







Technology for Learning and Knowledge Strategies in Virtual Education: A Case Study of Higher Education

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Abstract. This research is oriented to the application of Information and Communication Technologies based on Learning and Knowledge Technologies, for the development of virtual environments that improve concentration, creativity, and student interest in virtual or face-to-face classes. The objective pursued by the research is to relate ICT and TAC in the development of personal learning environments in students of higher education. The methodology used is experimental, exploratory through a quantitative approach. The technique used was the survey, using two instruments; a structured questionnaire focused on web 3.0 tools used as a pre-test, made up of 24 questions, later the previously validated instrument was applied as a post-test based on the Technology Acceptance Model (TAM) made up of 15 questions in which measures the acceptance of digital resources. The instruments were validated using the Cronbach's Alpha statistic, having high-reliability values. The population used for this research was 49 students: obtaining as a result the acceptance of the Moodle educational platform. Recognizing that ICT and TAC are fundamental in the educational field since they demonstrate an innovative educational strategy that fosters interaction with free web 3.0 tools available on the Internet, where students prefer to work with TAC tools on gamification platforms due to their ease of use demonstrating greater interest in collaborative work, optimizing time and resources.

Keywords: ICT · TAC · Virtual education · Pedagogy · Strategies

1 Introduction

The evolution of society and the innovation of technology that daily creates and designs new resources and digital tools for all areas of personal and professional use, has made it necessary for educational institutions to continuously train teaching staff for the management, control, and design of educational material from an innovative approach consistent with current technology [1].

The research develops an experimental work, which serves as the basis for the articulation of system and plan of virtual training, which facilitates the professional development of teachers in resource issues with Information and Communication Technologies (ICT), for the efficient development of the teaching-learning process in students.

The need for the academic training of a human being is an important parameter in the evolutionary process that lasts a lifetime; personal development and acquiring new knowledge is of vital importance to complete the goal set since childhood. In teaching, it is not enough to share the knowledge acquired in their professional training, but it is also important to continuously update and discover new tools and original pedagogical resources, which have a direct impact on the academic satisfaction of students and are connected to new approaches [2], methodologies and technological resources.

The pandemic and the health emergency declared by the World Health Organization (WHO), has revealed several deficiencies in educational systems worldwide, and in a particular way in our country Ecuador, according to surveys developed by UNESCO, UNICEF [3] quoted by [4], and the World Bank. Only half of the total number of countries surveyed offered training processes focused on the management of info-pedagogical resources.

UNESCO, in its study, reveals results that indicate that 81% and 78% of primary and secondary teachers, respectively, worldwide, barely meet the minimum requirements to carry out their work as educators. In the case of the Latin American population, the problem is even more alarming since the results reflect that 83% and 84% of primary and secondary teachers, respectively, do not have or handle the basic tools to face the challenge imposed by the new virtual education modality [5] quote by [6].

Lifelong learning is an important aspect that guarantees quality comprehensive academic training, which endorses significant knowledge, where TIC TAC TEP takes a fundamental place. The impact is that the student feels motivated through the educational process in a personal learning environment suitable for the development of skills. The problem is evident with the use only of ICT in the educational field, therefore, it is intended to improve the didactic strategies used in the teaching of English, in which teachers must change their conventional pedagogical practices in interaction with the student, applying technologies to build knowledge [7].

In this context, the originality of this project is aimed at relating ICT and TAC to obtain content in a more dynamic and flexible way, involving different learning styles and responding to the current needs of the Educational Institution, enhancing training and continuing education according to with the study variables. In Ecuador, the Ministry of Education undertook an online training project for the entire teaching staff at the national level in 2016, after the declaration of the health emergency in 2020, an emerging training process was activated with several training courses that aimed to support teachers to face the challenge of virtual education [8]. The objective pursued by the research is to relate ICT and TAC in the development of personal learning environments in students of higher education. The methodology used is experimental, exploratory through a quantitative approach.

2 State of the Art

The development of new technologies allows the elimination or reduction of time and barriers between individuals, shortening the geographical distance around the world, even outside it for almost instantaneous communication. What a few years ago was developed as a complement, today has become an undeniable necessity, because if we

look around us it is easy to notice that we are surrounded by technology and interconnected through it. This process of technological and telecommunications development has allowed the creation of new working fields and the development and improvement of the standard of living of society [6].

