Analysis of the Learning Achievement Gap Between Courses Adapted to Virtual Modality and Courses for a LMS in Undergraduate Studies

Gustavo Quevedo Tamayo
Universidad Peruana de Ciencias Aplicadas, Peru

pcmagque@upc.edu.pe

Abstract: The purpose of this research was to determine if there is a gap between a course adapted from a face-to-face to a virtual format and a course specifically designed to be taught in a virtual environment through an LMS. The results showed a gap of more than 10%, with the experimental group obtaining an average final grade 23% higher than the control group. A 24% improvement in grades was observed with the increase in supervisory activities in one unit of the course. The tutor-teacher's expertise and willingness to help students were key elements to the success of undergraduate students.

Keywords: LMS, Virtual teaching, Learning platform, Virtuality

1. Introduction

Distance education has been an inclusive mechanism supported by educational materials for individual study and self-learning. With the emergence of online learning, it was possible to include instruction with teachers and peers without the need for physical presence (Guadalupe & Rivera, 2021). The Covid-19 pandemic accelerated the virtualization of courses in higher education, leading many institutions to adapt face-to-face material without an adequate instructional design for virtual platforms (Valverde, 2021; Guadalupe & Rivera, 2021). This process, according to Bates (2019) and Boulos (2022), sacrificed the quality of the content to save costs. This problem needs to be evaluated from a professional and scientific educational perspective (Valverde, 2021). Villafuerte (2020) highlights that the controlled structure of a school cannot be replicated online, evidencing the need for differentiated educational proposals in virtual environments.

The research question arises: Is there an achievement gap between an adapted virtual course and one designed specifically for an LMS? What is that gap? The instructional design proposal in Peruvian universities is usually based on adapting face-to-face syllabuses to virtual modalities without an adequate instructional design for such platforms (Brenis-García et al., 2021). The temptation to virtualize courses to save costs has led to a reduction in educational quality by not using adequate tools and not training teachers (Bates, 2019).

An LMS (Learning Management System) is a virtual space that provides services and tools for a student to build their knowledge and includes hardware and software elements to create and distribute educational content and manage learning (Butum et al., 2018). The Covid-19 pandemic forced teaching-learning to shift to 100% online, using LMS platforms such as Google Classroom, Zoom, Google Meet, among others (Mishra et al., 2020). Learning achievements are results achieved by students after significant learning experiences, based on self-reflection and teacher accompaniment (Fernández Leandro et al., 2022). There is a positive correlation between the quality of the education system, ease of use, and satisfaction with online learning (Giday & Perumal, 2024). Boulos (2022) suggests that it is possible to achieve comparable levels of effectiveness between online and face-to-face instructional formats. This is measured by Learning Effectiveness. Effectiveness is the ability to achieve the desired effect, interpreted as the achievement of competencies in online education (RAE, 2023). An effective teacher achieves formative results feeling prepared and motivated (Infeanyi, 2023; Mishra et al., 2020). Success in online learning varies depending on how teachers deliver sessions and the effectiveness of the instructional techniques used (Butnaru et al., 2021).

In light of the above, the general purpose of this research is to know if there is an achievement gap between an adapted virtual course and a designed one, it is necessary to study whether the achievement gap is significant between an adapted virtual course and one designed specifically for a LMS, and if the achievement gap between an adapted virtual course and a designed one is greater than 10%. This goal may persuade universities to give more importance to professor capacitation and more time to instructional design.

2. Methodology

Following the quasi-experiment method analyzed by Creswell (1994) and executed by Chen & Huang (2024) in 48 fifth-grade students in a primary school in Taiwan, we aim to analyze the learning achievement in a course designed for a Learning Management System (LMS), compared to a course without LMS design.

