

Use of a Virtual Learning Environment in Computer Systems Engineering of the Technology of Ciudad Valles as a Tool to Support Face-to-face Classes

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Abstract

Educational research at the National Technological Institute of Mexico (TecNM) covers the thematic areas: Educational Models and Curriculum, Teaching and Learning, Evaluation and Performance Indicators, and Information and Communication Technologies. In this last thematic area, an educational research project was developed, which involves Virtual Learning Environments (VLE). The objective was determined to measure the impact of using a VLE as a tool in the teaching-learning process of the blending learning classes (face-to-face classes and online activities) of the Technology of Ciudad Valles. The methodology is mixed, qualitative and quantitative. In the quantitative, the number of teachers using AVA, the number of students in a Blending Learning (B-Learning) course, and the number of courses designed in Moodle are determined. In the qualitative, the impact of B-Learning on students is analyzed; determining the degree of motivation and performance that is generated when using AVA and the ability to use information technology to generate their learning strategies. A componential and structural analysis of the AVA used in the institute is presented, the research hypothesis is disclosed: the use of an AVA as a b-learning strategy improves the level of performance of student competencies compared to students who follow face-to-face learning strategies. The way in which the research is carried out, the frame of reference and relevant results and conclusions are shown.

Keywords: AVA; B-learning; Moodle

Introduction

The area of educational research on Information and Communication Technologies (ICT), has projects, activities and studies related to the integration of ICT in the educational process, benefits and risks of the use of ICT, models and modalities of non-formal education – at a distance – and mixed, learning management systems.

This educational research project arises from this area and aims to analyze the impact of a Virtual Learning Environment (VPA), such as Moodle, in a B-learning modality, to determine the performance of the student's academic competencies and

their motivation when learning versus with students who use the face-to-face modality. The object of study are the students of the engineering in Computer Systems of the National Technological Institute of Mexico campus Instituto Technology of Ciudad Valles of the subject of simulation. A mixed research methodology was used, i.e. quantitative and qualitative. The quantitative was applied to numbers of: courses, students, learning objects and evaluation criteria. The qualitative to the performance of the competences and the motivation of the student.

In the Technology of Ciudad Valles the educational modality is face-to-face, and with the emerging changes due to the COVID-19 pandemic, the virtual modality (e-learning) was used. For this

research, a B-learning modality is adopted to identify with a VPA. Using the VPA, in this case, Moodle, promotes inclusion in the social, cultural, economic and labor life of the twenty-first century, in which technology has a fundamental place. In this sense, teaching in a B-learning modality using Moodle, helps students acquire different skills and abilities linked to the learning environment and technology [2]. The alternate or research hypothesis determines that the use of a Moodle Virtual Learning Environment with learning objects (platform activities or strategies), evaluation of a course (evaluation instruments), improves the level of academic performance of the student's competences and their numerical score, compared to students who are evaluated with learning strategies or tasks in the classroom in person.

This article presents the general approach of the problem, the universe, the subjects and the study sample; the method and techniques used to carry out the research are described; begins with the componential and structural analysis of the VPA, reviews the evaluation criteria, learning objects and evaluation strategies of the face-to-face and b-learning modality, presents information collected, analyzed and integrated, to show results through the Mann-Whitney U statistical test; research findings.

Method Description

The National Technological Institute of Mexico works three dimensions in its educational model: philosophical, academic and organizational in its essential purpose is the integral formation of the student [1].

The National Technological Institute of Mexico has an educational model based on competencies, so the planning and implementation of the courses taught at the Technology of Ciudad Valles are designed under this model [5]. A document controlled by the Integral Management System is used for its academic process, called Didactic Instrumentation; this document establishes the generalities of the subject to be taught (name, credits, semester, career, department, didactic intention and competence to be achieved), teaching strategies and learning strategies; establishes the evaluation criteria that measure the academic performance of students.

In the competency model, it is intended to achieve a level of academic performance, with two options: Competence achieved

and Competence not achieved [3]. The competency performance option achieved is composed of four performance levels: excellent (meets 5 indicators), remarkable (meets 4 indicators), good (meets 3 indicators) and sufficient (meets 2 indicators); while the non-achieved competency performance option only has insufficient performance level (does not meet indicators).. These levels would be the ordinal qualitative variables of the research. For the student to accredit a subject, it must be evaluated in each and every one of the competences of the same, and the level of performance achieved by the student will be based on the evidence and compliance with the indicators of scope defined in the didactic instrumentation [5].

