INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
8 & 9 SEPTEMBER 2016, AALBORG UNIVERSITY, DENMARK

DEVELOPMENT OF A PEDAGOGICAL MODEL FOR A DISTANCE LEARNING COURSE OF AUTOCAD 2D SOFTWARE

Paulete Fridman SCHWETZ[1], Maria Paula C MALTA[2], Vinicius BORBA[3] and Franciele ANDRETTA[4]
[1]Professor at Federal University of Rio Grande do Sul
[2,3,4]Undergraduate Students of Federal University of Rio Grande do Sul

ABSTRACT
The aim of this work is the teaching of AutoCAD 2D software through distance education. This tool is used in the Technical Drawing undergraduate course, offered to the students of Engineering and Design at the Federal University of Rio Grande do Sul (UFRGS). A pedagogical model was developed and implemented in a Virtual Learning Environment (VLE) and MOODLE UFRGS VLE, available by the university, was adopted. A course was developed in the VLE with its own visual identity, aiming a clear interface, easy to understand, with a different design. The course was divided into twelve stages, so that the subject proposed in each of them was discussed, in a structured way. After ending each learning proposal task, students had to answer a quiz, in order to verify the construction of knowledge. Each quiz releases the advance in the course through a restriction feature. The course was available to Engineering and Design undergraduate volunteer students who had no previous knowledge of AutoCAD. After ending the course, students performed a presential evaluative work with the objective of learning check. Results showed that the performance of students who made the distance learning course of the software was quite satisfactory, indicating a good understanding of the proposed content. Thus, it can be concluded that the pedagogical model proposed by this work is appropriate for the teaching of this software in this distance learning course model. However, few adjustments are required in order to improve the comprehension of specific subjects by the students.

Keywords: Distance learning (DL), Virtual Learning Environment (VLE), Pedagogical Model, AutoCAD 2D.

1 INTRODUCTION

In the last decade, Brazilian Universities are undergoing a significant process of change regarding educational processes. It is possible to say that there is a paradigm crisis in education, resulting on significant changes in educational practices and, consequently, in pedagogical models. In line with this trend, Distance Learning (DL) emerges as an attractive alternative. Through this practice, a new pedagogical space was created, whose characteristics are: the development of competences and abilities, the respect to individual pace, development of learning communities and networking. It is very important to focus on learning, open and distance education and knowledge management. Thus, the concept about the construction of knowledge, autonomy, authorship and interaction contribute to create a space of cooperation, mutual respect, solidarity, activities centred on the learner and on the identification and solution of problems [1].

DL brings new possibilities in terms of learning quality, time flexibility for students, easy access from any location with internet and availability of education to places where it was not possible a quality teaching [2].

However, this new educational proposal, different from regular education, which is characterized by a teacher-students interaction with defined space-time, dominated by oral communication, began to use the concept of multimedia communication that do not require spatial and temporal co-presence. Therefore, it becomes necessary to develop new pedagogical models for DL, with not only the adaptation of derived models of classroom teaching, but construction practices to support the management of pedagogical distance [3].

In this perspective, researches on this educational model are constantly necessary for the academy and for organizations in order to better know the DL, its potential and risks. This knowledge will allow educational institutions, especially the higher educational ones, to implement it in a qualified way, providing learning by a quality education that enables the professional capacitation required by the work market in different segments.
The present study aims to develop a pedagogical model for a distance learning course of AutoCAD software, developed by *Autodesk Inc*., used by the Technical Drawing undergraduate course, offered to the students of Engineering and Design at Federal University of Rio Grande do Sul (UFRGS).

2 PEDAGOGICAL MODEL

Based on an extensive literature review, a pedagogical model, whose structure is shown in Figure 1, was developed.

