Journal of Engineering Education Transformations ,
Volume 36 , No. 3 , January 2023 , ISSN 2349-2473, eISSN 2394-1707

10.16920/jeet/2023/v36i3/23099

Impact of Telematic Tutoring on the Teaching and Learning of Scientific Knowledge

Patricia Cecilia Orbegoso Ciudad
Universidad Católica sede Sapientiae
patriciaoc22@yahoo.com

Abstract : Tutoring acquires a special significance as it is designed, at least in theory, to facilitate autonomous learning with the accompaniment of the professor as a specialist in the disciplinary area. The objective of the study was to determine the impact of telematic tutoring on the teaching and learning process of scientific knowledge of engineering students at Alas Peruanas University in the city of Lima during the I lapse of 2020. Quantitative study of quasi-experimental design with pre- and post-test in a sample of 120 male and female students, all engineering students of Alas Peruanas University of Lima, Peru. The results determined a significant impact of telematic tutoring in the inquiry, experimentation and critical judgment skills; furthermore, it could be determined that students significantly increased their average performance after the intervention of the teacher as a telematic tutor in the teaching and learning process of scientific knowledge related to the engineering area. In conclusion, the use of telematic tutoring in the teaching and learning process in the engineering area has been shown to have a direct and significant impact on the scientific knowledge of university students.

Keywords : learning; scientific knowledge; teaching; telematics; tutoring.

1. Introduction

N the face of such an unstable global reality, subject to constant changes in the social, political and economic context, especially in the wake of the COVID-19 pandemic which, according to Álvarez (2020), served as a catalyst, education systems worldwide were forced to make drastic changes in their educational activities, including in the training of their students.

According to the United Nations Educational, Scientific and Cultural Organization (2020), the advent of a new era has accelerated, demanding the acceptance and coping with educational change in a completely different environment than the one we are used to. Given that, information and communication technologies (ICT) have long since transformed the way we connect and communicate with each Other, to the point that they have changed the way we organize ourselves, work or learn.However, meaningful learning in a hybrid modality requires the teacher to play the role of telematic tutor, through which, in

Patricia Cecilia Orbegoso Ciudad
Universidad Católica sede Sapientiae
patriciaoc22@yahoo.com

addition to guiding, accompanying and evaluating both a group of face-to-face students and a group of students participating virtually, he/she assumes the task of designing learning spaces along platforms in line with the real needs of his/her students.

In this context, the concept of Appropriate and Critical Educational Technology (ACET) is assumed, according to which education is seen as an open space for critical reflection to investigate and compare educational practices mediated by techno-pedagogical actions, which cause various domains in the structural and socio-cognitive functions of people who learn through face-to-face, virtual or distance educational practices (Fainholc, 2009; 2012).

Consequently, during the contingency most university institutions were strongly affected by the need to adapt and redefine their teaching methods and techniques, having to focus on the massive modality of virtual classes, and in many cases, accelerate the digitalization process previously experienced by the increasing globalization and use of new technologies (Alvarez, 2020) by students, forcing most universities to undertake diverse activities to guide, train and orient their students.

Thus, new distance learning formats began to emerge which, thanks to the advance of technological development, adapted quickly to the new educational reality. Faced with the pandemic and its respective consequences, new teaching and learning models began to emerge, among which the hybrid model prevailed, currently being conceptualized and experimented with (De Obesso & Núñez, 2020). Thus, without interrupting the study period, it was necessary to become familiar with computer tools (Moodle, Teams, Stream, among others), however, for many teachers this type of activity represented only a first experience of distance learning or e- learning (Marcus, 2020), so that the quality of education has currently been compromised (Amaya, Cantú & Marreros, 2021), observing to some extent fatigue and apathy, in addition to very little participation of students in the educational process, so that even the achievement of virtual learning is not guaranteed in its entirety (Bagley, 2020).

