Design Thinking Course

Getúlio Antero de Deus Júnior*, Marcos Lemos Afonso† and Ricardo Henrique Fonseca Alves‡

*Escola de Engenharia Elétrica, Mecânica e de Computação,
Universidade Federal de Goiás, Goiânia, Brazil
E-mail: gdeusjr@ufg.br

†Escola de Engenharia Elétrica, Mecânica e de Computação,
Universidade Federal de Goiás, Goiânia, Brazil
E-mail: afonso_ml@uol.com.br

‡Escola de Engenharia Elétrica, Mecânica e de Computação,
Abstract: The nature of core competencies in training engineers involves technical, affective, and attitudinal areas as well as the development of interpersonal skills to coexist in multidisciplinary teams. Depending on the area of Engineering, the elaboration of projects seeks to solve real problems and projects, which can lead to technical recognition by the professional and even the creation of networking opportunities. The affective and attitudinal changes can promote self-knowledge, coping with adverse situations, resilience, ability to take risks, commitment and responsibility. The development of interpersonal skills involves assertiveness, flexibility, communication and business. In the pursuit of essential competences, the objectives of the course of Design Thinking in the formation of Engineers are structured in general, cognitive and attitudinal. The discipline uses active methodologies with emphasis on Problem-based Learning (PBL) and Project Led Education (PLE). The Design Thinking course is being offered through three modules or training axes: (1) Art, Science, Culture, Innovation and Marketing; (2) Business Plan, Intellectual Property and Industrial Property; and (3) Design Thinking. Thus, the teaching approaches of the course are transformative since in addition to using the active methodologies PBL and PLE they still use Texts Study, Brainstorm,
Conceptual Maps,Portfolio,Canvas,Problems Solution,Philips 66,Dramatization,Workshops,Middle Study,Teaching with Research,Product Development,Plant Patent,and Integration Conferences. The first offer of the discipline occurred in 2016, which allowed the achievement of unprecedented results. For example, the evaluation instruments of the teaching methodology approved by the Research Ethics Committee of the Universidade Federal de Goiás (UFG). In addition, an application of the evaluation instruments of the methodology of basic education for the reinforcement and understanding of the methodology by the professors, as well as being part of the continuous evaluation proposed by them of the course. It is important to emphasize that as teaching approaches have been adjusted in weekly meetings among professors so that the objectives are achieved in an increasing way as internal and external conditions for learning and outcomes related to the various factors that are due to work. However, the success of the provision of the discipline by two professors in different classrooms is related to the rigor of the follow-up of the Lesson Plan and the adjustments made during an offer of the Design Thinking course, as well as force of the parties involved.

**Keywords:** Engineering Education, Active Methodologies, Problem-based Learning, Project Led Education, Design Thinking.
21.1 Background

The nature of core competencies in the training of Engineers involves technical, affective and attitudinal areas, as well as the development of interpersonal skills to coexist in multidisciplinary teams. Depending on the area of Engineering, the elaboration of projects seeks to solve real problems and projects, which can lead to technical recognition by the professional and even the creation of networking opportunities. For example, Swart (2015) proposed the use of Project-Led Education (PLE) in case studies and practical workshops as pedagogies to solve problems in the Electrical Engineering Course\(^1\).

Affective and attitudinal changes can promote self-knowledge, coping with adverse situations, resilience, ability to take risks, commitment and responsibility. The development of interpersonal skills involves assertiveness, flexibility, communication, and negotiation. Depieri and Lopes (2014) confirm the importance of students’ perception of Engineering skills despite the low number of engineers per 10,000 inhabitants in Brazil when compared to other countries such as Korea, Finland, China, Japan, UK, among others\(^2\).

In pursuit of these core competencies, the goals of the Design Thinking course in the training of Engineers are structured in general, cognitive and attitudinal aspects. The discipline uses active methodologies, with emphasis on Problem Based Learning (PBL)\(^3-5\) and Project-Led Education (PLE)\(^6\). The
Design Thinking course is being offered through three modules or training axes: (1) Art, Science, Culture, Innovation and Marketing; (2) Business Plan, Intellectual Property and Industrial Property; and (3) Design Thinking.

