



**DESIGN THINKING AS ACTIVE TEACHING METHODOLOGY AT THE UNIVERSITY-
 COMPARATIVE STUDY BETWEEN COURSES**

Paulo Sergio de Sena¹, Maria Cristina Marcelino Bento², Nelson Tavares Matias³, Messias Borges Silva⁴

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ABSTRACT

In a move to go beyond pedagogical concerns for engineering teaching and learning and expand to other higher education courses and other professionals, this study compared the use of Design Thinking as a tool to pedagogically mobilize courses in Business Administration, Design, Nursing and Pedagogy. The results showed that the same pedagogical concern of engineering was shared with the compared courses. The relationships between students were fundamental for solving problems, as proposed by Design Thinking, as well as the relationships between the classes of a given course with their concerns about the professional profile that is being formed.

KEYWORDS: University classes. Pedagogical experiments. Design. Business. Nursing. Pedagogy.

RESUMO

Num movimento para ir além das preocupações pedagógicas para o ensino e aprendizagem da engenharia e expandir para outros cursos de ensino superior e outros profissionais, este estudo comparou o uso do Design Thinking como uma ferramenta para mobilizar pedagogicamente os cursos de Administração de Empresas, Design, Enfermagem e a Pedagogia. Os resultados mostraram que a mesma preocupação pedagógica da engenharia foi compartilhada com os cursos comparados. As relações entre os alunos foram fundamentais para a resolução de problemas, conforme proposto pelo Design Thinking, assim como as relações entre as turmas de um determinado curso com suas preocupações quanto ao perfil profissional que se está formando.

PALAVRAS-CHAVE: Aulas na universidade. Experimentos pedagógicos. Design. Administração. Enfermagem. Pedagogia.

INTRODUCTION

Under provocation and restlessness of Engineering courses regarding the models of teaching and learning the contents necessary for a good formation of its professionals and a revision of the teacher's posture, this paper advanced and led the provocation beyond Engineering, to other courses, besides to explore the methodology of Design Thinking as a protagonist of the change of focus of the

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teaching process, focus on the student and their learning process. Morán (2015) ratified the provocation and anxiety informal education that is experiencing a deadlock in responding to changes in societies. Schools need to change to become relevant and achieve a degree of learning that is competent and knowledge-intensive to build life projects that contain spaces for living with others. Thus, it is necessary to invest in new processes of curriculum organization, methodologies, temporalities, and spaces for teaching. As a result of this context, the research problem was designed, in a comparative study exercise, to observe the students' performance in Design Thinking activities and the contribution of the methodology to the development of learning and teaching, as well as professional training.

Morán (2015) ratified the provocation and discomfort informal education that is experiencing a deadlock in responding to changes in societies. Schools need to change to become relevant and achieve a level of learning that is competent and knowledge-intensive to build life projects that contain spaces for living with others. Thus, it is necessary to invest in new processes of organization of curricula, methodologies, temporalities, and spaces for teaching.

Another important point to look out for is Mosely's warning; Wright and Wrigley (2018) note that there is little design-focused research that will facilitate facilitators to teach non-designer students, as there is a complexity of the problem that can affect the facilitation of informal workshops under design thinking. Garreta-Domingo; Sloep; Hernández-leo (2018) have made a valuable contribution for non-designer educators, who need to adopt design thinking and acquire the skills necessary to meet the challenges they encounter in their daily practice. The design is user-centric, which provides the possibilities to find the methods needed to solve wicked problems.

In this sense, introducing new strategies for teaching and learning in Higher Education is a demand that brought, since the 1990s, in line with Bonwell's ideas; Eison (1991) and Menges; Weimer (1996); Hrastinski (2019) state that students must be in an environment that creates intrapersonal and interpersonal involvement (updated as socio-emotional skills) and that, to do so, the need to invest in an active teaching and learning process, ie processes involving students who materialize the ideas and the products of those ideas have the cognition to dialogue with the user. In other words, make content meaningful to solve everyday challenges.

