OF UNDERGRADUATION PROGRAMS AT UNISINOS UNIVERSITY'S POLYTECHNICAL SCHOOL

Abstract

National Parameters for Undergrad Engineering Programs determine that these are oriented by management of learning processes, which are constituted of: (i) definition of competences to be assessed, (ii) definition of instruments for assessment, (iii) assessment of competences, (iv) result analysis, (v) proposition and implementation of improvements in the curriculum and (vi) evaluation of these actions. In this context, developing and implementing such a process to modernize undergrad engineering programs is assumed as a strategy of the program known as Projeto de Modernização da Graduação (PMG), developed at Unisinos University since 2019 as an initiative of CAPES and Fullbright, once it is a tool of university educational management focused on ensuring the development of student's learning skills. Thus, the implementation of a learning management process constituted by the collection and analysis of data referring to the learning process of the group of students becomes a premise of the Undergraduate Engineering Programs. This process, strongly originated in the Assurance of Learning dimension, which, in turn, comes from the international accreditation movements of business schools around the world, is of interest to the management of curricula as systematic processes and assessment plans that collectively demonstrate that students achieve competences of learning for the programs in which they participate. The objective of this work is to analyze the implementation of the management of learning process at Unisinos University's Polytechnic School, examining its impact on the curriculum management from the program coordinators' perspective. This implementation process was designed as a training program for coordinators of the 19 undergrad programs involved aiming at their development as managers of the process as the get involved in the process itself and organized in different stages; in the first stage, the mapping of the curriculum to define the learning competences considered as core specific knowledge in each program was the target. These curriculum maps make the result of coordinators' development visible, not only revealing their learnings in relation to the stages and characteristics of the process, but also making it evident that the process itself ended up being a locus for undergrad modernization, oriented by an authorial and innovative positioning of the University in relation to curriculum management processes. Thus, both the management of the learning process implemented, and its own implementation process triggered a series of transformations, from a curricular level to a university educational management level.

INTRODUCTION

The National Curriculum Parameters for Undergraduate Engineering Programs in Brazil, instituted by Resolution No. 2, of April 24, 2019, establish that every undergraduate program in Engineering have a Pedagogical Project for the Program which, in addition to ensuring the development of the competencies established in the profile of the graduate and to present the set of learning activities in the curriculum, clearly specify and describe "[…] VIII – the process of self-assessment and program learning management that includes the instruments for assessing the skills developed, and the respective contents, the diagnostic process and the elaboration of action plans to improve learning, specifying the responsibilities and governance of the process" (BRASIL, April 24, 2019, p. 3). In this way, (i) the instruments to assess competences, (ii) the diagnosis and (iii) the action plans for improving student learning considering the results you achieve in the previous stage – which constitute the learning management process – correspond, in turn, to conditions for the educational management of the curricula of undergraduate programs in Engineering.

Therefore, Unisinos University proposed new Pedagogical Projects for undergraduate programs in Engineering at the Escola Politécnica (Rocha et al., 2021): called Pro Graduation, in addition to promoting a solid training in relation to knowledge in the area, they favor of a greater deepening of transversal skills as well as greater student protagonism through the flexibility of student choices in their academic trajectory integrated with reality (Borba et al., 2021). Ensuring that the competences defined in the Pedagogical Projects are developed is one of the tasks of the Graduation Modernization Project (PMG), which, since 2019, has been developed in partnership with CAPES and Fulbright and in dialogue with the University's Teacher Training, through the qualification of teachers

and coordinators in the implementation and evaluation of curricular competences in order to effective learning (Rocha et al., 2021).

Thus, the learning management process constitutes a strategy of the Graduation Modernization Project (PMG) as a university educational management tool aimed offering programs which develop the competences they were projected to. In addition, however, Unisinos University decided to implement the learning management process not only in the programs that make up the Graduation Modernization Project (PMG) – Environmental Engineering and Civil Engineering – but, at first, also in the Architecture and Urbanism program, in the Geology program and in the other undergraduate programs in Engineering, namely: Agronomics, Biomedical, Computing, Food, Control and Automation, Energy, Materials, Production, Electrical, Electronics, Mechanics and Chemistry.

Therefore, the objective of this article is to analyze the implementation of the learning management process at Unisinos University's Polytechnic School, examining the impacts of the implementation process on the management of the curricula by the respective coordinators. The study refers only the first stage of the implementation of the process, which takes place from a training program for the coordinators of the programs involved with a view to their training, it aims at mapping the curricula to define the skills linked to the specific knowledge of each program.