ICTs are technologies that, with information technology, microelectronics, and telecommunications, create innovative forms and methods of information exchange, using tools and devices of a communicational and technological nature. This information processing method has managed to combine information technologies (IT) and communication technologies (CT); CTs are made up of media such as television, radio, and even mobile telecommunication, while IT is focused on information processing through digital methods and content management [9].

By combining these technologies, a network of communication channels is developed without time limits or distance barriers, making it possible for people to see and hear situations or events that occur anywhere in the world almost instantly. A practical example of the use of these communication networks is the new modality of teleworking and Tele-education that the society had to face due to the declaration of a health emergency and subsequent confinement worldwide due to COVID 19 during the years 2020 and 2021 [10].

TACs are constituted in two great areas of attention: the computer and communicational nomenclature. On the other hand, the process of transmitting knowledge to facilitate understanding in the various areas of development of a society or organization it is exploring positive actions that generate knowledge, thus allowing true digital inclusion, where teachers share with their students an entire accumulation of necessary information in real-time [11]. All this by assigning categories from which the initial interest that each teacher has about ICT and the use of tools such as individual blogs, collective blogs, and blogs in the classroom are fostered.

Also considering that, in this research, a technological literacy was given to strengthen the skills and abilities in the management of technological knowledge that allows greater integration of teachers for cooperative work, both in their lines of research and in their extension activities [12].

Within the educational environment, there are also applications of TACs in the development of inclusive practices implemented with students who present an attention deficit hyperactivity disorder, in which they refer to the use that students can make of this medium for the improvement of your learning. The potential that TACs have in an educational environment, especially for students with specific educational needs, is very remarkable since they make it possible to scaffold many of the difficulties student learning [13].

Considering the interest, the majority of children have for Learning and Knowledge Technologies (TAC), the educational strategy based on learning centers where working with technology is included will increase the incentive towards learning. It is important to take advantage of all the resources at their disposal in order to ensure that the student understands the contents around the center of interest in a relevant and attractive way [14].

The primary objective of education is intended in offering the student the possibility of creating their own knowledge based on their experiences. For the educational system, it

is essential to have methodologies that facilitate the process and learning can be obtained with all the information acquired from various sources such as radio programs, television and physical documentation generated by educational entities or by the teacher himself (Bravo Mancero & Varguillas Carmona, 2020; United Nations - ECLAC, 2020).

The use of ICT in the educational process is essential to maintain the constant relationship between teacher and student since they can transform, improve, and complement education. One of the hypermedia that has facilitated remote work is virtual education, which consists of maintaining lines of communication through technologies that facilitate the exchange of digital resources. The activities that take place in a virtual environment must necessarily encourage students to autonomously build their knowledge.

All these changes have made educators be committed to the skills in digital resources management in order to improve the experience of virtual education. Thus, breaking the paradigm of the use of technology in the educational process by making use of platforms such as Moodle or Blackboard that facilitates the application and development of pedagogical strategies, which in some cases are new since they are not fully familiar with them [15].

Within the technological advances at the educational level, virtual learning environments have a greater acceptance in the teaching process due to the benefits they provide. Technological exploration has become a challenge for current pedagogical models increasing the application of innovative strategies that favor the development of skills that allow students to foster a critical and reflective capacity of essential knowledge in different media.

These environments have the purpose of becoming a space that enables a diversification of the different teaching modalities in all the different educational levels. One characteristic that virtual learning environments have is the functionalities that facilitate communication between the participants, which ends up promoting new roles for the teacher, seeking to play the role of guide and moderator: while for students, through a more active role in the construction of knowledge. All this is possible thanks to the fact that these areas offer work and collaboration spaces for the different research teams [16].

Education has changed since the moment new technologies were incorporated in the 90s, through the generation of new programs and the incorporation of technological mediations, as a complement to face-to-face programs, making it possible to reconfigure teaching-learning methodologies and propose new strategies.

Lines of education have been developed hand in hand with lines of educational research, which seek to strengthen the teaching-learning process through technology. In previous research studies, the need to expand the field of study where virtual environments are applied is evident, as well as considering experiences developed in other countries as a reference [17].