Gerholz; Liszt and Klingsieck(2017) reported the importance of students applying curriculum content in practices that involve concrete problems, it is these moments that institutionalize the insights on activities of professional engagement with daily causes. They also report a lack of research into the link between learning design patterns and learning effectiveness. Learning patterns become didactic or methodical interventions to support the learning process at the service of students. Qualitative results provide a deeper understanding of these changes, including students' different perspectives and their organizational processes. There are differences in learning patterns and support for the teaching and learning process.



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Regarding the teaching of Business Administration, it is important to dialogue with Prentiss and Walton (2019) who showed that there is a tendency to focus on intercultural communication applied to the business and professional world, from an interdisciplinary perspective promoted by the incorporation of various areas with their diverse contents, including communication and interpersonal listening, diversity and work in team. The authors further pointed out that the types of activities that focus on intercultural communication become an excellent opportunity that engages students with theory and practice with the knowledge and skills they will need in the 'real world' yet requires a continuous movement to innovate and experiment to meet the needs of users who are changing their behaviors.

Sawyer (2018) brought a teaching and learning trend to Design courses involving the use of studio modeling. However, the important thing was the investment in pedagogical practices that guided students to learn how to create. The central concept of the model was the creative process, with three articulated aspects: learning outcomes associated with the creative process; project assignments that sustained mastery of the creative process; and classroom practices that led students through the creative process.

For Barton; Bruce and Schreiber (2018) has a widespread demand for teamwork with high reliability and performance in healthcare, particularly in nursing. Derived from this demand there are many educational initiatives developed to build team competency. They also added, after a research review that constructivist pedagogy was chosen to teach, practice and refine the competence of nursing teamwork, involving integrated and individualized determinations, knowledge, skills, and attitudes.

Considering teacher education as one of the attributions of the Pedagogy Courses, Leijen and Pedaste (2018) showed that teachers' pedagogical beliefs and instructional practices have their genesis, most of the time, in initial teacher education that is not oriented towards the autonomy of these future teachers. Thus, it is possible to invest in an update, making the course more attractive and in line with recent innovative international trends in the formation of autonomous teachers able to seek changes from the re-reading of their pedagogical beliefs and instructional practices. The teachers said Zeldin; Guley; Barringer and Plaque (2018) should break traditional roles and power hierarchies to help students discover their sources of involvement. Auerbach and Andrews (2018) added that Pedagogy pays attention to another important factor, the pedagogical knowledge that the teacher must possess, that is, knowledge about teaching and learning that goes beyond specific content relates to knowledge of theory, learning, classroom management, and student motivation.

The other element of this article is the Design Thinking methodology that presents itself with broad and diverse concepts, there is literature with numerous aspects of approach and interpretation of the theme. We consider Brown's (2017) conceptual proposals on Design Thinking as a way of writing the history of product creation and analyzing the relationship between users and products and between users and users. Cavalcanti and Filatro (2017) added that Design Thinking is a human-



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centered, action-oriented, collaborative, prototyping, brainstorming, and cyclical process culture. A teaching and learning methodology brought from Design to streamline the classroom in the training of other non-designer professionals.

MATERIAL AND METHODS

The research was conducted in a classroom (Figure 1) of four different undergraduate courses - Pedagogy, Business Administration (BA), Nursing and Design, combining observation research aligned with Cooper and Schindler (2003) who ratified the importance of this method to verify reality with looks for the new every day and action research from Miranda's and Resende's (2006) perspective who showed that the research itself has become an action in educational intervention, enabling an effective pedagogical action on the studied reality.

Action research helps to correct the potential risks of selective memory or defective that may lodge in the observation and its subsequent record as alerted by Cooper and Schindler (2001). Considering the weaknesses of observational research but emphasizing the advantage of investigating data at the time of the research, this paper invested in the presence of an observer in action research, stealing from intrusive observers or delayed interviews or the coldness of the questionnaire.



Figure 1 Two classrooms for group activities.
Source: authors, 2019.

For this research, the classrooms were prepared for group activities (Figure 1), as well as printed material with information on the theme worked and complementary to the information presented previously through a flipped classroom. Office material was also made available for the development of the Design Thinking methodology.

Students were accommodated in four groups with up to six components. Each student was identified to facilitate observation (Figure 2).