THEORY

This section defines the learning management process by indicating and describing its stages. However, in addition to the characterization of each part of the process, there are two political perspectives to the process that are important to be highlighted in this article as each will take the process to different results: (i) evaluation for accountability and (ii) evaluation for learning improvement. Since “adopting either of these two perspectives will decisively influence institutional choices about what and how to evaluate, how to organize the evaluation and how to communicate the results of the evaluation” (Ewell, 2009, p. 3), this work emphasize the need of the institution – in our case, of higher education – to clearly establishes the political perspective to which it will align itself in order to establish actions both for the planning and for the implementation of the process in accordance with this perspective.

The second perspective – that of assessment for the continuous improvement of student learning – is the one that guides the development and implementation of the Learning Management process at the Universidade do Vale do Rio dos Sinos. In accordance to what Blaich and Wise (2011) pointed out, there is an approach aligned with this second perspective that is guided by the responsibility that administrators, teachers and employees assume.

Learning assessment – which is at the heart of the Learning Management process – is, in turn, part of the Assurance of Learning process. For the Association to Advance Collegiate Schools of Business (AACSB, 2020, p. 40), learning assessment, corresponding to one of the main requirements for the accreditation of business schools, concerns the management of curricula as “systematic processes and plans of assessment that collectively demonstrate that students achieve learning competencies for the programs in which they participate”. This article highlights the importance of learning assessment as a component of the learning management process and is aligned with the definition postulated by Palomba and Banta (1999, p. 4): learning assessment corresponds to the processes of “collection, review and systematic use of information about educational programs carried out with the purpose of improving student learning and development” (Palomba and Banta, 1999, p. 4).

Table 1 presents the six strategies established by Palomba and Banta (1999) for assessing student learning:

Table 1 – Strategies for assessing students' learning.

Set goals and objectives of learning
Design and implement a thoughtful approach to assessment planning
Engaging individuals on and off campus
Select or design and implement data collection approaches
Examine, share and act on assessment results
Regularly review the assessment process

Palomba e Banta (1999)

The first strategy for effectively evaluating outcomes, "setting goals and objectives for learning," means that each program is oriented towards ensuring that specific (and general) knowledge and skills are learned (Marshall, Leisa Lynn, 2007). The second strategy, "designing and implementing a thoughtful approach to evaluation planning", consolidates the step in which each program maps its curriculum to define direct measures and indirect measures, which configures the evaluation planning process itself. According to Kopera-Frye, Mahaffy, and Svare (2008, p. 9), "curriculum mapping is a versatile process tool that can help faculty discern whether different components of the curriculum align; and if not, what adjustments can be made".

The third strategy, "select or design and implement data collection approaches", corresponds to the stage of the process where students' learning data is collected. As collecting data is "much easier than using the information to improve student learning" (Blaich, Catherine & Wise, Kethleen, 2011), it is easy to assign more importance to this stage than to the next one, which is "examine, share and act on evaluation results". Indeed, "if teachers do not participate in understanding and interpreting assessment evidence, they are much more likely to focus only on finding failures than on considering ways in which the evidence might relate to their teaching" (Banta , Blaich, 2011, p. 24). Finally, the last strategy, "regularly review the evaluation process", does not end the process; in fact, it resets it.

Instead of just listing the stages of the process, in the second edition of their book, Palomba and Banta (2015) consider the evaluation of a continuum which comprises three stages: (i) planning, (ii) implementation and (iii) improvement and maintenance of the process. Initially, the planning stage has five objectives: engaging stakeholders in the process; establish purposes; build a thoughtful approach to evaluation planning; produce a written plan; and evaluate the time. Then, in the implementation stage, you need to appoint a leader, choose or create data collection approaches, allocate resources, educate faculty and staff, evaluate resources, processes and outcomes, and share findings. Finally, the assessment improvement and maintenance stage leads to obtaining credible evidence, protecting the use of assessment results, and re-examining the assessment process.

METHODS

In this section, we explain in more details, how the training program was conceived of and developed, aiming at providing information both about who participated and how the encounters were organized as well as their goals and methodology. We also share, in this section, some pedagogic tools used in the program. As stated before, the program was organized in stages, mirroring the stages to be implemented in the process. In the first stage of the institutionalization of the Learning Management process, twenty-two programs from the Escola Politécnica (Polytechnic School) take part, considering the São Leopoldo (SL) and Porto Alegre (POA) campuses and the onsite and distance education modalities (Table 2). As part of the PMG, it was decided to institutionalize the process in the other Engineering, Architecture and Geology programs and not just with the programs that are officially part of the PMG at Unisinos University. This decision is due both to the DCNs and to the understanding of the shared construction of program directors and a collegiality that allows a transversal look for this set of programs.

