Inverted Classroom in Self-regulated Learning during the Covid-19 Pandemic in University Students

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Abstract

The year 2020, the Peruvian authorities decreed the development of virtual learning in universities, due to the appearance of the pandemic that originated the COVID.19, in order to avoid the increase of contagions, it is this context that the higher houses of study should, implemented strategies to improve the performance academice of the students, being one of them the use of the inverted classroom, the objective of this study was to demonstrate that the use of the Inverted Classroom significantly influences the self-regulated learning during the pandemic of the COVID-19. The method used was quantitative, basic, with a quasi-experimental design, applying a program to second cycle students of a public university.

From the statistical processing it was possible to conclude that the inverted classroom significantly influences self-regulated learning.

Keywords

Self-regulated Learning, Flipped Classroom, Pandemic and Covid-19.

Introduction

The appearance of the pandemic of COVID-19, determined in 2020 that the Peruvian government like other countries establish the virtual learning system, to avoid the increase of contagions; promulgated the RV No. 085 "Guidelines for the continuity of higher university education service, in the framework of the health emergency by COVID-19" (MINEDU, 2020) in this document were given the guidelines of the educational service, curricular adaptations, methodology, implementation of platforms and training of teachers in digital competence; However, this modality was not new for many universities which already taught classes in a semi face-to-face or virtual way, according to the regulations that allowed the University Law No. 30220 in Article 47, described its nature and characteristics (MINEDU, 2014).

The challenge during this context was to involve university students in this form of virtual learning, taking into account that when they chose a university for their professional training it was face-to-face, so that many were not prepared to have the necessary technological resources and an adequate internet connection, which revealed the digital gaps in Peru that prevented the continuity of the educational service (Gómez & Escobar, 2021). A similar situation to the Peruvian one occurred in other countries, for example in Spain (Ortega Ortigoza et al., 2021) described that this study modality generated uncertainty in the university community: but at the same time it demanded challenges that allowed the use of technological tools in teachers and methodological adaptations. In this line, also the United Nations Educational, Scientific and Cultural Organization (UNESCO) pronounced itself on the subject and recommended to the countries that no student could be left behind, due to the pandemic they are responsible for executing the best actions (UNESCO-IIESAC, 2020), besides this situation also demanded reflection, if the need to maintain academic continuity for students to complete their cycles, was allowing to train future professionals according to the required graduate profiles, (Miguel, 2020) the characteristics of teachers and university students in virtual education, is not the same as face-to-face, therefore the preparation in the use of digital tools and development of classes was necessary.

It is in this sense, according to the health emergency caused by the COVID-19 pandemic, to test strategies that would allow virtual learning, in which the student would be engaged, connecting through synchronous or synchronous communication, maintaining their professional training.

### The Student as the Center of their Learning

Universities within fulfill a democratic and inclusive role. form future professionals according to their needs and styles, they become the protagonist of their training and the teacher is only a facilitator, for this reason it is promoted that students are the center of learning, in recent years innovative methods have been promoted in universities to involve them (Gargallo López et al., 2017) in which education moves away from the cognitive side; on the contrary strategies that favors self-regulation, metacognition and collaborative work were designed. In addition, (Tintaya, 2016) the way it is taught will also determine their personality, because it assumes responsible and reflective behaviors, which will be used as a professional, on the other hand the houses of higher education are spaces for discussion and promote research, which will make available to society, for such reason, it is essential to provide students with quality education (CNE, 2019).

The Inverted Classroom

In the inverted classroom, the traditional way of developing class sessions was abandoned, in the university it was frequently carried out during face-to-face education, the master class, which was characterized by being expository; however, in virtual learning the teacher had to resort to resources that would make their sessions more dynamic, for example, as the use of branching, instead in the inverted classroom the main drivers (Bergmann and Sams, 2012) "turn the class" was the proposal of the authors realized that, providing in advance the resources such as a video, allowed to arrive with a certain degree of knowledge to school, where they would perform the tasks. "The flipped classroom is a methodology in which direct instruction becomes effective and efficient when done individually" (Ventosillalla et al., 2021).