Students use this software with other media resources in order to achieve educational goals; due to their benefits as they are open, flexible, and can be incorporated into any situation of the teaching-learning process. They can be supported in constructivist, behavioral, or cognitive environments, which favor collaborative and cooperative learning. It is understood then those virtual environments are spaces for the teaching and

learning process under face-to-face, virtual, and mixed modalities, in which communication processes are carried out through ICT both synchronously and asynchronously, to allow the exchange of information through processes of cooperation, monitoring, and continuous evaluation of teachers, including students [18].

Virtual teaching is supported by various digital resources, among which are the use of educational platforms, thanks to the advancement of technology and the Internet, several institutions have distance education courses, as an alternative to traditional education, giving way to the management of ICT tools through educational platforms.

In this case, the Moodle platform represents a very useful technological tool, by enabling the use of resources adaptable to different teaching-learning environments, together with methodologies that allow learning to be managed, and communication and collaboration between teachers and students to be facilitated.

When using this platform in the learning of English, positive results were obtained because the use of these virtual platforms contributes favorably to the attitude that students take towards behavioral learning, also it reinforces students' intrinsic motivation [19].

One important issue that must be considered when using the Moodle platform is in terms of functionality since experts emphasize the importance of designing its environment, which must be intuitive, easy to handle, and correct with the objective of facilitating access and interaction to users. Emphasizing the importance of both synchronous and asynchronous communication channels. Its main benefit is that it is an open-source tool, so it can be adjusted to the needs of users, as well as providing ease of use managing to connect study with work and thus favor relationships of reciprocal enrichment [20].

3 Methodology

The research was carried out with the students of Higher Education of Zone 3, has private support, which is in the urban area, with a morning shift.

This research is experimental because it developed a virtual learning environment in the Moodle educational platform and was used as an experiment for teaching English. The PACIE methodology was applied, using free tools of the web 3.0. The experimental method proposes the following procedure: the statement of the problem, the hypothesis, observation, experimentation, verification, and generalization.

The use of the pedagogy wheel for this research was essential since tools focused on Bloom's taxonomy were used with a change in the wheel that allows the use of gamification resources in virtual education as an important tool to select the appropriate applications for being used in accordance with the learning skills to be achieved.

For the verification of the hypothesis, the results are obtained considering the selection of the three most representative questions within the investigation, in this case, they are by the independent variable (VI) P23 and P24 and by the dependent variable (DV) P12 that are detailed below:

- Q23: Do you consider that the development of web 3.0 resources is important to improve virtual teaching and collaborative work?
- Q24: Do you think that the correct application and use of web 3.0 tools promote the interest, participation and motivation of students in collaborative work?

- Q12: How often do teachers use 3.0 tools to teach?

The most representative questions were considered when considering the development of web 3.0 resources by the teacher to improve virtual education and collaborative work. In the same way, the correct application and use of web 3.0 tools promote interest, participation, and motivation of students in collaborative work, which refer to the independent variable, ICT and TAC; and according to the dependent variable, the development of personal learning environments is used to know the frequency teachers apply 3.0 tools.

Table 1. Hypothesis summary.

Null hypothesis	Test	Sig.	Decision
The categories of Do you consider that the development of web 3.0 resources by the teacher is important to improve teaching occur with equal probabilities	One-Sample Chi-Square Test	,000	Reject the null hypothesis
The categories of Do you believe that the correct application and use of web 3.0 tools promote interest occur with equal probabilities	One-Sample Chi-Square Test	,000	Reject the null hypothesis
The categories of How often do teachers use 3.0 tools to teach occur with equal probabilities	One-Sample Chi-Square Test	,000	Reject the null hypothesis

Table 1. shows the summary of the hypothesis test, according to the chi-square test statistic of a sample, the rejection of the null hypothesis is taken as a decision and the alternative hypothesis is accepted, with a level of significance of 0.5 and asymptotic significance.

To check the summary of the hypothesis, the three most representative questions detailed above were taken into consideration, and the Kolmogorov Smirnov statistic K-S of a sample was used, therefore, the following Hypotheses are established:

- H0: Learning technologies and knowledge as learning strategies do not contribute to virtual education.
- H1: Learning technologies and knowledge as learning strategies contribute to virtual education

Table 2. Kolmogorov-smirnov test.