Table 2. Polytechnic programs with implementation of the Learning Management process

Programs	Learning Modality	Campus	Nº program administrators
Architecture and Urbanism	Onsite	São Leopoldo	2
Architecture and Urbanism	Onsite	Porto Alegre	2
Agronomic Engineering	Onsite	São Leopoldo	1
Environmental Engineering	Onsite	São Leopoldo	1
Biomedical Engineering	Onsite	São Leopoldo	1
Civil Engineering	Onsite	São Leopoldo	2
Civil Engineering	Onsite	Porto Alegre	1
Computer Engineering	Onsite	São Leopoldo	1
Computer Engineering	Onsite	Porto Alegre	1
Food Engineering	Onsite	São Leopoldo	1
Control and Automation Engineering	Onsite	São Leopoldo	1
Energy Engineering	Onsite	São Leopoldo	1
Materials Engineering	Onsite	São Leopoldo	1
Production Engineering	Onsite	Porto Alegre	1
Production Engineering	Onsite	São Leopoldo	1
Production Engineering	e-learning	São Leopoldo	1
Electrical Engineering	Onsite	São Leopoldo	1
Eletronic Engineering	Onsite	São Leopoldo	1
Mechanical Engineering	Onsite	São Leopoldo	2
Mechanical Engineering	e-learning	São Leopoldo	1
Chemical Engineering	Onsite	São Leopoldo	1
Geology	Onsite	São Leopoldo	1

In addition, the development and implementation of the Learning Management process at the Escola Politécnica not only aim at implementing the stages of the process, but are oriented towards its development, through the construction of an innovative process for training program coordinators in relation to the process itself, and in relation to the materiality of the process in the set of programs. The program is taught by professors who make up the Learning Management Working Group at the university and by the Teacher Training team, and is supervised by the Academic Undergraduate Unit through the Teaching Development Management and by the Management of Programs at the Polytechnic School. One of the objectives of this format is to engage coordinators in the decision-

making process of the Learning Management model and, with this, make the process authorial from the perspective of the institution itself and the programs in question. The program – whose action plan is presented in Table 3 – consists of physical and online, onsite, meetings with a total workload of 20 hours, being planned as a result of the needs of each stage of the process.

Table 3. Action Plan for the implementation of the Learning Management process

Process **Steps**	**Requirements for the** Stage	Training **Actions**
Establishing the Specific *Knowledge Competency*	Train program coordinators on theLearning Management Process	A onsite meeting to present the Learning Management Process and its stages through a theoretical approach and applied cases from programs at the School of Management and Business.
	Recognize the Knowledge Areas that should compose the Specific Knowled geCompetency	Task directed to coordinators to identify the specific knowledge developed in their program by searching the reference documents.
Curriculum *Mapping*	Train the coordinators on the elaboration of the Curriculum Map that should aggregate the different Specific Knowledge Areas of the professional's education. As well as highlighting the function of this Map within the Learning Management process.	Online meeting to conceptualize and relate Specific Knowledge andAreas within the Curriculum Map, as well as exemplify through programmaps from the Business and Management School.
	To draw up the Curriculum Map for the Specific Knowledge Competence of each program from a model that substantiates the choices of academicactivities in each area.	Task oriented to coordinators forthe elaboration of the Map togetherwith the NDE (Núcleo Docente Estruturante) of the program, according to the model.
	Accompany the elaboration ofthe Maps, with support for questions and guidance for completion.	Online meeting with groups of programs from related areas to verify the sharing of the map elaborated and evaluate needs for adjustments for its finalization.
	Validate the submission of the Curriculum Map for eachprogram.	Onsite meeting to presentthe finished Maps with peer review.

The Mapping of the Curricula resulted from the indication of Academic Activities (AA's), which are the different courses of each program, that develop the competence connected to Specific Knowledge, which in turn are organized into Knowledge Areas. As shown in Table 2, the maps were drawn up based on a model in which the program coordinators, together with the structuring teaching cores, should register and justify the composition of the areas by certain Academic Activities. It is important to point out that there was nostandardization regarding the number of Areas to be defined and the number of APAs for each area, making this definition as part of the analysis of each program.

Mapping of curricula in relation to the competence linked to Specific Knowledge constitutes the first stage in the institutionalization of the Learning Management process. Among the next stages is the implementation of the process in relation to other competencies, which consider, even more strongly, the institutional mission and vision in a transversalway to the various programs, belonging - or not - to the Polytechnic School. Figure1 shows the detailed Curriculum Map model used by the programs involved.