Despite this, Hodges et al. (2020) point out that it is incredible the effort that some higher education institutions have made to move their academic activities to a fully online modality or to a hybrid teaching model, which is still known as emergency remote education, a term that, according to Alvarez (2020), is used to refer to the educational process that was developed during the pandemic, transforming the face-to- face class into a virtual classroom using methodologies, resources and curriculum similar to those used in the face-to- face model.

Faced with this new reality, educational institutions, especially universities, were forced to transform the traditional, distance and virtual education models into a complementary model, capable of taking advantage of the strategies and resources of each modality, assuming the role of the professor as a telematic tutor.

A new modality in which, according to Viñas (2021) the participants (students and teachers) had to self-organize to create new spaces of interaction mediated by the existing technology and take advantage of the different learning styles. According to Felder (1993), the use of different methodologies makes it possible to harmonize different learning styles in the student, thus helping to maintain their interest in mastering the subject. In the new reality, the role of the teacher as a telematic tutor begins to take center stage.

In line with what was stated in previous lines, this research aims to determine the impact that telematic tutoring has had on the teaching and learning process of scientific knowledge in engineering students at Alas Peruanas University in the city of Lima during the first term of 2020.

A. Development

In the face of the current crisis caused by SARCOVID-2, the computer or telematic teleprocessing is presented as an alternative to ensure the continuity of the university academic process, since, according to Marabotto & Grau (1999), it offers access not only to a new interconnectivity but to a model that allows the interaction of users through communication networks, also allowing the autonomous processing of data and communication between people.

B. Telematics and ICT: alternatives for quality education

Currently, the aim is to bring both the teacher and the student closer to virtual applications and a large number of interactive educational resources through

an alternative approach that, according to Burbules and Callister (2001) cited in Fainholc (2019), allows seeing technology not only as simple tools or means to continue doing better and faster what was already being done, neither as simple innovations to do things that were unthinkable before, but as a technique capable of modifying users' perceptions, changing interpersonal relationships and transforming the concept of time and space, with special emphasis on how people use them (p. 17).

In this context, rethinking what is meant by quality virtual education requires reflecting on the contextual, historical, cultural and organizational relevance of science and technology practice within educational programming that is increasingly integrated with a combination of the face-to-face (Fainholc, 2019) and the virtual.

Now, due to the continuous technological development and the proliferation of innovative pedagogical methods as effective tools that offer new ways of teaching and learning in the face of the new reality, ICTs are gaining special interest. So online teaching has proven to be an excellent way for teachers to involve their students in their own learning process (Sánchez Rivas et al., 2020) Hence, the aim is to implement effective and quality methods and tools in the teaching and learning processes, adapted to the needs and demands of both the face-to-face and digital context, using technology as a key factor for the education of the present and the future.

In the words of the aforementioned authors, ICT can help students acquire the skills and abilities necessary to make them competent individuals in the use of information technologies, capable of solving problems and making decisions autonomously, encouraging creativity and efficiency in the productive use of these digital tools, eventually turning them into responsible citizens who are knowledgeable about the environment around them.

The incorporation of digital tools into the education of the present and the future is shaping a process that has led to the emergence of a new educational environment in which the role of teachers and students is redefined, making didactic relationships a closer and more committed activity, since the aim is to create relevant, functional and meaningful learning (Sánchez Rivas et al., 2020) through telematics.

In this sense, one of the main applications of telematics are computer applications, which arise from the need to connect personal computers through networks so that users can exchange information or share resources. In this sense, telematics, according to Echeverría (2001), allows the creation of a new ecological space, where social processes and relationships are configured and inscribed, which, for many, are known as third environment, in which telecommunications and information technology are combined.

Therefore, the field of education cannot remain oblivious to the development of the information society, which is why teaching is also moving towards a model that is increasingly moving away from the lecture or classroom, in which the teacher was the center of the system, to a blended model that encourages student participation as the subject and object of learning, in which the teacher assumes the role of learning tutor.