The teacher becomes a facilitator in the class, advises and guides the students, who will develop more complex activities, which require analyzing, interpreting, judging, analyzing, reflecting, etc. (Ketil, 2019) seeks meaningful learning through autonomy, seeking interactivity (Abío et al., 2017; Martínez-Olvera et al. 2014; Ligarretto and Hernández, 2020; Hernández Silva and Tecpan, 2017).

For (Yuan and Moran, 2018) the teacher becomes a support, because it does not develop the traditional expository class, will have more time in the classroom to guide students. For the implementation of this model in the classroom, it is necessary to have access to Information and Communication Technologies (ICT) (Martinez et al., 2014). The pandemic by COVID-19 has improved the use of technological resources, in the platforms of which university students have to enter their courses, is the virtual classroom those that contain a set of resource, which favor their self-training, in that sense, when the synchronous meeting or videoconference is held, the guidelines for the development of an academic product are socialized. In addition, the sessions are recorded, in case there are doubts that could not be captured. Arráez et al., (2018) argued that, that in recent years the use of this method in universities, has evidenced improvements in the final grades of students; also another advantage making comparisons was that, in school the teacher has more time to attend to students; however, the teacher in higher education has limited schedules and curricular requirements, which must be met according to the schedules, the classroom represents a help, because on the platforms can be placed a number of resources, these will facilitate greater access information of the academic content necessary for the course. (Haftador et al., 2021) this method of the inverted classroom, encourages the university student, that in classes perform practices and learning according to the disposition of their time perform them at home, also the teacher can give a more personalized attention and feedback (Cho et al., 2021). Finally, for this experience to be enriching, the contents that are shared should be selected very carefully, because since the student can review them, he can feel motivated to put them into practice (Lastayo, et al., 2018).
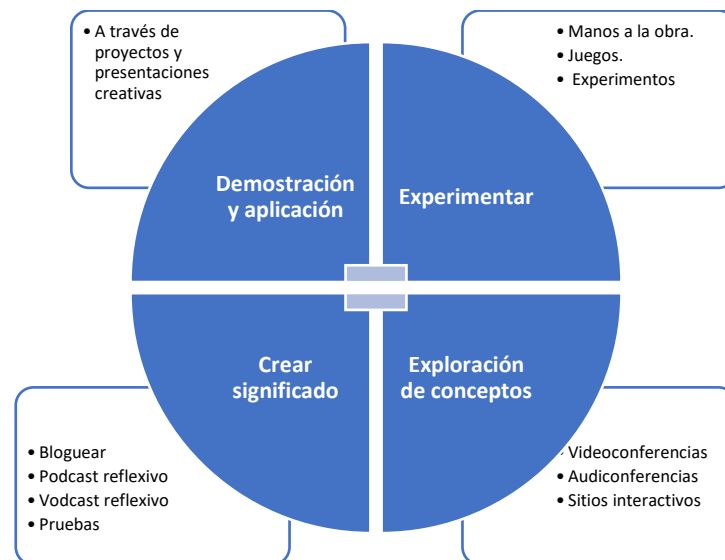
Figure 1 Structure of the inverted classroom
Note: Adapted from Zhong, Song and Jiao (2013)

Self-regulated Learning

In higher education in virtual learning the student regulates their time, this strategy is not exclusive to the juncture of the health emergency by the COVID-19, it was already starting years ago (Torrano et al., 2017), for such reason, it must be a fundamental competence which will allow the ideal academic development in their professional training, being motivated to correctly manage their own resources and learning tools (Navea, 2018; Chaves-Barboza and Rodríguez-Miranda, 2017), it becomes an active and autonomous subject, able to regulate their cognitive processes (Cosi, 2020; Suárez and Fernández, 2015).