Figure 1. detailed Résumé Map Template to justify the composition

MODALITY			
LOCATION			
COORDINATORS:			
CURRICULUM MAP FOR SPECIFIC KNOWLEDGE			
DOCUMENTS CONSIDERED FOR PREPARATION			
	AREAS OF SPECIFIC KNOWLEDGE		
	Define area		
AA	Indicate AA		
Semester	Indicate in which semester of the curriculum the AA is		
Depth level	Depth level of AA (introductory, intermediate or advanced)		
Evidence in the characterization	Indicate the competence of the AA that justifies its appointment to the area		

After completion, all maps were analyzed for their detailing, according to the itemsrequested for completion.

RESULTS AND INVESTIGATION

The formative meetings of the program coordinators as well as the oriented tasks enabled the development and implementation of the Learning Management Process to result from the centrality, engagement and protagonism of coordinators and NDEs of the Engineering programs. Thus,the maps of the curricula correspond to the materialization of the result of the training process of the program coordinators involved in the first stage of the institutionalization of the process and reveal their learning in relation to the stages, the characteristics of the process and its articulation with the curriculum they coordinate.

As observed in Table 3, the 21 programs involved produced 18 maps according tothe program and the teaching modality. Programs with the same curriculum in the onsite teaching modality, but in different campi, such as Architecture and Urbanism, Civil Engineering, Computer Engineering and Production Engineering,presented a single map, considering the same Specific Knowledge Areas and thesame Academic Activities in their compositions.

The programs that are offered in both learning modalities (onsite and at distance), such as Mechanical Engineering and Production Engineering, prepared maps with the same Specific Knowledge Areas, but differing in the indication of Academic Activities.

The number of defined areas in the map of each program varied between 4 and 6, with an average of 4.95±0.64. The number of AAs in the composition of the maps varied between 15 and 35, with an average of 25.33±6.83. In this aspect, it is noteworthy that, although the number of Areas and AAs for the mapcomposition was not standardized, it is observed that the average of this relationship in the programs was 5.21±1.64 (AAs/Area) with a variation between 3and 8.75.

These quantitative data from the maps prepared are important for monitoring the process in the later stages, since the map should guide the preparation of the collection instrument, as well as the improvement actions afterobtaining the results. In this sense, maps that present the quantity of areas and academic activities at the minimum and maximum limits become analysis pointsin relation to their function within the process and may be updated if necessary.

Table 3. Quantitative data about the elaborated Curriculum Maps

Programs	**Campi**	**Mode**	**Map**	**Total** Areas	**Total** AAs	**nº** AAs/Area
Architecture and Urbanism	SL	Onsite	1map	6	20	3,33
Architecture andUrbanism		Onsite				
	POA	Onsite				
Civil Engineering	SL	Onsite	1 map	4	20	5,00
Civil Engineering	POA	Onsite				
Agronomic Engineering	SL	Onsite	1 map	5	24	4,80
EnvironmentalEngineering	SL	Onsite	1 map	5	30	6,00
Biomedical Engineering	SL	Onsite	1 map	4	17	4,25
Food Engineering	SL	Onsite	1 map	5	30	6,00
Chemical Engineering	SL	Onsite	1 map	5	25	5,00
Materials Engineering	SL	Onsite	1 map	5	21	4,20
Geology	SL	Onsite	1 map	5	35	7,00
Production Engineering	POA	e-learning	1 map	5	15	3,00
Production Engineering	SL	Onsite				
Production Engineering	SL	e-learning	1 map	5	15	3,00
Mechanical Engineering	SL	Onsite	1 map	4	35	8,75
Mechanical Engineering	SL	Onsite	1 map	4	35	8,75
Computer Engineering	SL	Onsite	1 map	5	22	4,40
Computer Engineering	POA	Onsite				
Control and Automation Engineering	SL	Onsite	1 map	6	32	5,33
Energy Engineering	SL	Onsite	1 map	5	23	4,60
Electrical Engineering	SL	Onsite	1 map	5	26	5,20
Electronic Engineering	SL	Onsite	1 map	6	31	5,17

Curricula maps obtained materialize the result of the coordinators' development process, not only revealing their learning in relation to the stages and characteristics of the process, but especially showing that the process was configured as a *locus* for modernization in graduation, guided by a positioning authorial and innovative approach of the university regarding the management of curricula. Thus, the implanted learning management process and the implantation process itself trigger a series of transformations from the curricular level to the level of university educational management.