C. Telematic tutoring: a new training function in the university context

In any presential teaching-learning process, both the teacher and the student must be present as participants interacting through a communication process; however, in the case of telematic learning, in addition to virtual environments, the use of technology is required, based on the following essential elements:

1) Preparing Telematic tutor.

2) A computerized learning server, equipped with an application to manage the process.

3) Necessary learning materials or online and offline resources, such as physical or virtual books, files, videos, etc. (Bueno, 1996).

No In a tele-training system, the tutor is an elementarycomponent of distance learning, and feedback is the basic principle of self-learning support. In this sense, telematic learning is interpreted as didactic advice aimed at solving not only conceptual problems, but also procedural and attitudinal problems related to the management of the didactic material, the adequacy of the methodology, the specific needs of the students and the learning process in terms of learning habits and methods.

In telematics tutoring, guidance and learning support are essential and important aspects for the successful completion of the student's training. Within this context, it must be taken into account that students have different conceptions about the subject, as well as different abilities and interests among them; therefore, the tutor must also take into account the time that their students will dedicate to learning.

2. Method

Quantitative study, which followed a descriptive-correlational, non-experimental and cross-sectional design, which according to Hernández et al (2014) suggests a set of processes that respond to a strictly predetermined sequence, being possible to redefine some of its steps depending on its intentionality.

A. Sample

Study that was intentionally conformed with a sample of 120 students of both sexes of a population 401 engineering students of the University "Alas Peruanas", Lima during the academic period I-2020, corresponding to 30% in attentio to the points of Sáez López (2017).

B. Instruments and technique

Correlational research that used the survey as a technique for data collection through a100-item evaluation questionnaire related to the variables tutoring and learning of scientific knowledge, as well as their respective indicators, with the objective of determining the level of influence of telematic tutoring in the process of teachingand learning of scientific knowledge of engineering students of the ALAS Peruanas University in the city of Lima, taking into consideration the levels of learning according to a scale of assessment of achievement of Very Good, Good Regular and Deficient.

C. Validity and reliability

Regarding the validity of the instrument, a pilot test was applied to 20 students, representing one third of the sample, using Cronbach's alpha statistical analysis, in which a coefficient of 0.86 was obtained. Taking this into account, the instrument was previously analyzed by experts, who gave their opinion from a professional point of view, thus allowing its validation.

D. Data analysis

Figures To carry out the data analysis, all the information was processed through a Microsoft Excel database in Microsoft Office and, subsequently, the IBM Statistics SPSSV 24 statistical program was used to determine the relationship between the variables using Student's t-test.

3. Results

A. Descriptive analysis

Table 1 shows that, before the treatment, the students in the control and experimental groups were at the "Deficient" level in all the parameters analyzed,

Table 1 : Telematic Tutoring in The Control Group and in the Pretest Group

Group/ Scale	Work Equipment		Addressees		Material resources		Computer resources		Didactic Resources	
	fi	hi	fi	hi	fi	hi	fi	hi	fi	hi
Very good	0	0	0	0	0	0	0	0	0	0
Good	4	3	8	7	4	3	4	3	4	3
Regular	20	17	24	20	12	10	28	23	20	17
Deficient	96	80	88	73	104	87	88	73	96	80
Total Control Group	**120**	**100**	**120**	**100**	**120**	**100**	**120**	**100**	**120**	**100**
Very good	0	0	0	0	0	0	0	0	0	0
	4	3	8	7	4	3	4	3	4	3
rt	16	13	20	17	12	10	12	10	16	13
Total,	100	83	92	77	104	87	104	87	100	83
Experimental Group	120	100	120	100	120	100	30	100	120	100

Source: Author own elaboration

Table 2 : Scientific Knowledge in the Control Group and in The Pretest Group

Group	Scale	Telematics capabilities		Inquiry capabilities	
		fi	hi	fi	hi
Experimental	Very good	0	0	0	0
	Good	8	7	16	13
	Regular	24	20	36	30
	Deficient	88	73	68	57
	Total	**120**	**100**	**120**	**100**
Control	Very good	0	0	0	0
	Good	12	10	8	8
	Regular	28	23	32	25
	Deficient	80	67	80	67
	Total	**120**	**100**	**120**	**100**

Source: Author own elaboration

with material resources and computer resources (87%) being the dimensions with the highest frequency in the experimental group, while in the control group the dimension with the highest frequency was material resources (83%).