		Kolmogorov-Smirnov Test for one sample		
		Do you consider that the development of web 3.0 resources by the teacher is important to improve teaching	Do you believe that the correct application and use of web 3.0 tools promote interest?	How often do teachers use 3.0 tools to teach
N		49	49	49
Normal Range ^{a,b}	Media	3,98	3,02	3,94
	Standard deviation	,829	1,266	,659
Extreme differences	Absolute	,306	,291	,374
	Positive	,245	,199	,320
	Negative	-,306	-,291	-,374
Z de Kolmogorov-Smirnov		2,140	2,034	2,616
Sig. asintót. (bilateral)		,000	,001	,000

a. Contrast distribution is normal.

b. It is been calculated from data.

Table 2 verifies the hypothesis considering the P-value of the relative questions for the experimentation that is, having a P value less than 0.05 in the three cases, the null hypothesis is rejected, and the alternative hypothesis is accepted.

Therefore, the scores that were obtained within the experimentation have a normal distribution and at the same time, they allowed to measure the degree of concordance that the distribution of the data and its experimentation had, finally it was possible to contrast that the development of the applied personal learning environments to the population gave positive results.

4 Results

To demonstrate the results obtained within the investigation, the most representative questions were considered and from which the most relevant data for the investigation and its results were obtained (Table 3.) (Fig. 1).

Question 1: What type of web 3.0 tools do you use to make conceptual and mental maps in virtual classes?

Table 3. Web 3.0 tools to create conceptual and mental maps.

		Frequency	Percentage
Valid	Creatly	12	24,5
	Lucidchart	32	65,3
	Mindmodo	2	4,1
	Bubbl.us	2	4,1
	Mind meinster	1	2,0
	Total	49	100,0

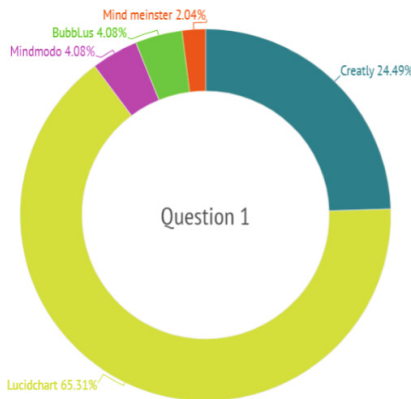


Fig. 1. Tools to create conceptual and mental maps.

Of a total of 49 students, 32 students, which corresponds to 65.30% mention that the web 3.0 tool used to make conceptual and mental maps is Lucidchart. The 24.50%, which are 12 young people, indicate that the tool used is Creatly. The 4.10%, who are 2 young people, indicate that the tool used is Bubbl.us, the other 4.10%, who are 2 young people, indicate that the tool used is Mindmodo and the remaining 2.0%, which is equivalent to 1 student, affirm that the tool used is Mind meinster. In these results, it is observed that the students in most works corresponding to the development of conceptual and mental maps use the Lucidchart tool (Table 4.) (Fig. 2).

Question 2. What kind of web 3.0 tools does your teacher use for the evaluation of synchronous and asynchronous classes?

Table 4. Web 3.0 tools used for assessment.

		Frequency	Percentage
Valid	Educaplay	1	2,0
	Kahoot	48	98,0
	Total	49	100,0

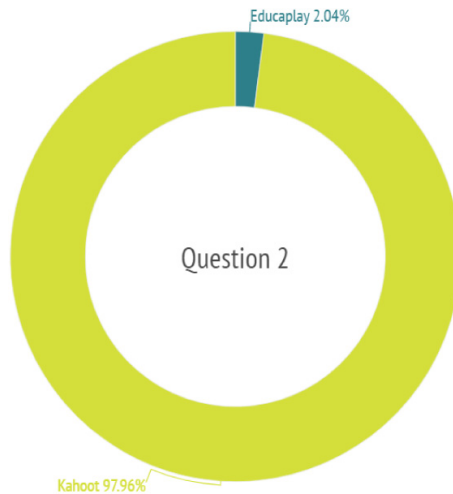


Fig. 2. Tools used for assessment.

Of a total of 49 students who represent 100%, 48 students that correspond to 98.00% affirm that the tool used by the teacher for the evaluation is Kahoot and the remaining 2.00% that corresponds to 1 student mentions that the platform used is Educaplay. Results allow us to know that teachers use the Kahoot platform more frequently for the evaluation of knowledge in their students (Table 5.) (Fig. 3).

Question 18. From the following list, which tools does your teacher use for learning purposes in synchronous classes?