Taking into account the above, the objective formulated in this study was to demonstrate that the use of the inverted classroom significantly influences self-regulated learning during the COVID-19 pandemic in university students, for which a program was designed. This study was considered a significant contribution to the academic community because it has been carried out when the ravages caused in education by the health emergency were being experienced, which will allow future researchers to make comparisons, pre pandemic and post pandemic; in addition, to understand that educational processes are changing, having to adapt to the context or moment.

Method

The method was used within the positivist paradigm, with quantitative approach, Basic type and quasi-experimental design, a program was applied in which the use of inverted classroom was implemented to students of second cycle of a public university, to a population of 102 students who were divided into 51 control group and 51 experimental group.

Inclusion criteria were considered to be active students with current enrollment for 2021, in addition to students of the general courses, in the exclusion criteria the participation of students of higher years and those who due to the advanced of the cycle had in excess of absences was disqualified.

A Likert scale instrument was constructed to measure the participants' perception of the effectiveness of the program. A sample of 30 students was used for its reliability.

Table 1 Reliability of the instrument

| Variable	Reliability Statistic	Value	No of elements
Self-regulated learning	Cronbach's Alpha	0.919	60

According to the information in Table 1, the instrument was found to be highly reliable. Due to the contesto that is going through the health emergency, a form was developed in Google Forms which was distributed via WhatsApp, and informed consent was requested from the participants.

Results

The following are the results according to descriptive statistics.

Table 2 Pretest and post test of self-regulated learning

			Self-regulated learning			Total
			Inadequate	Regular	Suitable	
G. control	Pre	fi	48	4	0	52
		% fi	92.3%	7.7%	0%	100
	Post	fi	47	5	0	52
		% fi	90.4%	9.6%	0%	100
G. experimental	Pre	fi	47	5	0	52
		% fi	90.4%	9.6%	0%	100
	Post	fi	1	30	21	52
		% fi	1.9%	57.7%	40.4%	100
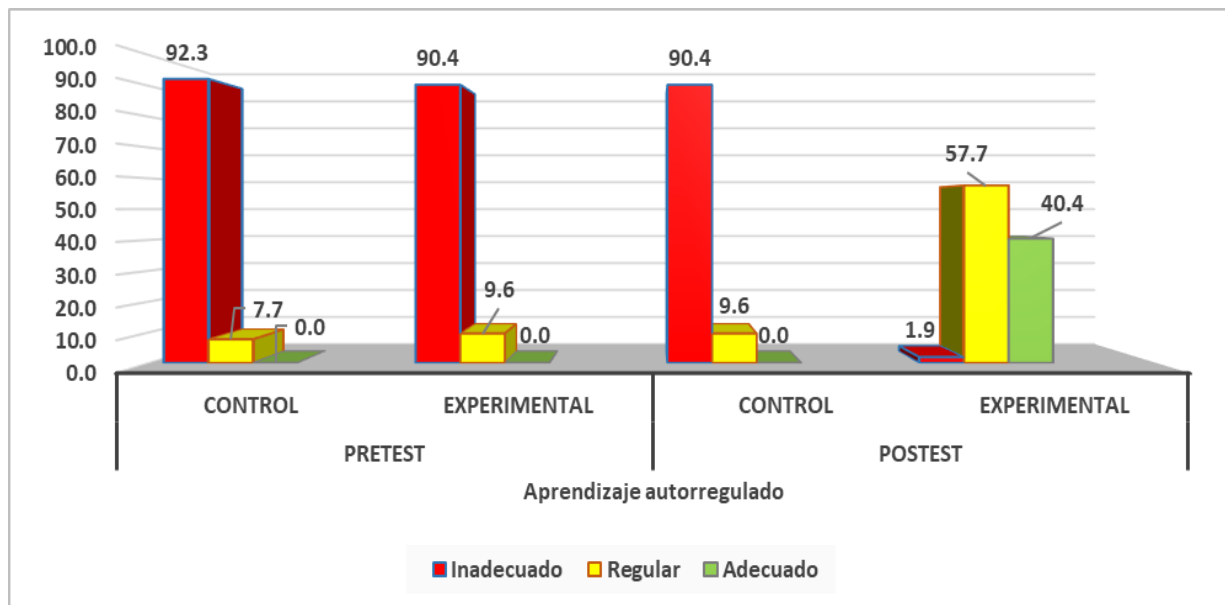
Figure 2 Percentage levels of self-regulated learning

In table 2 and figure 2 it was found that in the pretest and post test control presented close results. In the pretest of the experimental group, 90.4% evidenced inadequate level, 9.6% in regular level and the post test of the experimental group 1.9% was found in inadequate level, 57.7% in regular level and 40.4% achieved an adequate level.