The results of the evaluation instruments of each competence are averaged to obtain the qualification of the subject, as long as all the competences have been achieved. The numerical assessments assigned by the teacher, to a competence, indicate the level of performance with which the student achieved the competence and will be based on the methods, techniques and evaluation instruments used by the teacher for the subject, taking as a reference the scope indicators that are defined below: a) adapts to complex situations and systems, b) makes contributions to the academic activities developed, c) proposes and explains solutions or procedures not seen in class, shows creativity, d) introduces resources and experiences that promote critical thinking, e) incorporates knowledge and interdisciplinary activities in their learning, f) performs their work autonomously and self-regulated [4].

For this project, the courses created in the Virtual Moodle Learning Environment of the Technology of Ciudad Valles for the curriculum of computer systems engineering ISIC-2010-224 ©TecNM, valid for May 2016, are considered as a research universe [4]. The study students are the students of the Computer Systems Engineering career and the muestra, the students who took the subject of Simulation in the years 2017, 2018 and 2019.

To carry out this research, a mixed methodology, both qualitative and quantitative, will be integrated. Regarding the quantitative methodology, the number of study programs that have been developed in the AVA will be determined, the number of students who take a course having Moodle as a support tool in their learning process, the number of students who take a course in person without Moodle support.

As for the qualitative methodology, an analysis will be made of the learning and evaluative objects created in Moodle and the evaluation strategies applied in the classroom; determining the level of performance of the competence that the student reaches when using one or another option.

The interpretation of the results of the research will lead to the construction of training programs that promote and strengthen teachers in the creation of their courses in the AVA Moodle as support for the face-to-face teaching-learning process, to improve the level of academic performance of the competencies in the students.

Methodology to be developed

The quantitative and qualitative methodology of the project is based on techniques of observation, selection, verification and analysis of information. The instruments used are search engines such as Google, the guidelines of the National Technological Institute of Mexico, Plan and Program de studies of Engineering in Computer Systems TecNM © mayo 2015, Virtual Campus of the Technology of Ciudad Valles (Moodle), didactic instrumentation of the subject of Simulation face-to-face modality and b-learning, learning objects and face-to-face assessment strategies.

The specific objectives and activities defined for the project are the following:

- Identify the Virtual Learning Environment used in the Technology of Ciudad Valles
- Perform an analysis of the Moodle Virtual Learning Environment on its global and component structure
- Identify the Moodle pedagogical model
- Develop a diagnosis regarding which study programs (courses) of the Computer Systems Engineering career have been developed in Moodle
- Review and list which courses have been created in the Virtual Learning Environment
- Review and describe the structure of the course created in the VPA
- Identify the learning objects that determine the student's competency assessment performance in Moodle
- Review the design of the didactic instrumentation and obtain the evaluation criteria
- Review and describe the learning objects that are used to evaluate the student in the Virtual Learning Environment
- Verify if the learning objects have been created in relation to each evaluation criterion defined in the instrumentation for the achievement of the competence of the thematic unit
- Identify assessment strategies that determine competency assessment performance in the classroom
- Review the design of the didactic instrumentation and obtain the evaluation criteria
- Review and describe the learning strategies used to assess the student in person
- Verify whether the learning strategies have been created in relation to each evaluation criterion defined in the instrumentation for the achievement of the competence of the thematic unit
- Carry out a comparative study of the level of performance of competences of the student of Engineering in Computer Systems of the IT of Cd. Valles in a given subject, comparing those who use the Moodle platform versus those who do not use it.
- Select group where the subject whose course has been created in Moodle and uses the mixed modality.
- Select group with the same subject whose course is only face-to-face
- Collect information on the grades obtained in the thematic units, the performance of the competition and the level of performance achieved by the students of the course that was supported with a VPA
- Collect information on the grades obtained in the thematic units, the performance of the competition and the level of performance achieved by the students of the course that was not supported with a VPA
- To carry out a comparative study of the collection of information regarding the performance of competencies in students with the Mann-Whitney U statistical technique.
- Describe the result of the study by preparing a report of the performance of the students' competencies determining the impact on the level of performance when using a Virtual Learning Environment in the teaching-learning process.