Also, Table 2 shows that students in both groups are in the Deficient level, with telematic capabilities being the dimension with the highest frequency in both groups with 73% and 67%, respectively.

B. Inferential analysis

Table 3 : Statistical Parameters of Telematics Tutoring and Scientific Knowledge in Both Pretest and Posttest

		Pre test		Post test	
	Statistical parameters	Group experimental	Control Group	Group experimental	Control Group
Experimental	Average	22,43	23,53	41,1	24,77
	Standard Deviation	2,98	3,17	3,95	4,31
	Variance	8,87	10,05	15,6	18,60
Control	Average	21,23	21,23	31,13	21,37
	Standard Deviation	4,12	3,59	5,82	3,89
	Variance	17,01	12,87	33,91	15,14

Source: Author own elaboration

As for Telematic Tutoring in the pre-test the mean values of the experimental group and the control group present close values, while in the post-test the mean value of the experimental group increased significantly compared to the control group.

Similarly, in scientific knowledge as a variable, it is observed that in the pre-test the mean values of the experimental group and the control group show close values, while in the post-test the mean value of the experimental group increased significantly compared to the control group.

Table 4 : Telematic Tutoring in the Control Group and in the Pretest Group

		Average		Variances		Exp. value	Value tabular
		Post test	Pre test	Post test	Pre test		
Tutoring telematics	Experimental Group	41,1	22,43	3,95	2,98	38,85	1,67
	Control group	24,77	23,53	18,60	10,05	1,27	1,67
Scientific knowledge	Experimental Group	31,13	21,23	33,91	17,01	7,59	1,67
	Control group	21,37	21,23	15,14	15,22	0,14	1,67

Source: Author own elaboration

When testing the research hypothesis with a Student's t-distribution of 58 degrees of freedom and a significance of 5%, the null statistical hypothesis according to which the mean in the post-test is equal to the mean in the pre-test was compared with the alternate statistical hypothesis according to which the two means are different, an experimental value equal to 7.59 greater than the tabulated value of 1.67 was determined, so the null statistical hypothesis was rejected, therefore, the mean values are significantly different ($p < 0.05$).

3. Discussion

The approaches presented here allow us to observe the technological implications of pedagogical innovations, as well as in the quality of teaching and in the academic results of future generations. Research that helps to establish the most effective guidelines for a hybrid learning model centered on the role of the teacher as a telematic tutor. Whereas, the digitalization of universities and teacher training in the virtual field have become two of the most important educational challenges of the present century, in the face of a changing and dynamic environment that constantly creates new opportunities and challenges.

Thus, when comparing the mean values of scientific knowledge in the experimental group before and after the treatment, an experimental value of 7.59 was obtained, higher than the 1.67 corresponding to the value in the table, therefore the null statistical hypothesis that states that the mean value of scientific knowledge for the experimental group in the post- test is equal to the mean value reached by the same variable in the pre-test is rejected, concluding that for a ($p < 0.05$) these mean values differ significantly, therefore, the Telematic Tutorials influence the capacities of inquiry, experimentation and critical judgment.

In this context, a study on the use of ICT in telematic teaching in higher music conservatories in Andalusiaconducted by López Martín & Córdoba Cabús (2021) shows that 68.87% of teachers used the technology to make presentations, while 66.89% used it to listen to music, 49.01% to project videos and only 45.03% to carry out research work.