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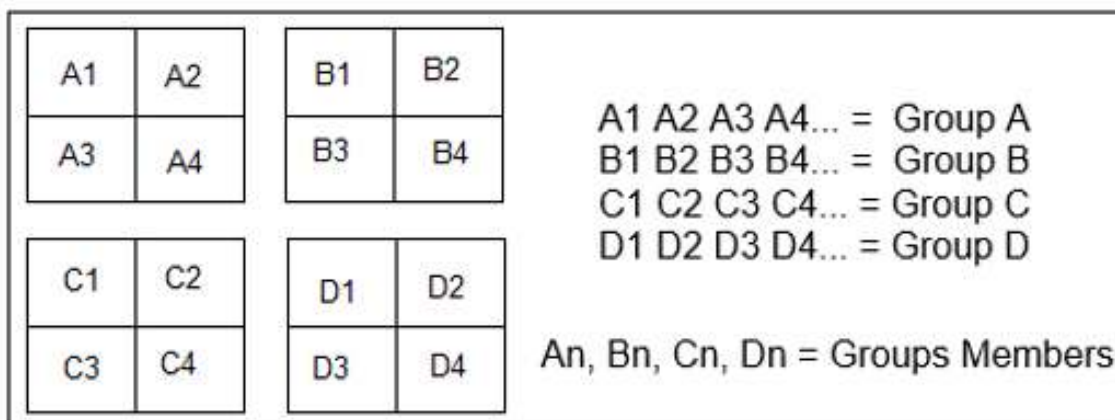


Figure 2 Organization of student groups and their identifications.

Source: authors, 2019.

An observation matrix was constructed to record interactions among students and their interventions to solve the activity (Figure 3).

group component	Intervention of the group component in the Activity								
	01	02	03	04	05	06	07	08	n..
An									
Bn									
Cn									
Dn									

Figure 3 Matrix of observation of the interventions of each student, in his group, in activity.

Source: authors, 2019.

This methodology is anchored in the works of Bonwell and Eison (1991) that pointed out some important elements for students' learning and involvement: 1. individual participation of each student in the flipped class; 2. reading in small group study built around a study guide, and 3. academic reading, in which students listen to a presentation of 20 to 30 minutes without notes, followed by their writing for five minutes as a tool for remembrance of the topics presented, taking advantage of the thematic immersion phase of Design Thinking. At a moment 3, in possession of the problematization developed at time 2 of immersion, the proposal is to systematize ideas to solve the problem. The ideas should be systematized to be presented in prototype form for all working groups, configuring phase 4 of Design Thinking, prototyping the idea. The presentation of the prototype and the choice of the best idea or the best ideas complete the cycle of work in phase 5 of proposals for the application of ideas.

The results of the research were treated in a comparative manner between the various working groups as well as with the various higher courses involved. The sample consisted of 182



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subjects. However, to unify the workgroups for comparative analysis, 4 groups of each higher course were considered by lot, with up to 5 students, making a total of 72 subjects studied (Figure 4).



Figure 4 Working groups: (a) Business Administration; (b) Design; (c) Nursing; (d) Pedagogy. Source: authors, 2019.

This maker motion is in line with Pusca and Northwood (2018) who understand that the design and implementation of high impact activities develop in all participants in the process - teachers and students - to communicate in a constructive and synergistic structure with the potential to transform teaching and learning experience in a way that students gain confidence in their work and knowledge to appropriate specific skills in communication, critical thinking, design, problem solving, analysis and synthesis, creativity, and teamwork.

RESULTS AND DISCUSSION

The Business Administration classroom used as a model for this research consisted of four groups with five students as shown in Figure 5. It was noted that in each group there was one student or more students with the largest number of interventions (five to eight), totaling six in the classroom as a whole, for the problem-solving process.

There were also, for each group, students who participated little in the process (one by two), totaling 10 in the whole classroom. Four students made interventions ranging from 3 to 4. Groups worked similarly, with little division of labor.

The Students involved in the activities did not follow the trends presented by Prentiss; Walton (2019) regarding the focus on intercultural communication demanded by the business and



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professional world, which makes it difficult to incorporate the various contents, interpersonal communication and listening, and teamwork.