21.2 Purpose/Hypothesis

The Elective course Design Thinking uses active methodologies with emphasis on Problem Based Learning (PBL) and Project-Led Education (PLE).

Ribeiro (2005) proposes the use of three evaluation forms during the learning process through the PBL. The first evaluation form is the Performance Evaluation (AD), in which learners individually evaluate the performance of the PBL group after the execution of an activity. The second evaluation form is the Evaluation of the Educational Process (APE), in which students evaluate the problem and the educational process. Finally, the third evaluation form is the Instructional Method Assessment (AMI).

The evaluation process consisted of calculating the arithmetic mean of the final grades of each module that could involve activities in the classroom, extra class activities, completion of the activities programmed through the PBL and PLE methodology, evaluation activities of the PBL and PLE methodology (AD, APE and AMI) and self-assessments made during the semester. Therefore, there was no traditional evaluations during the Design Thinking course.
21.3 Design/Method

The following contents are part of the Design Thinking discipline syllabus: Art, Science, Culture and Innovation; Market research; Marketing; How to build innovative value propositions (Canvas 1); Preparation of Business Plan (Canvas 2); Intellectual Property and Industrial Property; Design Thinking: prospecting, immersion, evaluation; Ideation and prototyping; Preparation of Industrial Property documentation; Development of products and/or services; Application of real problems and projects.

The offer of the Design Thinking discipline are transformative since it uses the active methodologies PBL$^{3-5}$ and PLE$^6$ and the following teaching strategies: Text Study; Brain storm; Conceptual map; Portfolio; Canvas; Problems solution; Philips 66; Dramatization; Offices; Middle study; Teaching with Research, Product Development; Drafting of Industrial Design; and Integration Samples.

For the teaching methodologies evaluation in the offer of the Design Thinking discipline, the following instruments were used: Kolb Learning Assessment; Performance Evaluation (AD); Evaluation of the Educational Process (APE); And Instructional Method Assessment (AMI).
21.4 Results

The first offer of the discipline occurred in 2016, which allowed the achievement of unprecedented results. For example, the evaluation instruments of the teaching methodology approved by the Research Ethics Committee of the Universidade Federal de Goiás (UFG).

The graphs presented in Figure 21.1 present the Kolb Learning Style Assessment\textsuperscript{13} in one of the classes of the Design Thinking course in two ways: (a) direct application; and (b) using a more elaborate methodology proposed in\textsuperscript{14}.

![Figure 21.1](image)

Figure 21.1 – Evaluation of the Kolb Learning Style in one of the classes of the Design Thinking course: (a) direct application and (b) application using the methodology proposed in\textsuperscript{14}.

In the case of direct application, learners have identified the order of their learning styles freely only making a choice in the proposed scale for each of
the four learning styles: Thinking (T), Watching (W), Doing (D) and Feeling (F). Using the methodology proposed in\textsuperscript{14}, learners performed assignments in order of importance in four columns (following row by row) to choose words that best characterize their learning style, each of the four words chosen having a weight ranging from 1 (lowest) to 4 (highest). In this case, the sum of the points made it possible to find the order in the learning scale: Thinking (T), Doing (D), Watching (W) and Feeling (F).

21.5 Conclusions

The research revealed that the learning style most recognized by the learners is Thinking (T), being evidenced in both cases free application as well as in the evaluation methodology proposed by\textsuperscript{14}.

It is important to emphasize that as teaching approaches have been adjusted in weekly meetings among professors so that the objectives are achieved in an increasing way as internal and external conditions for learning and outcomes related to the various factors that are due to work.

However, the success of the provision of the discipline by two professors in different classrooms is related to the rigor of the follow-up of the Lesson Plan and the adjustments made during an offer of the Design Thinking course, as well as force of the parties involved.
Bibliography