The above points to the need to develop teacher training focused on telematics learning that will enable them to respond appropriately to the learning

needs of their students. We believe that the tutor's learning strategies, competencies and skills should serve as a bridge and mechanism for the socialization and integration of the student body. Therefore, the strategies and competencies of the virtual tutor have to internalize in the learner education as a process of culturalization, inasmuch as he/she lives immersed in cultural actions (Aguirre Andrade & Manasía Fernández, 2018).

Followed by comparing the means of the Telematic Tutoring in the experimental group before and after treatment through inferential analysis, an experimental value of 38.85 greater than the tabular value of 1 was arrived at. 67, therefore, the null hypothesis which states that the mean value of Telematics Tutoring for the experimental group in the post- test is equal to the mean value achieved by the same variable in the pre-test is rejected, concluding that both averages are significantly different ($p < 0.05$), therefore, Telematics Tutoring influences the technological and telematics capabilities of engineering students.

Given this situation, Cifuentes Faura (2020) states that students tend to feel overwhelmed and frustrated if they do not feel any attention or security of being able to contact the teacher to get the instruction and guidance they need in case they feel lost. Since it is not enough for a teacher to only conduct videoconferences explaining the syllabus, additional training is required regarding the role of the tutor in these telematic spaces.

Faced with the challenges of this new reality, the authors argue that teachers need to be inclusive, since not all students have the same opportunities or the necessary resources for distance or online learning. In the opinion of Emanuel (2020), the transition from traditional education to telematic digital learning is inevitable.

In this sense, agents of the public sector of education see the need to improve virtual education through the strategies, competencies and skills of teachers in virtual learning environments (Aguirre Andrade & Manasía Fernández, 2009). Alvarez (2020), warns that digital technologies are only part of the student's experience and the pedagogy of the teacher, who must actively use them in the teaching and learning process, taking into account the student's profile, the need for flexibility and continuous learning. The author also presents some suggestions on how the necessary steps for digital transformation in the university should be identified and what considerations should be taken into account to advance in the development of a new educational model adapted to the newtimes.

Deivis Cordero, Education and ICT Specialist at the Antonio Ruiz de Montoya University, indicated in the newspaper El peruano (2021) that in a post-pandemic scenario it is very useful to implement a hybrid model in which teaching and learning strategies can be defined and implemented -in space and time- both in face-to-face and distance modalities; as well as accompanying students in the process, through personalized follow-up and monitoring of learning.

Based on the results and in view of the new educational reality, this study aims to provide some ideas for the construction of a quality university education, more practical, innovative, interactive and real, methodologically multidisciplinary, which allows the student to acquire, transform and produce scientific knowledge from its understanding and application. Therefore, telematic tutorials should be used in teaching practice as part of the innovative learning methodologies within the competency-based curriculum, since they provide key tools that facilitate the learning and knowledge acquisition processes.

5. Conclusions

The pandemic forced to rethink not only the teaching strategies to maintain and build learning coherent with the pedagogical objectives, but also to evaluate the impact of the alternatives that emerged afterwards to give continuity to the learning process without losing its quality.

In the case of telematic tutoring, we determined its impact on scientific knowledge skills before and after the treatment, determining that students significantly increased their mean scores after the telematic tutor intervention.

Likewise, the impact of telematic tutoring on the capacity for research, experimentation and critical judgment was proven, since students significantly increased their averages. Consequently, the telematic tutoring used had a direct impact on the scientific knowledge of engineering students at Alas Peruanas

University in Lima during the academic period I-2020.

Reference

[1] Aguirre Andrade, A, & Manasía Fernández, N. (2018).