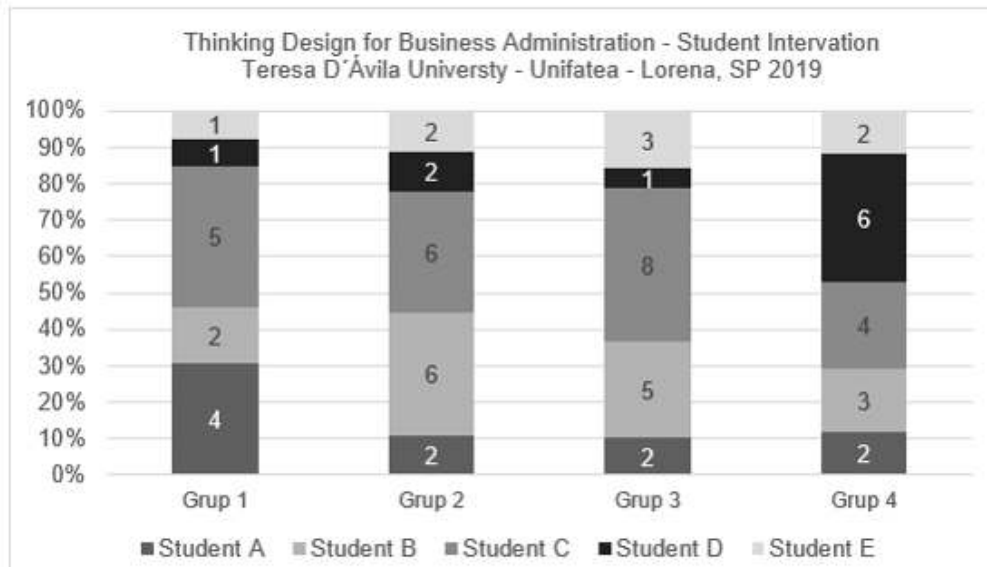


Figure 5 The intervention of Business Administration students in a Design Thinking activity.
Source: authors, 2019.

The Design classroom consisted of three groups with four students and one group with five students, as shown in Figure 6. There were fourteen students with the most interventions (five to thirteen) involved in the problem-solving process. There were also, for two groups, three students who participated little in the process (two and three). What was observed were groups with very similar performance concerning student involvement, a very productive balance.

Design students dialogued directly with Garreta-Domingo; Sloep and Hernández-leo (2018) who understand the designer as a professional who thinks about the project from the perspective of acquiring the skills to face the proposed challenges. The working group dialogued internally and built intergroup methods to solve the proposed problem. In other words, they behaved like designers.

The Design Thinking activities brought the creative process ratified by Sawyer (2018) in his considerations about teaching and learning trends for Design courses. Design Thinking's pedagogical practices guided students to learn how to create. It also provided that learning outcomes were associated with the creative process all the time in class, and classroom practices required a creative exercise to solve the proposed problem.



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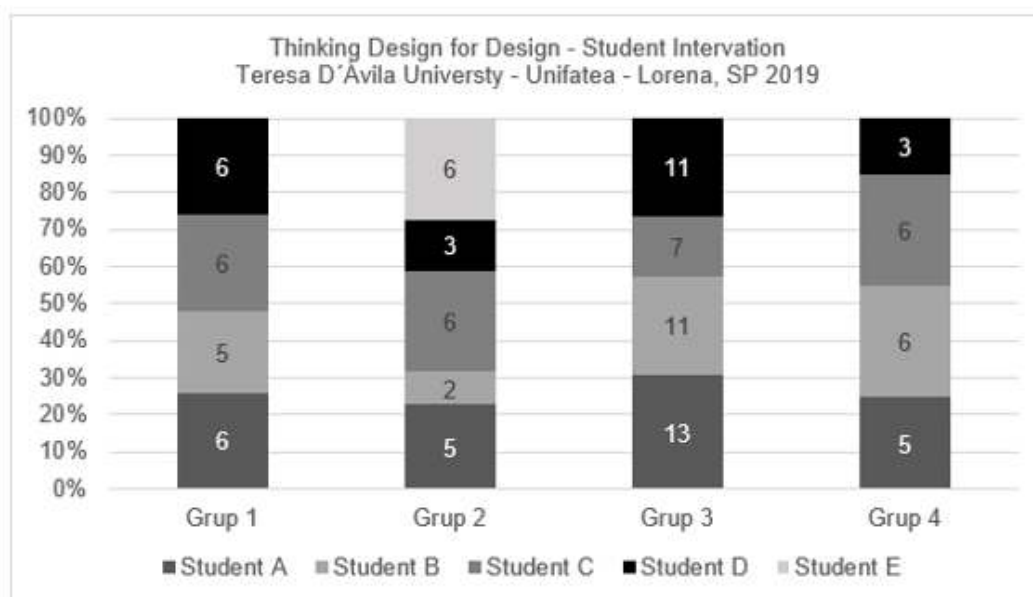