Table 5. Tools used by teachers for the learning process

		Frequency	Percentage
Valid	Blogs	7	14,3
	Wikis	4	8,2
	Social network	3	6,1
	Digital documents	25	51,0
	Multimedia Resources	2	4,1
	Education platform	6	12,2
	Podcasts	1	2,0
	Interactive boards	1	2,0
	Total	49	100,0

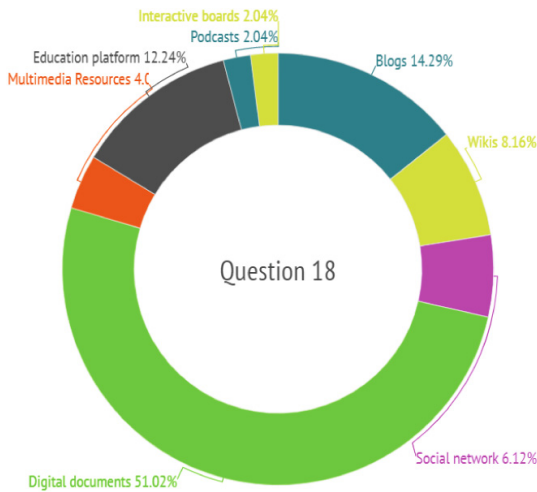


Fig. 3. Tools used by teachers for the learning process

Of a total of 49 students who represent 100%, 25 students that correspond to 51.00% affirm that the tool used by the teacher for learning purposes is Digital Documents. The 14.30% that are 7 students mentioned that they use tools such as Blogs. The 12.20% of which are 6 students mention that they use educational platforms, 8.20% of which are 4 students mention that they use Wikis. The 6.10% of which are 3 students mention that they use social networks, 2.00%, which is 1 student, mentions that they use Podcasts and the remaining 2%, which corresponds to 1 student, affirms that they use Digital Whiteboard. Results allow us to know that teachers use digital documents more frequently for learning purposes due to the advantage of having valuable bibliographies in scientific databases (Table 6.) (Fig. 4).

Question 19. How important is the use of web 3.0 tools in your learning in virtual classes?

Table 6. Importance of Web 3.0 tools in the learning process

		Frequency	Percentage
Valid	Low importance	1	2,0
	Slightly important	8	16,3
	Important	19	38,8
	Very Important	21	42,9
	Total	49	100,0

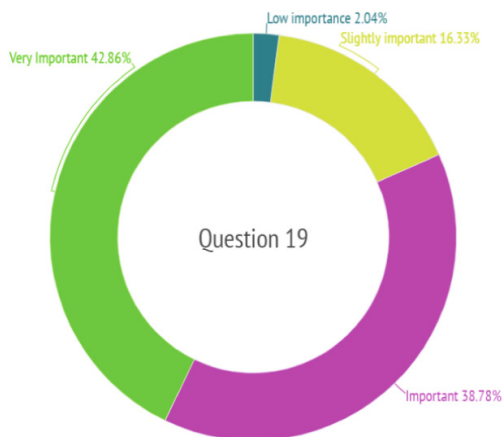


Fig. 4. Importance of Web 3.0 tools

Of a total of 49 students, 21 students, which corresponds to 42.90%, state that the use of web 3.0 tools in learning processes is very important. The 38.80%, which are 19 young people, mention that it is important, 16.30% that is equivalent to 8 students affirm that it is moderately important and 2.00% that is equivalent to 1 person indicates that

it is of little importance. It can be affirmed that most of the students consider that the use of web 3.0 tools in their learning is very important because of the advantages they obtain by using the different technological tools available.

5 Discussion

The current situation forces teachers to innovate the methodological and didactic strategies used in the teaching-learning process of English, allowing them to take advantage of the resources, creativity, and skills of the student in virtual classes. Technology constitutes fundamental support demonstrating a favorable response in the development of ICT and TAC in learning in a participatory and dynamic way. Personal learning environments based on TACs are fundamental since they present an innovative educational strategy that fosters adequate interaction with several free web 3.0 tools available on the Internet, facilitating understanding and the student's experience of learning at their own pace and style.

All the information analyzed through statistical tables and graphs after the application of the technology acceptance model generated important results correlating the perceptions of the population with respect to the experimentation carried out through a training instrument. The results obtained represent beneficial information that contributed significantly to the verification of the hypothesis, which focuses on the relationship between teacher training and meaningful learning. The analysis carried out with the data allowed the design and creation of an online platform for teacher training in five digital tools that were relevant in the experimentation in the population.

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