Results

The results are described by objective

The Structural and component analysis of the Moodle Platform of the cd technology. Valles was carried out using the technique of collection, observation and analysis of the information. The component structure is integrated by blocks: administration, configuration, calendar, profile and user role, the central column shows an image of Welcome and the categories and subcategories that integrate the Virtual Campus of the cd technology. Valles; this analysis corresponds to qualitative research. See figure 1.

Figure 1: Moodle Platform. Source: www.tecvalles.mx.

Through the technique of observation and analysis of information, the categories that the Platform Administrator has created are analyzed quantitatively. The diversity of categories it covers is related to the careers offered by the Technology of Ciudad Valles. See figure 2.

Figure 2: Categories of the Tec Valles Virtual Campus. Source: www.tecvalles.mx

The category delimited for the educational research project, that of Computer Systems Engineering, is selected, the subcategories that define the semesters, the specialty and the tutorials offered for that career are analyzed. The quantitative analysis is carried out counting the courses and a table is elaborated where the semester, the course and the teacher who has elaborated that course is recorded in the Moodle platform of the cd technology. Valles, there are 48 courses in 11 subcategories.

The Simulation course that is in the subcategory 4th semester of Computer Systems Engineering is taken for research purposes to review the evaluation criteria defined in the didactic instrumentation of the professor. The groups analyzed are those of the ISI55A keys of the teacher Rosa Imelda García Chi, the ISI55B group of the teacher María Antonieta Hernández that uses the b-learning modality.

For this purpose, qualitative and quantitative research is carried out. It begins with the technique of collecting didactic instrumentation and then with the technique of observation. Based on the analysis of the evaluation criteria established in the didactic instrumentation, it is quantitatively determined how many learning objects have been created, between learning activities and teaching resources; the learning objects generated in the virtual campus are reviewed to verify the correspondence with what is established in the instrumentation and evaluate the level of performance that the student can achieve and that contributes to their cognitive learning process. See figure 3.

Figure 3: Simulation Course in Moodle. Source: <http://tecvalles.mx/moodle/course/view.php?id=255>.

A record is made of what objects are developed, with what tool and how it contributes to the student's learning process by interacting with the object, providing qualitative information to the research.

Figure 4: Unit 1 of the Moodle Simulation course. Source: <http://tecvalles.mx/moodle/course/view.php?id=255>

Figure 5: Activities of unit 1 of the Moodle Simulation course. Source: <http://tecvalles.mx/moodle/course/view.php?id=255>

The percentage or score that the learning object contributes to the level of performance according to the evaluation criteria established in the didactic instrumentation is described.

The technique of information collection, observation and analysis were used at this point. The didactic instrumentation was collected with the teacher who teaches the subject of Simulation in the face-to-face modality, the ISI55C group in charge of the teacher Arturo Eguía Álvarez. Once obtained, the criteria used to

Figure 6: Didactic Instrumentation of the Simulation course. Source: Didactic instrumentation document.

measure student performance for each learning unit are analyzed and extracted quantitatively. Some of the learning strategies used in the classroom are also collected, these show the qualitative characteristics that an evaluation instrument must have to evaluate factual learning.

Figure 7: Didactic Instrumentation of the Face-to-Face Simulation course. Source: Didactic instrumentation document.

In this objective, the selection of the groups to be used in the research was carried out, both those of the b-learning modality and the face-to-face modality. The selected groups correspond to

the subject of Simulation of the career of Engineering in Computer Systems, the groups are the ISI55A by the teacher Rosa Imelda García Chi, the GROUP ISI55B by the teacher María Antonieta

Hernández and the GROUP ISI55C by the teacher Arturo Eguía Álvarez. The technique of collection is used where the report cards of the three groups are collected, as shown in figure 8, 9 and 10.




Figure 8: ISI55A Group Qualifications Report. Source: www.tecvalles.mx/SII



Figure 9: ISI55B Group Qualifications Report. Source: www.tecvalles.mx/SII



Figure 10: Isl55C Group Qualifications Report. Source: www.tecvalles.mx/SII

To determine the impact of using a virtual learning environment to support face-to-face classes, the Mann-Whitney U statistical technique is used with SPSS software. The qualitative variable and the qualitative ordinal variables are the educational modality and the level of performance.

The non-parametric testing of two independent samples is carried out; the following information is obtained from the IBM SPSS software.