Figure 6 The intervention of Design students in a Design Thinking activity.
Source: authors, 2019.

In the Nursing experiment, the classroom consisted of four groups with five students, as shown in Figure 7. There were five students with the largest number of interventions (five to seven interventions) involved in the problem-solving process, distributed among the four groups. There were students in all groups who participated little in the process (zero to two interventions) totaling eight subjects; there were also six students with medium interventions, between three and four. What was observed were groups with very similar performance concerning student involvement, with subjects who led the process, few other participants, including one with no intervention.

Taking the references of Barton; Bruce and Schreiber (2018) on the demand of Nursing courses for teamwork, from the perspective of activities developed with Design Thinking, which involved teamwork, the results were not in line with the educational initiatives developed to build team competence, described by the authors. The groups were subsidized by concepts and methods of constructivist pedagogy, which according to the authors is the tendency to teach, practice and refine the competence of nursing teamwork.



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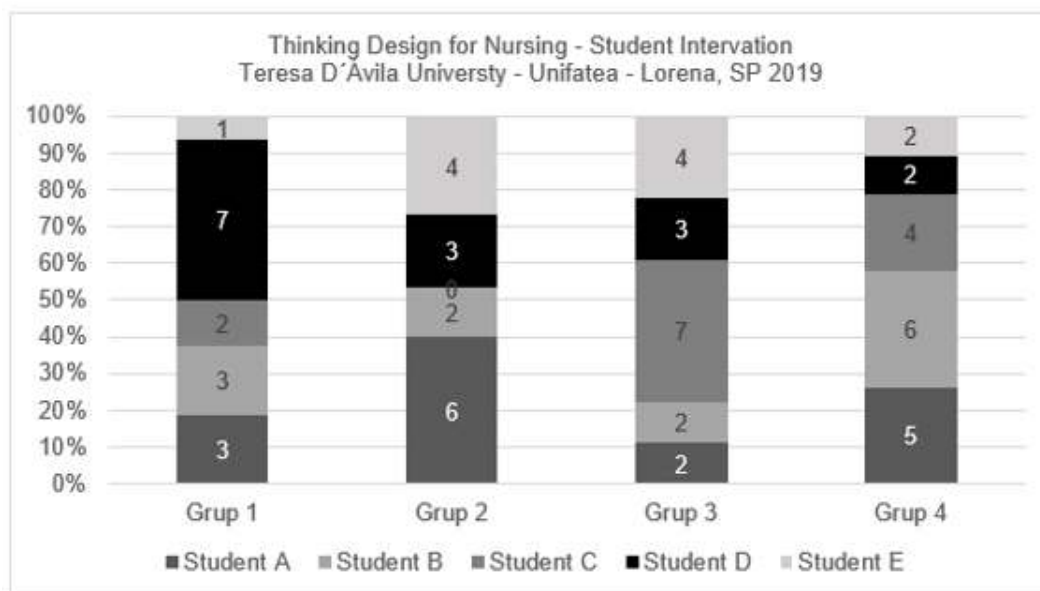


Figure 7 The intervention of Nursing students in a Design Thinking activity.
Source: authors, 2019.