To exemplify the result of this mapping stage, Figure 2 shows the Specific Knowledge Curriculum Map prepared by the coordinators of the in-class Civil Engineering programs for both the São Leopoldo (SL) and Porto Alegre (POA) campuses. The map presents 4 Areas of Specific Civil Engineering Knowledge, and each Area aggregates a set of 5 Academic Activities located in different semesters and which present different levels of depth (introductory, intermediate and advanced) in relation to the specific knowledge worked on. The choice of these Academic Activities was justified on the basis of the development of competencies for the Area. This construction is part of the very process of joint and institutional construction of Learning Management and the appropriation, asa field of knowledge, of the specificities of the area.

Figure 2: Civil Engineering Specific Knowledge Curriculum Map (Onsite/ SL andPOA)

	AREAS			
	GEOTECHNICS	CONSRUCTION	WATER RESOURCES	STRUCTURAL ANALYSIS
	Infrastructure and mobility 3rd semester introductory	Concrete and mortar technology 4th semester Introductory	Hydraulics and water networks 5th semester Introductory	Building Statics 4th semester Introductory
	Geotechnical fundamentals 5th semester Introductory	Construction and Performance 6th semester Intermediate	Design of hydrosanitary installations 6th semester Intermediate	Material mechanics 5th semester Intermediate
	Applied geotechnics 6th semester Intermediate	Internship II 8th semester Advanced	Hydrology and drainage 7th semester Intermediate	Hyperstatic structures 6th semester Advanced
	Infrastructure and paving			

The four areas (educational lines) described in Figure 2 correspond to theGeneral Education in Engineering of the Political-Pedagogical Project of the CivilEngineering Program. This structure was composed based on the evaluation of the perspectives and the main demands of the regional civil construction market, contemplating the technical knowledge and the competencies required to solve the main challenges imposed by the labor market.

The process of mapping the curriculum and Academic Activities by axis allowed coordinators to identify the points of connection between the axes and, progressively, the way in which knowledge is developed in each area. In addition,it made it possible to understand how the program is distributed in relation to teaching methodologies in each Academic Activity, in order to determine what knowledge, the student appropriates in the classroom, so that, in a second moment, the instruments to collect evidence of learning in each area can be defined.

The four thematic lines of specific knowledge are aligned with the development of a systemic vision of the area of geotechnical works and transport/transit (*Mobility and infrastructure line*); the constitution of competencesfocused on the more classical field of Civil Engineering, related to materials, construction processes, planning and management of works (*Building*

performance and environmental sustainability line); the development ofcompetencies related to dealing with water, sewage, and waste (*Availability and quality of water resources*); and the fostering of competencies necessary to conceive and develop structural projects (*Innovation, safety, and structural stability*). Specifically, the choice of certain Academic Activities stemmed from their potential to generate learning indicators. Following the process, the four established areas will be considered for the elaboration of the collection instrument that will have to be applied at the end of each academic semester.

CONCLUSION

By taking the decision to implement a learning management processinstitutionally, aligning itself with a perspective of learning management as a strategy for continuous improvement of curricula, Unisinos University points to some important drivers in its implementation process. Guided by a process in whichmanagers, professors and employees take responsibility, Unisinos University designs process as authorial and innovative, which means that there is no predefined process, with its stages and markers, prior to the beginning of the implementation. This fact materializes in the way coordinators are involved in the implementation through a formative process that, at the same time as it develops the managerial competencies of those who will be responsible for managing learning management on a day-to-day basis, makes room for the construction of the process in the institution. Thus, coordinators are involved not only in the implementation of a process but also in its construction.

In the stage presented in this work, which was the construction of the curriculum map, it can be observed that the discussion between coordinators throughout the formative process and the way in which coordinators had space to analyze the programs they coordinate allowed for the maps not to be discrepantin terms of the areas to be assessed. Although there is no definition in the literature about how many areas should be assessed, it can be observed in this process that maps were created that reveal the coordinators' appropriation of thecore points of the curriculum and the specific competences of each area.Furthermore, it also allowed the closest programs to also have maps that reflect this proximity.

It is thus observed the importance, for the implementation of a learning management process that is at the service of curriculum management, of the active participation of the management teams not only to take ownership of the process but also to actively participate in its materialization in the programs they coordinate and to develop their competences to become managers in face of learning management processes. By designing the process in this way, the institution makes room for institutional authorship and innovation, strengthening the process as a *locus* for the modernization of undergraduate education.

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