2.1 Participants

Following Creswell's (1994) methodology for quasi-experimental processes, the study took 94 university students from two classes of the AD2454 Project Management course, 47 of them grouped in the KS85 section and the other 47 in the MX86 section, both virtual modalities. The grouping process took place during enrollment at the beginning of the semester. The course was taken for convenience, after the researcher was authorized by the university to carry out the research with two of his classes. Without affecting the composition of the classes, one of them was randomly chosen to become the experimental group, and the other the control group. In the experimental group, the learning methodology linked to the specific design for a LMS will be applied. The control group will follow the traditional method of learning, simulating a face-to-face class only that the sessions will be remote online. All participants agreed to the research process voluntarily. To ensure that the groups were equivalent, an entrance test was taken to measure prior knowledge of the AD2454 Project Management course.

2.2 Experimental Design

The study was conducted in two classes of the AD2454 Project Management course, each with 47 students enrolled. Both groups are taught the content in 4 learning units, during the 4-month span of the 2024-2 semester. The experimental group develops the learning units by attending the class sessions and carrying out the 13 learning activities designed in the EVA. Activities such as forums and the portfolio of deliverables are carried out throughout the semester, and the other 11 activities are specific to the achievement of each learning unit. Each teaching unit also has graded activities to measure learning achievement. For the control group, the same achievement assessment activities established for all 12 sections of the course, both face-to-face and virtual, were considered.

2.3 Experimental Process

The experimental procedure of this study includes a pre-test stage, an experiential stage, and a post-test stage. In the pre-test, the knowledge of the course of the students enrolled in both classes, MX86 and KS85, was evaluated. On a 20-point rating, the MX86 class achieved an average rating of 7.78 and variance of 3.820, and the KS85 class achieved an average rating of 7.85 and a variance of 3.413. This ensures that both groups are equivalent. (Bono Cabré, 2014). In the experimental stage, during the first session, both groups were explained the course content, the activities per unit and the corresponding learning assessments per unit. Both groups will receive the same course content throughout the semester; The experimental group will perform a greater variety of learning activities per unit and both groups will take the same partial assessments to measure the learning achievement of each unit. Table 1 presents the group of activities per unit for both the experimental and control groups.

Table 1: Learning activities by unit

EXPERIMENTAL GROUP			CONTROL GROUP		
With LMS Program	Entry test	Unit 1	Without LMS Program	Entry test	Unit 1
	Forum about Stakeholders				
	Reading Control 1			Reading Control 1	
	Case study about cost management	Unit 2			Unit 2
	Quiz about quality				
	Parcial Essay			Parcial Essay	
	Case study about risk management	Unit 3			Unit 3
	Reading Control 2			Reading Control 2	
	Final Essay Presentation			Final Essay Presentation	
	Final Essay			Final Essay	
	Final Exam			Final Exam	
	Performance Evaluation			Performance Evaluation	
	Portfolio of partial essays	Longitudinal Achievement			

3. Results

Since this experiment is being carried out between the months of August-November 2024, only the pre-test measures are available. The following will be carried out during the academic calendar of the current semester. We present preliminary test results based on what was achieved in previous research carried out by the author where the analysis was carried out for the Marketing course virtual modality, where the achievements by learning units and achievements of the course in general were analyzed. The results obtained from the T-test for the final averages of the course show that the difference between the means is statistically significant. With a 90% confidence interval, the observed difference between the means is not zero, indicating that the course

designed specifically for VAS outperforms the adapted course in effectiveness. The p-value of significance yielded 0.015, being lower than the alpha significance level of 0.05, supports this conclusion. (Quevedo 2018). This implies that although the learning process between the two groups is successful, the achievements are more significant if a specific teaching-learning proposal for the LMS is worked on. Similar results linked to achievement in online classes were found in (Geng & McGinley, 2021).

Table 1: T-test for means of final grades.

Dimension 4 **Confidence Interval for the difference between means 90% [-3.761, -0.450 [**	
Difference	-2.106
T (Value observed)	-2.626
|t| (Critic Value)	2.064
LD	24.000
p-Value (bilateral)	0.015
alpha	0.050
The number of degrees of freedom is approximated by the Welch-Satterthwaite formula	
Interpretation:	
H0: The difference between the means is equal to 0. Ha: The difference between the means is different from 0. Since the computed p-value is less than the alpha=0.05 significance level, the null hypothesis H 0 must be rejected, and the alternative hypothesis Ha accepted.	