The activities in the Pedagogy classroom were based on the composition of four groups with five students, as shown in Figure 8. All groups had one or two students with higher participation, ranging from five to eight interventions, totaling six subjects, for the problem-solving process. There were also, in all groups, students with low process participation (one to two interventions) totaling 10 subjects; four other students showed average interventions, between three and four. What was observed were groups with very similar performance concerning student involvement, with subject highlights that led the process, always two per group.

Under the guidance of Leijen; Pedaste (2018), the Pedagogy class broke with the absence of autonomous postures of the students. It has invested in a more attractive method and line with recent innovative international trends in teaching and learning autonomously. He also aligned himself with Zeldin; Guley; Barringer; Chapa (2018), when traditional roles and teacher-student hierarchies of power were broken to discover sources of involvement. There was an internal movement in the working groups that followed Auerbach; Andrews, (2018) regarding students' acceptance to express pedagogical knowledge about teaching and learning beyond specific content, experimenting with learning theories, classroom management and the variables involved in student motivation.



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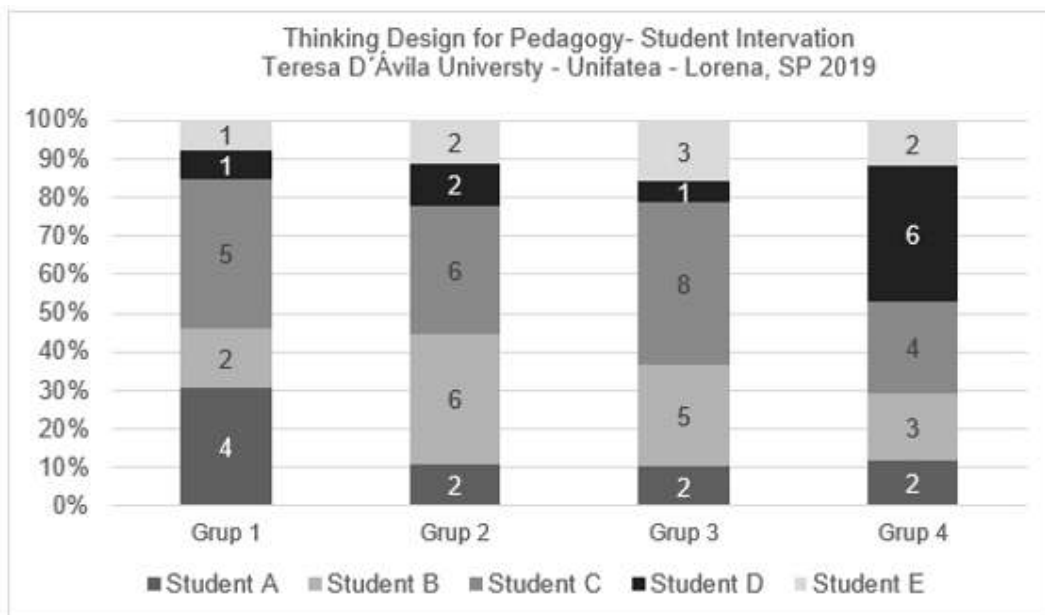


Figure 8 The intervention of Pedagogy students in a Design Thinking activity.
 Source: authors, 2019.

In a study comparing the four Design Thinking experiments (Figure 9) in the four courses covered in this paper, Design stood out with more uniformity of interventions, followed by the Pedagogy course. The Business Administration and Nursing courses performed more similarly, highlighting more isolated interventions in each group.