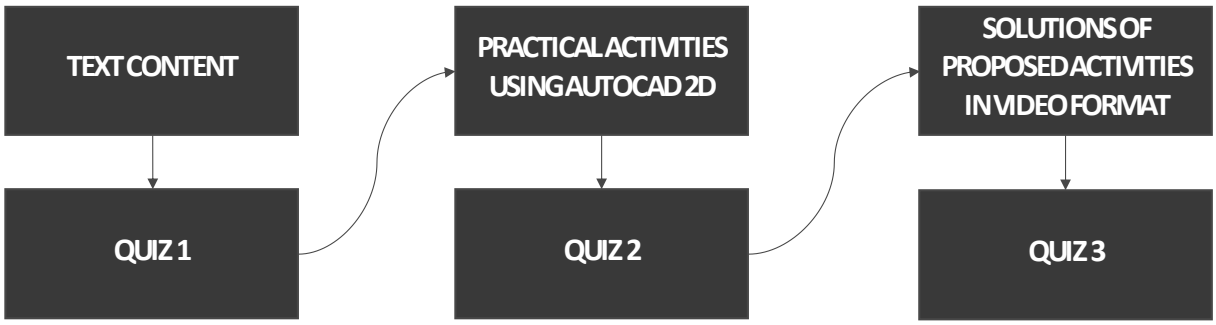


Figure 1. Pedagogical Model

It is observed, in Figure 1, that the students will find three different learning proposals:
- explanation texts with illustrations by PDF files, in order to make the access easier;
- practical activities to be developed using AutoCAD software (a student version is available for free download). In all activities differentiated exercises are proposed, aiming to challenge the user to experience new situations;
- solutions of proposed activities, in video format, generated from AutoCAD screenshots.

Figure 1 shows that, after accessing each learning proposal, the user should answer a quiz aiming to verify the construction of his knowledge. Each quiz releases the advance in the course through a constraint resource.
Since the pedagogical model was defined, instructional material was developed as well as the creation of activities, interactions and evaluation procedures.
The next step was the definition of the virtual learning environment (VLE). MOODLE UFRGS VLE was adopted because it presents some tools that are not offered by other VLE, in addition to always being updated by the Data Processing Centre with the support of the Department of Education to Distance Learning of the university (SEAD).
A course was developed in the VLE with its own visual identity, aiming at a clear interface, easy to understand, with a particular design. The course was divided into 12 topics. In the first topic, called zero, three links was created (Figure 2):
- **Files - Downloading AutoCAD and Learning MOODLE UFRGS VLE**: In this link student is able to read PDF files with instructions about how to obtain a free license software for students offered by *Autodesk Inc*., as well as the necessary information to use the MOODLE UFRGS VLE. At the beginning of the course, these files were sent to students by email. However, they are also available on MOODLE UFRGS VLE;
- **General instructions - IMPORTANT**: This link refers to a PDF file, in which general operational rules, hardware and software requirements and the basic knowledge needed are presented;
- **FÓRUM - Solve your doubts**: This link provides to students a space where they can post their doubts about the course. Questions are answered by tutors and teachers. This forum enables also an exchange of information between students. It is important to point out that the student's doubts can also be solved by messages exchanged in MOODLE VLE. All messages are also answered by tutors and teachers.

