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Blended learning experience of networks and telecommunications through a SPOC Course

Experiencia de aprendizaje mezclado de redes y telecomunicaciones a través de un Curso SPOC

OTERO-ESCOBAR, Alma Delia†*

Universidad Veracruzana, School of Accounting and Administration, Mexico.

ID 1st Author: *Alma Delia, Otero-Escobar* / **ORC ID:** 0000-0001-9266-6587, **Researcher ID Thomson:** P-8871-2016, **CVU CONACYT ID:** 203484

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Abstract

This research reports the results of student-centered learning of the educational experience of networks and telecommunications that is taught at the Universidad Veracruzana implemented through a SPOC (Small Private OnLine Course) taking advantage of for this the benefits of blended learning. The general behavior of online learning was analyzed in the performance of the students. This work is practical and provides guidance for the analysis of learning and individualized teaching in small study groups. A challenge in virtual learning is to provide personalized teaching in a large class with quality and effectively according to the needs of each student. Blended learning is an opportunity to offer personalized instruction through the SPOC. The goal is to identify the learning outcomes when implementing personalized teaching in blended learning. The contents, activities and assessments represent a mixed learning scenario, the data representing the learning behavior of the students was collected and used to measure their performance. The results show that students' online behavior can measure their performance and performance.

SPOC, Blended and individual learning, Performance

Resumen

En esta investigación se reportan los resultados de aprendizaje centrado en el estudiante de la experiencia educativa de redes y telecomunicaciones que se imparte en la Universidad Veracruzana implementado a través de un SPOC (Small Private OnLine Course - "curso privado online para grupos pequeños") aprovechando para ello las bondades del aprendizaje mezclado. Se analizó el comportamiento general de aprendizaje en línea en el desempeño de los estudiantes. Este trabajo es práctico y proporciona orientación para el análisis del aprendizaje y la enseñanza individualizada en grupos de estudio reducidos. Un reto en el aprendizaje virtual es brindar una enseñanza personalizada en una clase numerosa con calidad y de manera eficaz de acuerdo con las necesidades de cada estudiante. El aprendizaje mezclado es una oportunidad para ofrecer la enseñanza personalizada a través del SPOC. El objetivo es identificar los resultados de aprendizaje al implementar la enseñanza personalizada en el aprendizaje mezclado. Los contenidos, actividades y evaluaciones representan un escenario de aprendizaje mezclado, los datos que representan el comportamiento de aprendizaje de los estudiantes se recopilaron y utilizaron para medir su desempeño. Los resultados muestran que el comportamiento en línea de los estudiantes puede medir su desempeño y su rendimiento.

SPOC, Aprendizaje mezclado e individual, Desempeño

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* Correspondence to Author (aotero@uv.mx)
† Researcher contributing first author.

Introduction

In Mexico until before March 2021, traditional higher education, also known as face-to-face, was the main form of teaching where the main provider of information and knowledge was the teacher and the role of the student was as a receiver, as a result of confinement by the COVID-19 Coronavirus pandemic resorted to emergency remote teaching, leading to numerous changes in the learning scheme for students but accentuating the inactive role of students.

Technology went from being an option to a necessity, becoming a determining factor in student learning, which is why there are opportunities for the advancement and development of new teaching schemes. The traditional teaching method is increasingly difficult to adapt to the development of the new age, and its quality is difficult to guarantee. University students from the August - February 2021 period identify themselves as digital natives who have grown up in the digital age and practically next to the Internet, so that traditional teaching for them is not visualized without the use of information and communication technologies.

Internet users in Mexico reached 84.1 million in 2020, which is equivalent to 72% of the population (INEGI, 2020). In this sense, the Internet has become very accessible for them to access information and knowledge (INEGI b, 2020). On the other hand, access to sources of knowledge is very wide and within the reach of students, allowing them to have a great variety of educational resources, so the teacher is no longer the only one who provides knowledge and courses that are not enriched. properly they can cause students to lose interest and consequently decrease their performance and learning.

According to Ortiz (2021), the mobile phone has been the main means to carry out educational activities such as accessing educational platforms, browsing social networks, watching short videos, using email, making video calls, among others, becoming the basic equipment of the students.

However, excessive use of the mobile phone has turned students into phubbers in the classroom, affecting their attention and learning in class Mendoza, J., Pody, B. Lee, S. Kim, M. and McDonough, I. (2018). Therefore, a mediation between technology and learning must be sought.

In addition, serving large groups of students poses difficulties in trying to provide individualized instruction and could even have negative effects on student academic performance. Sobrados (2016), Monks (2011).

Small Group Private Online Course (SPOC) launches an educational revolution in classroom teaching. The SPOC is intended for small group instruction and is widely used to impart professional knowledge. Prego (2020).