Note. USMP Qualifications. Own elaboration. T-test for two related samples / Bilateral test. Taken from Quevedo G. (2018, p82)

4. Preliminary Conclusions

As seen in table 1, the results for dimension 4, as for the other three dimensions not shown used in the preliminary research, there is statistical evidence to establish that the significant difference in the achievement of competencies between the control and experimental groups. Depending on the instrument used in the learning achievement of each unit of study, it shows a greater gap, therefore it is evident the importance of establishing the most appropriate learning tools according to the objective to be achieved, and that better learning results will be achieved by doing so. The results underscore the relevance of the teacher's role in virtual education (Brenis-García et al., 2021), the notable improvement in grades with the increase in teacher interaction and their proposed activities, is crucial for student engagement (Woo et al., 2021). In addition to this, it suggests the idea of strengthening the education and training of teachers who participate in online teaching, to ensure that they are prepared to offer the necessary support to their students (Marciniak & Gairín Sallán, 2017; Nortvig et al., 2018).

References

Barrantes, E., Bossio, J. y Chang, M. (2016). Satisfacción estudiantil con respecto a la modalidad semipresencial (blended): El caso de la Facultad de Negocios de la División EPE de la UPC. Universidad Peruana de Ciencias Aplicadas (UPC), Lima, Perú. Retrieved from http://hdl.handle.net/10757/623714

Bates, W.A. (2019). La Enseñanza en la Era Digital. Recuperado de http://solr.bccampus.ca:8001/bcc/file/da50f5f1-bbc6-481e-a359-e73007c66932/1/La%20Ensen%CC%83anza%20en%20la%20Era%20Digital_vSP.pdf

Brenis-García, A., & Alcas-Zapata, N., & Maldonado Alegre, F. (2021). El desarrollo de competencias digitales en docentes universitarios frente al auge de la educación virtual. 593 Digital Publisher CEIT, 6(4), 111-121. Recuperado de https://www.593dp.com/index.php/593_Digital_Publisher/article/view/651

Bono Cabré, R. (2014). Diseños Cuasi-Experimentales y Longitudinales. Departamento de Metodología de las Ciencias del Comportamiento, Universidad de Barcelona. Barcelona, España. Recuperado de http://diposit.ub.edu/dspace/bitstream/2445/30783/1/D.%20cuasi%20y%20longitudinales.pdf

Cegarra, J. (2013). Webquest: estrategia constructivista de aprendizaje basada en internet. INVESTIGACIÓN Y POSTGRADO, [S.l.], v. 23, n. 1, p. 73-91, jul. 2013. ISSN 2244-7474. Recuperado de https://revistas-historico.upel.edu.ve/index.php/revinpost/article/view/860/289

Chen, C. M., & Huang, M. Y. (2024). Enhancing programming learning performance through a Jigsaw collaborative learning method in a metaverse virtual space. International Journal of STEM Education, 11(1), 1–24. https://doi.org/10.1186/S40594-024-00495-2/TABLES/6.

Creswell, J. W. (1994). Research Design: Qualitative and Quantitative Approaches. Thousand Oaks. CA: SAGE Publications.

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry & research design: Choosing among five approaches (Fourth ed.). SAGE Publications.