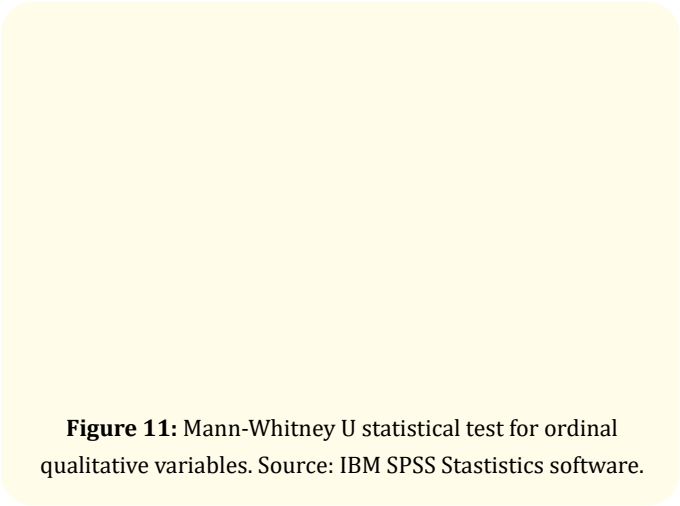


Figure 11: Mann-Whitney U statistical test for ordinal qualitative variables. Source: IBM SPSS Statistics software.

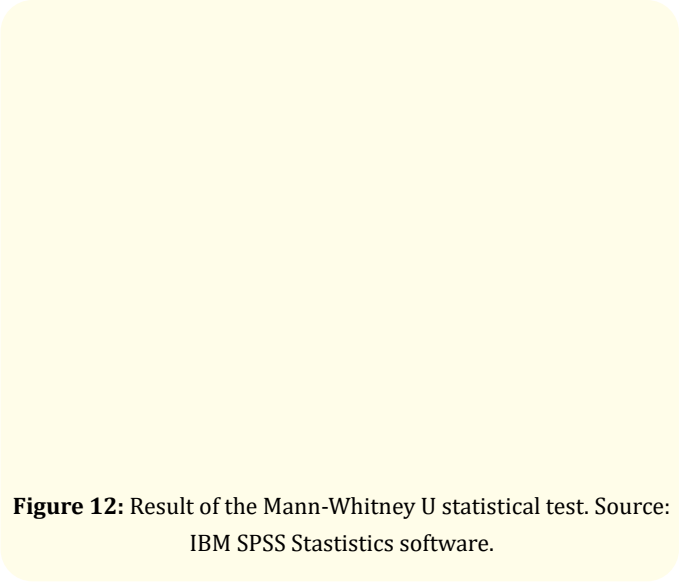


Figure 12: Result of the Mann-Whitney U statistical test. Source: IBM SPSS Statistics software.

If $z \leq 0.05$ the null hypothesis is rejected and the research hypothesis is accepted.

$$Z = -3.904$$

$-3.904 \leq 0.05$ therefore the null hypothesis is rejected.

The research or alternate hypothesis is accepted.

Conclusions

The educational research in the TecNM campus Ciudad Valles in the theme of Information Technologies applied to education, began to develop projects based on the use of Virtual Learning Environments, to support face-to-face classes and promote meaningful learning in the student. This project measured the impact of the use of this tool on the teaching-learning process and determined how it influences the obtaining of a passing numerical grade and the level of academic performance of the training competences.

From the research hypotheses raised in this project, the following conclusions are obtained:

- **Alternate hypothesis:** The use of a Moodle Virtual Learning Environment with learning objects or evaluation of a course, improves the level of performance of competences of the student
- **Null hypothesis:** Students who are evaluated with face-to-face learning strategies do not achieve a better level of performance

At apply the mann-Whitney U statistical technique to ordinal qualitative variables such as the student's level of performance (Excellent, Remarkable, Good, Sufficient and Insufficient) and the qualitative variable learning modality (1: Face-to-face, 2: blearning) the z statistic less than 0.05 is obtained so that the null hypothesis is rejected and the research or alternate hypothesis is accepted. It also shows a description of the two groups purchased (face-to-face and blearning), the sum of ranges and a value that represents which group has a higher median, this data is the average range, which is obtained by dividing the sum of ranges of each group by the number of cases in the group.

The use of a Virtual Learning Environment as a tool for face-to-face classes turns the teaching activity into a b-learning modality;

it is demonstrated that including well-designed learning objects as learning strategies in Moodle, improves the level of academic performance of the student of Computer Systems Engineering of the subject of Simulation of the Technological of Ciudad Valles.

This project served as the basis for using the Moodle Virtual Learning Environment in an emerging virtual learning process due to changes due to pandemic.

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