Some practices with SPOC that have achieved good results are Serna, A. Garrido, C., Herrero, D. (2018) who made a comparison of two groups of university students who carry out two learning experiences, developed in very different learning contexts , one online through a SPOC course inserted in a Bachelor's course and another face-to-face obtaining favorable results, Fernández, Pérez del Río, Guillén & Gabarda (2021), analyzed the evaluation models and instruments that are implemented in the SPOC. On the other hand, Mailhes, V., Almada, N., Raspa, J. (2018) investigated and deepened about the different aspects of academic literacy in English and in particular of the abstracts through SPOC courses, finding as a finding that English literacy is encouraged.

In recent years, SPOC has also been popular in blended learning, Ziebarth & Hoppe (2014), Cepeda (2017). Therefore, SPOCs are seen as an opportunity for teachers to explore personalized teaching when groups are small between 20 and 30 students.

It is pertinent to identify the appropriate dynamics to achieve learning through the recording of the behavior of the students during the course, for example the time dedicated to study and the grades of the tasks, activities, quizzes, etc. for later analysis through diagrams generated on the SPOC platform. The research question seeks to identify what is the relationship between these data and student performance?

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In this research, a SPOC course was designed for the educational experience of networks and telecommunications that was taught in virtual mode to explore the performance behavior of students.

Based on blended learning, student performance was measured by integrating activities and assessments, including video review, reading technical reference manuals, testing, peer review, information search, which were integrated on the SPOC platform. A correlational analysis was used to analyze the impact of online behavior on student performance.

Through the measurement of the performance of the students in an SPOC, it is intended to pay for personalized learning, allowing the integration of all the learning activities distributed throughout the course for their subsequent analysis through educational data mining.

By using learning behavior through the SPOC to identify student performance and provide personalized instruction, providing an example for the design of virtual learning.

Literature review

The behavior analysis of academic performance in virtual learning environments is considered a key element. For this, the literature that supports this study is presented. In the case of SPOC courses in particular, there are few studies in this regard.

The evaluation of the capacity of linear regression and logistic regression in the prediction of performance and academic success / failure has been analyzed, starting from variables such as attendance and participation in class (García, Alvarado & Jiménez, 2000)

Castrillón, Sarache & Ruiz-Herrera (2020), predicted the academic performance of higher education students, based on various influencing factors using artificial intelligence techniques, designing an algorithm that allows its measurement for the benefit of learning.

According to Rojas & González (2009), student performance is often quantified by final grade, through partial evaluations and participation during the course, among others.

The interactions of students with the SPOC can be identified through the number of accesses, number of clicks, views of the videos, publications and participations made, as well as the results of the online quizzes are considered predictors of academic performance.

Based on related works, this research mainly used correlational analysis to analyze the performance of students and the elements that support their learning.

Figure 1 shows the map of blended learning activities carried out through the SPOC.

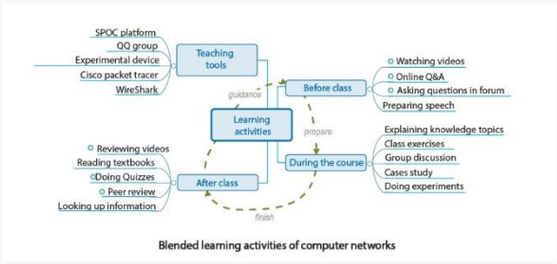

Figure 1 Blended Learning Activities at the SPOC

Context of blended learning in the SPOC

The design and implementation of blended learning for understanding the work environment is presented.

A. Blended learning design

For the design of the SPOC, eminus v4 was used as a platform that was adapted in such a way that it allowed the inclusion of SPOC resources to student-centered teaching, allowing progress at the student's own pace and implementing blended learning through synchronous sessions with collaborative work through teams.

In order to verify the deep alignment of online and offline learning, a variety of online and offline activities were designed. These activities include self-paced learning, such as watching videos, taking quizzes, and collaborative learning, such as peer review and group discussion. The online learning activities were carried out on the SPOC platform. The other activities were mainly offline activities and were carried out through the flipped classroom. Before class, students learned mainly on the SPOC platform.

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They can preview the course in advance by watching videos, answering questions and answers in the videos, or discussing with their classmates on the forum. They have the freedom to choose when and where to explore the online course.

Class activities were driven primarily by the flipped classroom. Through the SPOC, key and difficult elements of knowledge were presented according to the learning situations of the students and the use of the EMINUS platform was incorporated to carry out a random list, case studies and control of instructions.

The SPOC focused on students giving privileges to generate peer-to-peer discussions with teachers and classmates, do exercises or send comments on screen through the teams and eminus platform. Online and offline learning was seamlessly connected and blended through synchronous classroom teaching.