Cruzado Puente de la Vega, C.F (2016). Tesis Magister Percepción del Campo virtual y la satisfacción de los estudiantes de Ingeniería de Sistemas de la Universidad César Vallejo- Ate, 2015. Recuperado de https://repositorio.ucv.edu.pe/handle/20.500.12692/7619

Durán Rodríguez, R. (2016). La educación virtual universitaria como medio para mejorar las competencias genéricas y los aprendizajes a través de buenas prácticas docentes. Recuperado de https://upcommons.upc.edu/handle/2117/98091

Flores Briseño, M. M. (2010). EN LA UNIVERSIDAD DE GUADALAJARA PROPUESTA DE NORMATIVIDAD PARA ASESORES EN LÍNEA. Revista Mexicana De Bachillerato a Distancia, 2(3). https://doi.org/10.22201/cuaed.20074751e.2010.3.47311

Hsu, L. (2021). A tale of two classes: Tourism students' cognitive loads and learning outcomes in face-to-face and online clases. Recuperado de https://www.sciencedirect.com/science/article/pii/S1473837621000435

Marciniak, R., & Gairín Sallán, J. (2018). Dimensiones de evaluación de calidad de educación virtual: revisión de modelos referentes. RIED-Revista Iberoamericana de Educación a Distancia, 21(1), 217-238. https://doi.org/10.5944/ried.21.1.16182

Nortvig, A. M., Petersen, A. K., and Balle, S. H., 2018. A Literature Review of the Factors Influencing E-Learning and Blended Learning in Relation to Learning Outcome, Student Satisfaction and Engagement. The Electronic Journal of e-Learning, 16(1), pp. 46-55, available online at www.ejel.org

Pesca de Acosta, C. (2012). Educación universitaria en desarrollo y aplicación del talento humano y la gestión del conocimiento. InterSedes: Revista de las Sedes Regionales, XIII (25), 98-115. Recuperado de https://www.redalyc.org/pdf/666/66623936006.pdf

Pham, L., Limbu, Y.B., Bui, T.K. et al. Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. Int J Educ Technol High Educ 16, **7** (2019). https://doi.org/10.1186/s41239-019-0136-3

Poquioma Woo, M. A., Saldaña Poquioma, K. D. J. D. C., Barrenechea Moreno, H. G., & Prado Lozano, P. (2021). Gestión de la calidad en la educación superior: una revisión sistemática. IGOBERNANZA, 4(16), 334–356. https://doi.org/10.47865/igob.vol4.2021.160

Quevedo, G. (2018). Aplicación de un Sistema Tutorial Mejorado modalidad virtual para el desarrollo de habilidades y actitudes para la comprensión de fenómenos competitivos en Marketing. Tesis Doctoral. Universidad de San Martín de Porres.

Sarker, P. C., Siddique, Md. N. E. A., Sultana, S., & Pal, S. K. (2023). Comparison between Traditional Classroom and Flipped Classroom on Student's Engagement and Satisfaction. International Journal of Multidisciplinary: Applied Business and Education Research. 4(2), 624 – 635. doi: 10.11594/ijmaber.04.02.29

Schutte, Jerald G. (s.f). Virtual Teaching in Higher Education: The New Intellectual Superhighway or Just Another Traffic Jam?. Recuperado de http://www.csun.edu/~egodard/dta/docs/P-VirtualTeaching.pdf

Vara - Horna, A. (2012). Desde La Idea hasta la sustentación: Siete pasos para una tesis exitosa. Un método efectivo para las ciencias empresariales. Instituto de Investigación de la Facultad de Ciencias Administrativas y Recursos Humanos. Universidad de San Martín de Porres. Lima. Recuperado: http://www.administracion.usmp.edu.pe/investigacion/files/7-PASOS-PARA-UNA-TESIS-EXITOSA-Desde-la-idea-inicial-hasta-la-sustentaci%C3%B3n.pdf

Wang, C., Hsu, H., Bonem, E., Moss, J., Yu, S., Nelson, D., Levesque-Bristol, C. (2019). Comparison between Traditional Classroom and Flipped Classroom on Student's Engagement and SatisfactionNeed satisfaction and need dissatisfaction: A comparative study of online and face-to-face learning contexts. Recuperado de https://www.sciencedirect.com/science/article/abs/pii/S0747563219300433?via%3Dihub

Wichadee, Saovapa. (2016). Factors Related to Students' Performance of Hybrid Learning in an English Language Course. International Journal of Distance Education Technologies. 12. 74-90. DOI: 10.4018/ijdet.2014010105.