According to the inferential statistical processing, the data obtained were as follows:

General Hypothesis Testing

H0: The flipped classroom does not significantly influence self-regulated learning during the COVID-19 pandemic in college students.

Ha: The inverted classroom significantly influences self-regulated learning during the COVID-19 pandemic in university students.

Table 3 Before and after applying the program in self-regulated learning

Test Statistical Ranges							
	Group	N	Average Range	Sum of ranks		Self-regulated learning Pretest	Self-regulated learning Posttest
Self-regulated learning Pretest	Control	52	51,46	2676,00	Mann-Whitney U test	1298,000	6,000
	Experimental	52	53,54	2784,00	W for Wilcoxon	2676,000	1384,000
	Total	104			Z	-,351	-8,752
Self-regulated learning Posttest	Control	52	26,62	1384,00	Sig. Asin (bi)	,725	,000
	Experimental	52	78,38	4076,00			
	Total	104					

In table 3, the mean rank of self-regulated learning in pretest is similar in both groups, while in posttest the test of (U-Mann-Whitney test: 6,000 and z= -8,752), with a $\rho = 0.00$, which means that inverted classroom strengthens self-regulated learning, the null hypothesis was rejected.

Next, the findings before and after the application of the program are detailed, taking into account each of the dimensions that were assigned to self-regulated learning, which were: execution, cognitive, motivation and environment, also, they allowed to accept or reject the specific hypotheses.

Table 4 Before and after applying the program in the execution dimension

Test Statistical Ranges							
	Group	N	Average Range	Sum of ranks		Pretest execution	Post-test execution
Pretest execution	Control	52	48,53	2523,50	Mann-Whitney U test	1145,500	13,500
	Experimental	52	56,47	2936,50	W for Wilcoxon	2523,500	1391,500
	Total	104			Z	-1,345	-8,706
Post-test execution	Control	52	26,76	1391,50	Sig. Asin (bi)	,179	,000
	Experimental	52	78,24	4068,50			
	Total	104					

In Table 4 the test statistics for both groups of the posttest (U-Mann-Whitney: 13.500 and z= -8.706), with a $\rho = 0.00$, rejecting the null hypothesis.

Table 5 Before and after applying the program in the cognitive dimension

Ranges							
	Group	N	Average Range	Sum of ranks		Cognitive Pretest	Cognitive Posttest
Cognitive Pretest	Control	52	54,77	2848,00	Mann-Whitney U test	1234,000	11,500
	Experimental	52	50,23	2612,00	W for Wilcoxon	2612,000	1389,500
	Total	104			Z	-,768	-8,720
Cognitive Posttest	Control	52	26,72	1389,50	Sig. Asin (bi)	,442	,000
	Experimental	52	78,28	4070,50			
	Total	104					

In Table 5 the self-regulated learning of the control and experimental groups presented in the posttest (U-Mann-Whitney: 15,000 and z= -8,720), with a $\rho = 0.00$, rejecting the null hypothesis.

Table 6 Before and after applying the program in the dimension of motivation

Ranges							
	Group	N	Average Range	Sum of ranks		Motivation Pretest	Post-test Motivation
Motivation Pretest	Control	52	49,13	2554,50	Mann-Whitney U test	1176,500	23,500
	Experimental	52	55,88	2905,50	W for Wilcoxon	2554,500	1401,500
	Total	104			Z	-1,143	-8,642
Post-test Motivation	Control	52	26,95	1401,50	Sig. Asin (bi)	,253	,000
	Experimental	52	78,05	4058,50			
	Total	104					

In Table 6, the motivation of the control and experimental group of the posttest (U-Mann-Whitney: 1176.500 and z= -8.642), with a $\rho = 0.00$ ($\rho < 0.05$), rejecting the null hypothesis.