The after-school learning activities were designed to help students digest what they had learned. The quizzes, the peer review tasks corresponding to each teaching content unit were implemented in the SPOC platform. The partial evaluations are randomly generated by the SPOC platform. The students had two opportunities to complete the partial evaluation according to their own decision. After school activities, students were able to review videos, work with simulators such as WireShark, Packet tracer, and command testers available all the time, read technical reference manuals, or consult other suggested materials through the SPOC.

B. Implementation and data collection

The SPOC course on Networks and Telecommunications was implemented in August 2021 with students of the Bachelor's Degree in Administrative Computer Systems who were studying the 5th period, access was granted through login and password only to those students enrolled in the course, the blended learning according to the elements already described. The course contains seventeen theoretical knowledge of didactic content. The videos and the course material were published in advance by the professor on the SPOC platform. The course consisted of 24 students. The students were exposed to blended learning for the first time.

To test the reliability of the online learning data, a delivery schedule of the activities was established. In the empirical study and experiments, the reliability of the data will be verified.

Throughout the semester, the SPOC platform recorded online learning data for the teacher. For the feasibility of the study, some general behaviors were considered such as: Activity Reports, labs and quizzes, Basic exam of network connectivity and communications, exam of ethernet concepts, exam of IP addressing, exam of network applications communications, exam of creation and security of a small network, Final exam and the evidence portfolio report, on the other hand, learning activities outside of SPOC were not considered predictors. At the end of the semester, the students took a final exam and submitted a portfolio of evidence, all of which were considered to measure their performance.

Analysis of data

This section examines whether the common online behavior in Table 1 can be used to predict student performance. Correlation was used to explore the relationship between online behavior and student performance.

A. Data pre-processing

The original data of the behavior of the students in the SPOC platform was previously processed before its analysis.

B. Student performance

SPSS statistical software was used to measure to identify the correlations between the behavior in each activity performed and the performance of the students. Table 1 presents a summary of the data registered through the eminus platform.

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VARIABLES									
1	2	3	4	5	6	7	8	9	10
QyL	1Ex	2Ex	3Ex	4Ex		6Ex	ExF	P	Total
35.42	5	5	5	5	2.5	2.5	25	10	95.42
8.06	2	0	5	0	0	0	0	0	15.06
0	0	0	0	0	0	0	0	0	0
34.02	2	5	0	5	2.5	0.8	22	10	81.32
13.68	5	5	5	0	2.5	2.5	0	0	33.68
17.62	5	5	5	4	2.5	2.5	25	10	76.62
15.08	5	5	0	0	0	0	0	0	25.08
13.94	5	5	4	0	2.5	2	25	8	65.44
0	0	0	0	0	0	0	0	0	0
35	3	5	5	5	2.5	2.5	25	9	92
0.26	0	0	0	0	0	0	0	0	0.26
27.1	5	5	5	5	0	2.5	25	8	82.6
25.96	5	5	5	5	2.5	2.5	25	10	85.96
38.18	5	5	5	5	2.5	2.5	25	10	98.18
38.44	5	5	4	5	1.5	2.5	25	8	94.44
37.92	5	5	5	5	2.5	2.5	25	10	97.92
5.2	0	0	0	0	0	0	0	0	5.2
12.38	2	5	3	0	2.5	2	0	0	26.88
18.38	5	5	5	5	2.5	0	25	10	75.88
35.06	5	5	3	5	2.5	2.5	25	10	93.06
15.34	5	5	0	0	2.5	0	0	0	27.84
27.92	0	5	0	5	2.5	2.5	25	0	67.92
38.8	5	5	4	5	2.5	2.5	25	10	97.8
22.98	5	5	4	4	0	2.5	25	8	76.48

Table 1 Concentrated data to analyze

Results

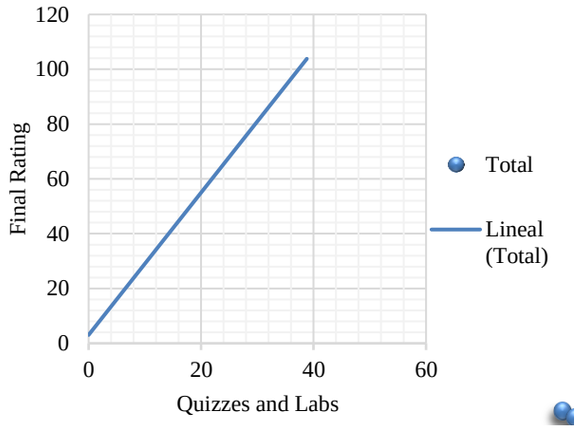
In this section some of the main results found are presented.