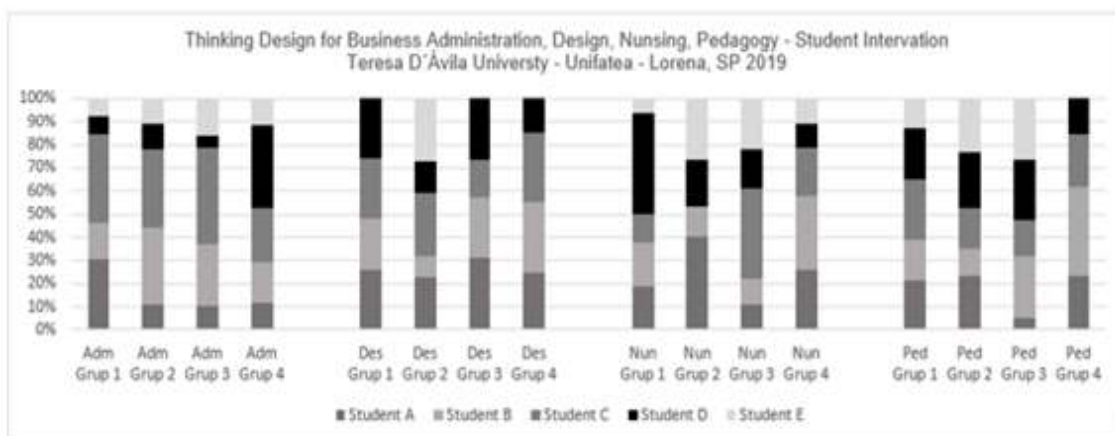


Figure 9. A comparative model of intervention of students of BA, Design, Nursing and Pedagogy in a Design Thinking activity.
 Source: authors, 2019.



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This comparative study dialogues with Gerholz; Liszt and Klingsieck (2017) firstly on the importance of students applying curriculum content in practices with concrete problems, valuing the insights that engage the professional to recurring causes in everyday life. They also contribute to the increase of research on the subject, under the complaint of insufficient. Another element was the finding that there are different learning patterns between courses, despite the use of the same tool as a didactic intervention. And of course, the qualitative results collected provided a richer understanding of the changing learning models, the different forms of student arrangement, and their organizational processes for learning. Figure 9 has shown that there are differences in learning patterns and support for the teaching and learning process of the various courses.

One of the pedagogical advantages of using Design Thinking is the interaction between workgroups that contribute to the solution of a common problem. This interaction occurs in the collective presentation phase of the prototypes and the definition of the best solution to be tested. Thus, it was possible to measure the relationship between the groups and establish a comparative study between the four courses studied. In Figure 10, in a tree graph model, each rectangle indicates, according to the size of its area, how much each group contributed and interacted. What was observed was a more homogeneous interaction between the Business Administration and Nursing groups. The Pedagogy course showed less symmetry, but with any interactions. However, the Design course was the extreme of heterogeneity, as there was one dominant group, followed by another with greater expression in front of the remaining two.



Figure 10 A comparative model of behavior in the group of BA, Design, Nursing and Pedagogy in a Design Thinking activity to solve a problem.

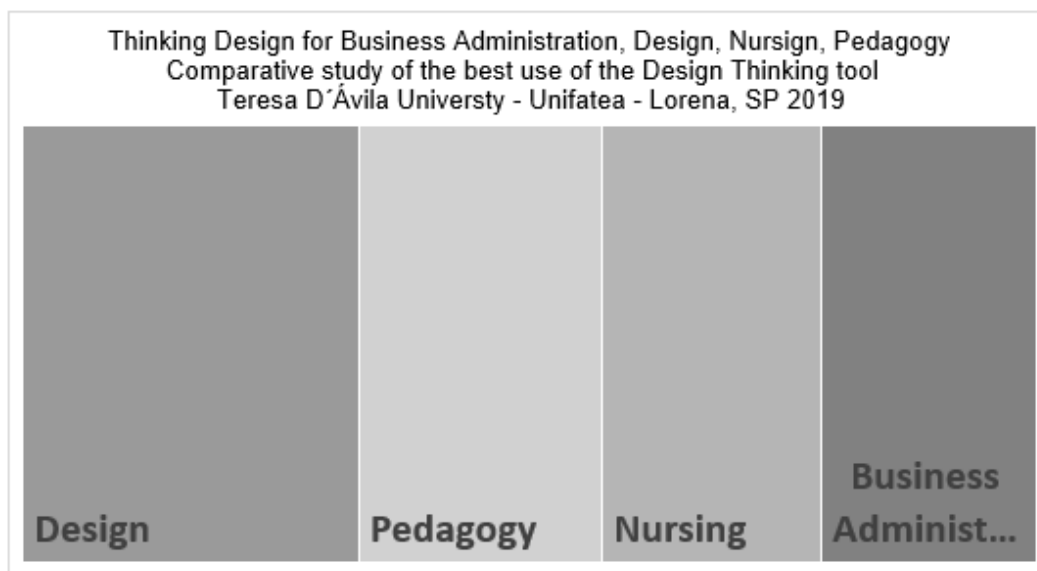
Source: authors, 2019.