Table 7 Before and after applying the program in the environment control dimension

Ranges							
	Group	N	Average Range	Sum of ranks		Ambient control Pretest	Post-test environmental monitoring
Ambient control Pretest	Control	52	53,96	2806,00	Mann-Whitney U test	1276,000	54,000
	Experimental	52	51,04	2654,00	W for Wilcoxon	2654,000	1432,000
	Total	104			Z	-,496	-8,444
Post-test environmental monitoring	Control	52	27,54	1432,00	Sig. Asin (bi)	,620	,000
	Experimental	52	77,46	4028,00			
	Total	104					

In table 7, of the control of the environment of the control and experimental group present in the posttest results (U-Mann-Whitney:1276.000 and z= -8.4444), with a ρ = 0.000 (ρ < 0.05), rejecting the null hypothesis.

Discussion

According to the statistical processing it could be evidenced that the findings were satisfactory because the use of the inverted classroom strengthens the learning of university students in the chosen population where this research was applied, which were similar to those of Fernandez and Quispe (2019) argued that the inverted classroom helps to improve self-regulated learning based on their results the evolution was given from a low average to a high average. Likewise, Ventosilla et al., (2020) who also conducted their inquiry in university students, determined the importance of the use of ICT to develop autonomous learning in the inverted classroom, in addition the emotional aspect is included when improvements are given, for such reason it can be explored the degree of satisfaction that generated in students improve their grades and the freedom to manage their times without pressure by resorting to the academic information that was seated in the virtual classroom.

In the context of the COVID-19 pandemic, the study by (Joseph et al., 2021) conducted on nursing students at Sultan Qaboos University, Oman, in which the class was flipped and videos were made available to students in complicated courses with overloaded content, which favored having the information available before the class; in addition this study was also a program with a quasi-experimental design, after its application, learning improved, which increased their satisfaction with the course and motivated their interest in its contents. Similar results were those of (Cho et al., 2021), in the same way carried out during the pandemic in Mechanical Engineering students, which by accessing the video on their academic subjects, allowing the student to be prepared before the online class, for that reason, inverted model, had a significant association with learning. Another encouraging study that demonstrated the positive perception of students when implementing the inverted classroom was that of (Campillo-Ferrer & Miralles-Martínez, 2021) conducted with students of Education at the University of Murcia, which in the context of the health emergency showed improvements in their academic performance.

Conclusions

The inverted classroom significantly influences self-regulated learning during the COVID-19 pandemic in university students, due to U-Mann-Whitney: 1298,000 and z=-8,752), with a ρ = 0.00 (ρ<0.05). which showed that despite the difficulties that occurred in 2020 when implementing virtual learning by the Peruvian authorities, this learning

strategy was found in a means that favors the integrated access of the curricular content of students, the teacher could take better advantage of his schedule, in that sense, during the development of the sncrónicas or online classes could provide more feedback, guiding with respect to the doubts, became a support and guide.

The selection of resources and contents that are added to the platforms must be understandable and intuitive, so that there are no limitations of access or management in the students, generating dissatisfaction towards this method. In addition, it was found that the use of the inverted classroom favors the self-regulation of students, who must responsibly manage their time, in compliance with asynchronous activities and access to content, assuming a critical, analytical and reflective stance.

Finally it was possible to find in other investigations important strengths in the use of the inverted classroom, improvement in the final grades, which determines that the students conclude satisfactorily their course and do not delay from cycle to circus for failing, another strength is the emotional topic, when accessing the resources according to their times, it offers them tranquility of not feeling pressured, in addition the favorable academic results improve their academic satisfaction and consequently their identity with the university responsible for their professional formation.

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