Correlation analysis: Pearson's coefficient describes the correlation between the total performance of the course and the elements of the SPOC, in Table 2 it can be observed.

Activities	Correlation coefficient	Interpretation
Quiz and Labs	0.94	The variables are closely related
1st Exam	0.67	The variables have a medium strength of association
2nd Exam	0.78	The variables have a medium to large strength of association
3rd Exam	0.64	The variables have a medium strength of association
4th Exam	0.92	The variables are closely related
5th Exam	0.63	The variables have a medium strength of association
6th Exam	0.78	The variables have a medium to large strength of association
Final exam	0.95	The variables are closely related
Briefcase	0.91	Variables have strong association strength

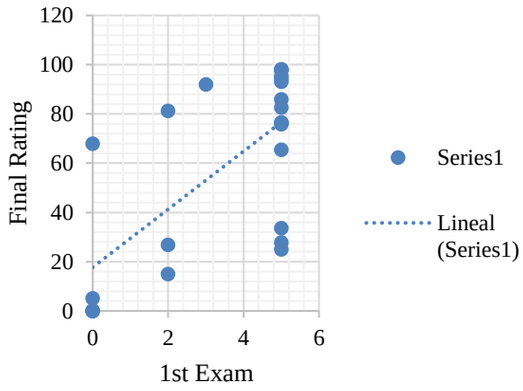
Table 2 Correlation of analysis variables

From the data analysis it turned out that the completion of quizzes and laboratories is closely related to student learning, reaching a very significant correlation of 0.94. With which it is confirmed that the online activities carried out through the SPOC and in a blended learning environment are identified as main in the student's learning, allowing them to access the study material at any time in addition to having various materials and above all having feedback through both synchronous and asynchronous virtual forums as shown in Graph 1.



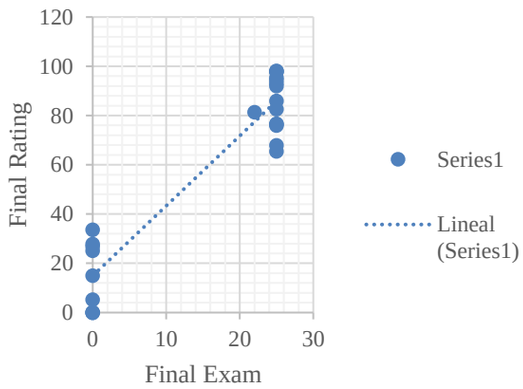
Graphic 1 Correlation between quizzes and labs and course performance

On the other hand, when analyzing the partial evaluations, it was identified that at the beginning of the course the correlation was positive but weak, an adaptation to the SPOC course materials can be interpreted, since in the subsequent partial exams the correlation was increasing (0.64, 0.67, 0.78, 0.92), an example of this is presented in graphic 2.



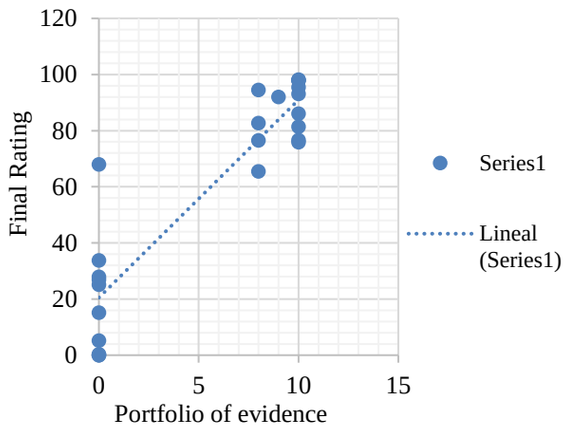
Graphic 2 Correlation between 1st midterm exam and course performance

On the other hand, the exam at the end of the course shows a close correlation (0.98), which represents a total adaptation of the students to the SPOC course, in addition to contributing significantly to their performance. Graph 3 presents this information.



Graphic 3 Correlation between final exam and course performance

As a review mechanism, at the end of the course the students delivered a final portfolio of performance evidence, Graphic 4 shows a positive and very close correlation of 0.91.



Graphic 4 Correlation between portfolio and course performance

Conclusions

In this research, blended learning was designed and implemented through a SPOC course during one semester for the educational experience of networks and telecommunications to explore the performance of the students and the personalized attention received through various techniques and tools hosted on the platform. of the course.
It is concluded that the online learning data that involves part of the blended learning learning activities can be used to improve student performance, and the characteristics related to the tasks during the development of the same were considered as main for a good overall student performance.

Correlation analysis provides important factors for the implementation of SPOC courses and allows teachers to learn about the point-to-point relationships between applied tasks and student performance, as well as a proposal to provide personalized attention in virtual teaching.

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