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Another relationship measured in this experiment was how the Design Thinking tool, as a teaching and learning model, moved the classroom in a problem-solving process. Figure 11 shows that Design stood out in the use of the tool, involving a larger number of student interventions in the workgroups. Pedagogy continued as the second highlight of the use of the tool, differing from Nursing



and Business Administration.

Figure 11 A comparative model of best use of Design Thinking of problem-solving.
Source: authors, 2019.

In summary, the courses studied showed empathy for the pedagogical tool based on Design Thinking. There was involvement and movement of students in an active learning strategy when students are directly responsible for the acquisition and application of the concepts needed to solve problems. It should be noted that the Design course, despite its heterogeneity in the interaction activities between the groups, presented the largest number of interventions and working students. The Pedagogy course was characterized by the process of learning the usability of the tool and its effectiveness to develop the learning and use of concepts, an attitude of the educator.

The Nursing course showed a cohesion of subjects and the conduction of group work, perhaps a common feature with everyday work. Business Administration students have shown that it is necessary to invest in a division of labor-management within groups, but that the tool is relevant to use in this vocational training segment.

FINAL CONSIDERATIONS

This paper brought one single memory for the complex of interactions contained in the taken by schools the thinking and learn the teach. Thus, a methodological tool for designing and thinking the



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world by designers, Design Thinking, the numerical process, and the world that happens and transforms when inserted in different Design contexts. In other words, a Design Thinking pedagogical tool was supported by learning historically in the learning cultures and the professionals of Business Administration, Nursing, Pedagogy, and Design.

When professional from different groups uses the same work methodology, such as the one described in this paper, a designer's methodology, care must be taken when inserting adaptations that may de-characterize the original methodology and generate other results that compromise the comparative studies. However, there is the benefit of updating the method and adjusting its usability. In the case of this experience, the update was due to the presentation of the results of the activities, which limited socialization between the groups, but the objective of applying the concept to solve a problem was achieved.

The interaction and movement among students proposed by the experiment took place in a climate of active learning methodology, taking things away, deconstructing concepts, generating access to tacit information, allowing the use of information technologies and the creation of solutions for an everyday or conceptual problem.

Two borderline situations need to be considered:

1. Some students did not interact with the movement in the classroom.

It is understood that it is an important pedagogical situation when placing students in a context of pedagogical abandonment, but the whole movement must be contextualized in a pedagogy that goes beyond techniques and practices, but that considers as a central fact of pedagogical action at that moment as unique of subjects' interaction with objects and problems. Knowing how to interact with a shy identity is also part of the historical writing of an anthropological place. It is important to highlight that there is no discourse of abandonment of the shy or less interested student, this is a challenge, but to take advantage of this student pedagogically, learn from him the limits of interactions and teach the possibilities to expand, within the group, shy looks to a problem that is crying out for a solution.

2. The role of the teacher needs to be defined as a facilitator or mediator.

While making the whole discourse of a student-centered methodology, one runs the risk of abandoning the teacher. Should this teacher behave as a mediator, that is, accompany and make viable the process thought by the group or facilitator, who actively intervenes by putting proposals to reorganize the creative paths proposed by the groups? This is an important question that should occupy another experiment, what is the teacher's role in the Design Thinking methodology?

Resuming the provocations and concerns of the Engineering courses facing the teaching and learning models that guided this study expanded with the Business Administration, Design, Nursing and Pedagogy courses, with the perspective of innovating the methods of teaching and learning in these new times that require new competencies and skills to the professionals.



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The results responded positively to the pedagogical malaise that is being installed in various engineering courses and justified the exploration of the Design Thinking tool as an active learning method with a focus on the student and his learning process. In addition to contributing incrementally to Mosely's warning; Wright and Wrigley (2018) of research scarcity to teach non-designer students to think about the complexity of a problem systematically.

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