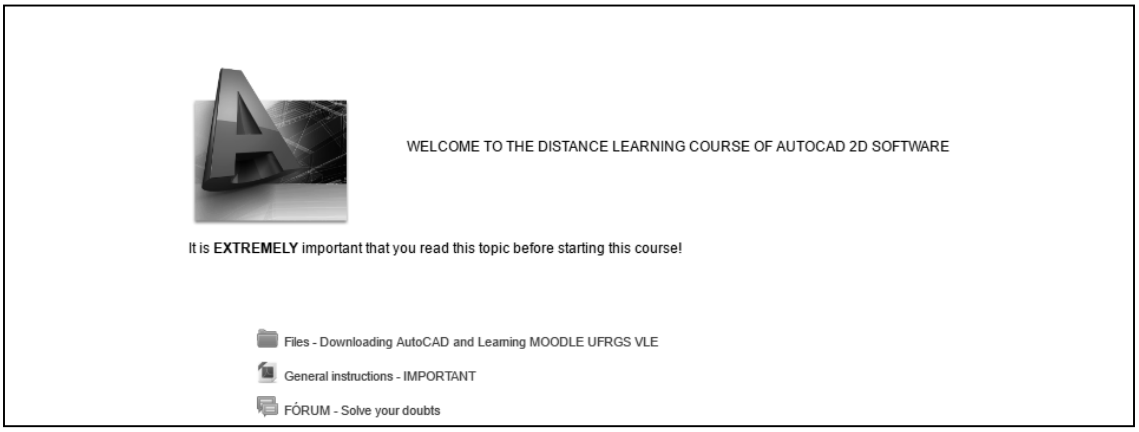


Figure 2. Downloading AutoCAD e Learning MOODLE VLE

Topics structure follows a design-based on the proposed pedagogical model. Figure 3 shows the topic structure of the First Class. The title corresponds to the class number (1). Next there, objectives to be achieved in the topic are listed (2). Below the objectives, explanation texts with illustrations in PDF files are presented (3). After reading the text, the student must answer a quiz, in order to verify the construction of his knowledge (4). In the following step, practical activities are proposed. The student must perform the proposed activities in AutoCAD and files must be attached and sent. Proposed activities always contain challenging exercises (5). In the next step, the student must answer another quiz with the same degree of difficulty of the previous proposed quiz (6). This new quiz aims to verify if there was an increase in the student knowledge with the solution of the proposed exercises. Next there, videos with the solution of the proposed exercises are available to the students (7). Finalizing the topic the student must answer a new quiz, with the same degree of difficulty of the other ones, to make sure that the display of videos provided a better understanding of the learning proposals (8). It is shown in Figure 3 that a constraint resource was used to the access of Proposed Activities, Quizzes and Video Solutions. This restriction prevents the student to access activities that he is unable to solve. This alternative can help to prevent evasion, which is a concern regarding distance learning courses.

3 PEDAGOGICAL MODEL IMPLEMENTATION

After concluding the development of the course in VLE, the validation process of the pedagogical model was started to check its suitability. A group of volunteer students was formed with the following profile:

- Being an engineering or designing student at the Federal University of Rio Grande do Sul;
- Being registered in the Technical Drawing Freehand undergraduate course, which limited volunteers to students who were starting to study Engineering or Design at the university;
- Students must not have any knowledge of AutoCAD software.

This profile has been set in order to keep the same level among the volunteer students. There was a great interest from the student community, but only 46 students have completed the course within the stipulated period of 30 days. During this period, each student was monitored by the teacher and tutors team aiming to solve problems, questions and ongoing control of the students. Thirty days after the end of the course, students carried out a classroom evaluation work to verify the construction of their knowledge. This evaluation work consisted of two parts: a multiple-choice quiz and a practical exercise using the software. The practical exercise was proposed only in order to verify the learning of the plotting process.

Moreover, at the end of the semester, it was performed the same evaluation test with volunteer students who learned the computational tool in classroom lessons. From these data, it was possible to establish a performance comparison among students who learned AutoCAD by distance education and those who have learned the computer program in classroom lessons.

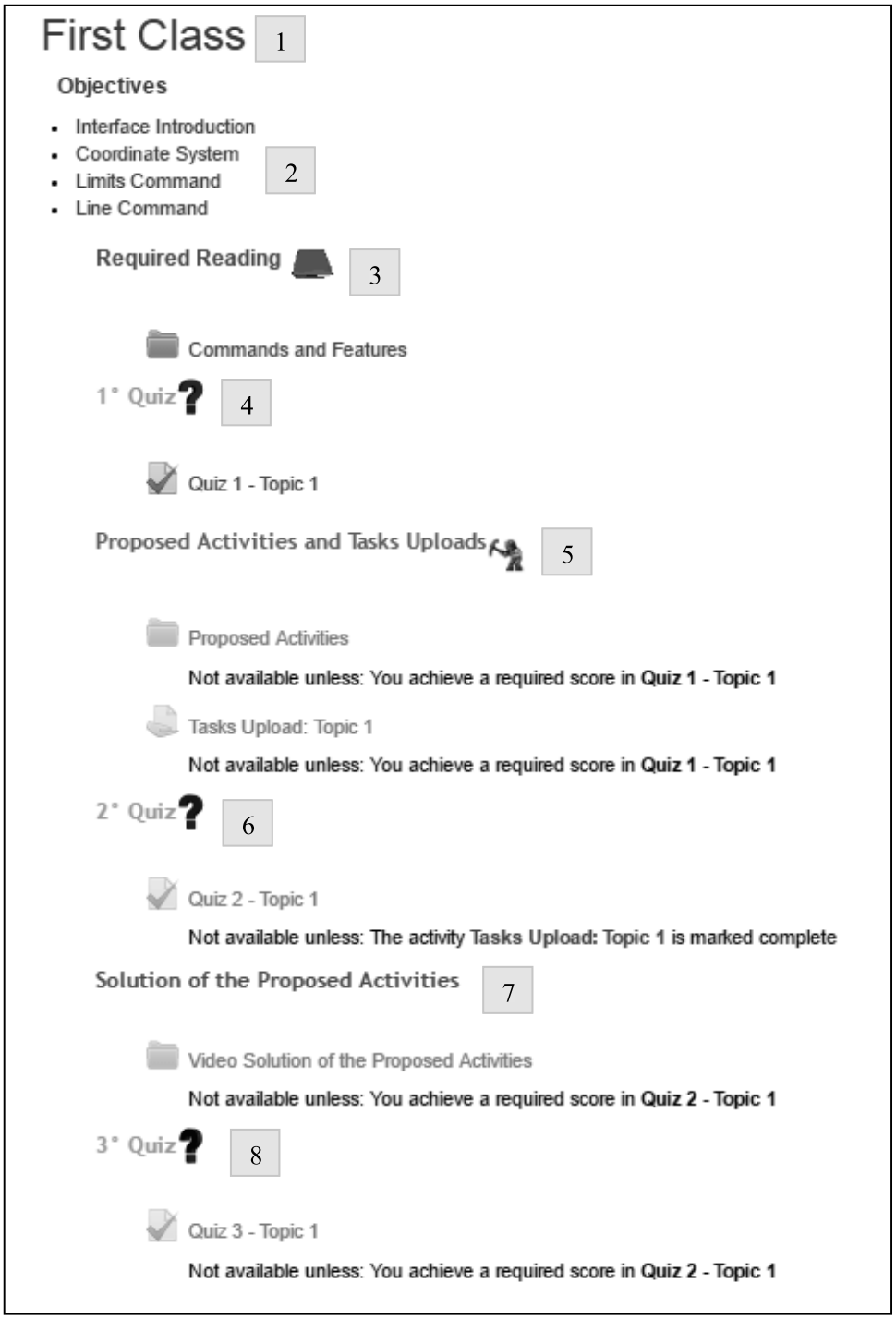
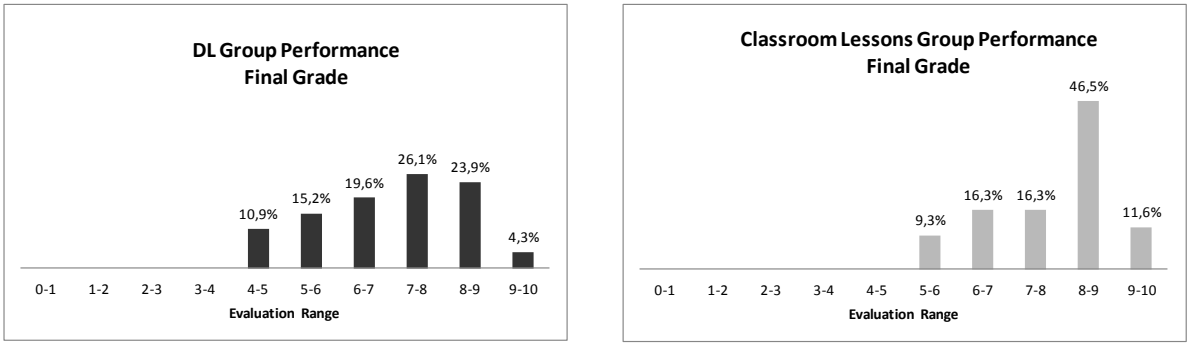


Figure 3. Topic structure of the first class

4 ANALYSIS OF RESULTS

Figure 4*a* shows results obtained from the evaluation work done by students who made the Distance Learning Course related to their performance both in multiple-choice quiz and practical exercise using the software. It can be seen that 73.9% of students achieved the rating 6.0, which is the average required by the university for a student to be approved in an undergraduate course. It is observed also that among these students, 50% had a rating between 7.0 and 9.0, which indicates that these students built their knowledge in the methodology proposed quite well. Also, Figure 4*a* indicates that no student rated lower than 4.0 and only 4.3% of the students rated higher than 9.0.



(a) *(b)*

Figure 4. (a) DL group performance and (b) Classroom lessons performance

Figure 4*b* shows results obtained from the evaluation work done by students who learned the AutoCAD by classroom lessons related to their performance both in multiple-choice quiz and practical exercises using the software.

Figure 4*b*, shows that 90.7% of students achieved rating of 6.0, which is the average required by the university for a student to be approved in an undergraduate course. It appears also that, among the students rated 6.0, 62.8% have a rating between 7.0 and 9.0, indicating a high comprehension of the software that was learned in the classroom course. Also, Figure 4*b* indicates that no student obtained a grade lower than 5.0 and only 11.6% of the students had a grade higher than 9.0.

Figure 5 shows a comparison between the performance of both groups. Looking at Figure 5, it is observed that, in general, the group that learned the software in classroom lessons had a better performance when compared to the group that learned AutoCAD by the distance learning course.

It is believed that this difference is related to two factors. The first concerns the practice time of the software by students of the classroom course, who performed a lot of exercises in AutoCAD throughout the semester, while students in the distance learning course made only the practical exercises proposed within the period of the course (30 days).The second factor relates to the learning of the software plotting process. Students in the classroom course could practice the printing of their designs throughout the semester while the students of the distance learning course made only one exercise of plotting.

These issues are properly highlighted in the Figure 6, which aims to establish a comparison between the performance of students in the evaluation work, considering separately results obtained from the multiple-choice quiz and the practical exercise of plotting. It is observed that, in general, the performance of the two groups was very similar in the quiz (Figure 6*a*) with the students of distance learning course outperforming the students of classroom course in ranges 6-7 and 9-10. However, when looking to Figure 6*b*, it is evident that the performance of the classroom course students is higher in the practical exercise. This observation indicates the need of offering a higher number of practical activities related to plotting in the distance learning course.

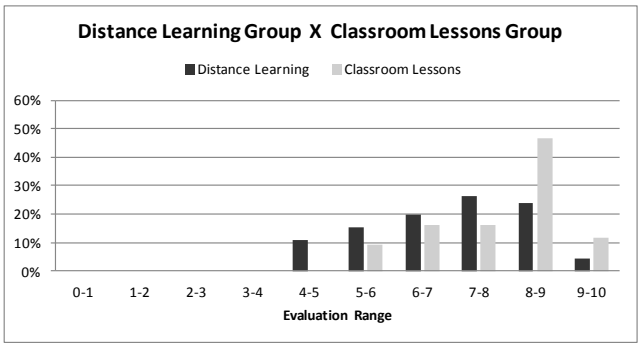
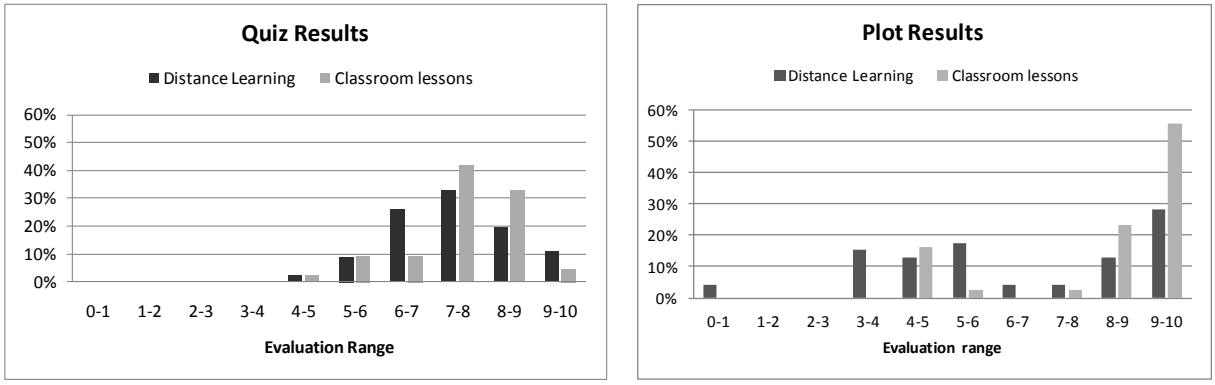


Figure 5. Distance Learning versus Classroom Lessons performance



(a) *(b)*

Figure 6. Comparison of performance between: (a) Multiple-choice quiz and (b) practical exercise of plotting

5 FINAL CONSIDERATIONS

In the present study, a pedagogical model was developed and implemented in a Virtual Learning Environment (VLE). The objective of the work was to create a distance learning course with its own visual identity, aiming a clear interface, easy to understand and a different design to teach AutoCAD 2D software. A pedagogical model validation to check its suitability was performed.

Results showed that the performance of students who made the distance learning course of the AutoCAD software was quite satisfactory, indicating a good understanding of the proposed content. Thus, it can be concluded that the pedagogical model proposed by this work is appropriate for the teaching of this software in this distance learning course model. It was found, however, that few adjustments are required in order to improve the comprehension of the plotting subject by the students.

ACKNOWLEDGMENTS

The authors acknowledge the Department of Education to Distance (SEAD/UFRGS), the Support Program Graduation (PAG) and the Federal University of Rio Grande do Sul for providing the financial support needed to develop this project.

REFERENCES

[1] BEHAR, P. A. *Modelos Pedagógicos em Educação à Distância*, 2009 (Artmed, Porto Alegre)

[2] BERNARDI, M. Prática pedagógica em ead: uma proposta de arquitetura pedagógica para formação continuada de professores. 2011. 200f. Tese (Doutorado em Engenharia) – Faculdade de Educação, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2011.

[3] BEHAR,P. Distance Education and paradigmatic changes: a new way of looking at them through pedagogical models. In *IFIP World Conference on Computers in Education, WCCE'09,* Bento Gonçalves, July 2009.