[2] Estrategias y competencias tutoriales en los Entornos Virtuales de Aprendizaje. Caso SEDLUZ. https://www.researchgate.net/publication/324731403

[3] _Estrategias_y_competencias_tutoriales_para_entorn os_virtuales

[4] Álvarez, S. M. (2020). El desafío de repensar la universidad en la era digital. Cuadernos Universitarios, 13(XIII), 09-26. https://doi.org/10.53794/cu.v13iXIII.297

[5] Amaya, A., Cantú, D., & Marreros, J. (2021). Análisis de las competencias didácticas virtuales en la impartición de clases universitarias en línea, durante contingencia del COVID-19. RED. Revista de Educación a Distancia, 21(65). http://dx.doi.org/10.6018/red.426371

[6] Bagley, S. (2020). The Flipped Classroom, Lethal Mutations, and the Didactical Contract: A Cautionary Tale.

[7] PRIMUS, 30(3), 243–260.

[8] https://doi.org/10.1080/10511970.2018.1555196 Bueno, M. (1996). Influencia y repercusión de las nuevas

[9] tecnologías de la información y de la comunicaciónen la educación. Madrid: Sociedad Española de Pedagogía.

[10] Cifuentes Faura, J. (2020). Docencia online y Covid-19: la necesidad de reinventarse. Revista de estilos de aprendizaje, 13(Especial), 115–127. http://revistaestilosdeaprendizaje.com/article/view/2149

[11] De Obesso, M. D. L. M., & Núñez, M. (2020). El modelo educativo híbrido: una respuesta necesaria de la enseñanza universitaria a partir de la Covid-19. Vol. 13140. https://dialnet.unirioja.es/servlet/articulo?codigo=7978090

[12] Echeverría, J. (2001). Tecnociencia y sistemas de valores, en López cerezo, J. A. and J. M. Sánchez ron (editores), Ciencia, Tecnología, Sociedad y Cultura. Madrid: Biblioteca Nueva, Organización de Estados Iberoamericanos.

[13] El Peruano (30 de julio 2021). Propuestas. Un modelo híbrido para la educación y las TIC. https://elperuano.pe/noticia/125709-un-modelo- hibrido-para-la-educacion-y-las-tic

[14] Emanuel, E. J. (2020). The Inevitable Reimagining of Medical Education. JAMA, 323(12), 1127–1128.

[15] https://doi.org/10.1001/jama.2020.1227 Fainholc, B. (2009). Diccionario práctico de Tecnología

[16] Educativa. Alfagrama.

[17] Fainholc, B. (2012) Tecnología Educativa Apropiada y Critica. Buenos Aires: Humanitas, magisterio.

[18] Fainholc, B. (2019). Algunos aportes acerca de la realidad telemática y la educación virtual. Signos Universitarios, (54). https://p3.usal.edu.ar/index.php/signos/article/view/4942

[19] Felder, R. M. (1993). Reaching the second tier. Journal of College Science Teaching, 23(5), 286–290. http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Secondtier.html

[20] Hernández, R., Fernández, C., & Baptista, P. (2014).

[21] Metodología de la investigación. México: McGraw- Hill Education.

[22] Hodges, Ch.; Moore, S.; Lockee, B.; Trust, T. y Bond, A. (2020). The Difference Between Emergency Remote Teaching and Online Learning. EDUCAUSE Review. https://www.researchgate.net/publication/34053

[23] López-Martín, Á. y Córdoba-Cabús, A. (2021). ¿Cómo ha incidido el COVID-19 en los conservatorios superiores de música de Andalucía? Valoración del alumnado sobre el proceso formativo. En B. Puebla- Martínez y R. Vinader-Segura (Coords.) Ecosistema de una pandemia: COVID 19, la transformación mundial (pp. 1856-1870). Dykinson. https://dialnet.unirioja.es/servlet/articulo?codigo=8027103

[24] Marabotto, M. I., & Grau, J. E. (1999). La tutoría telemática en la educación a distancia. RIED-Revista Iberoamericana De Educación a Distancia, 2(1), 117– 138. https://doi.org/10.5944/ried.2.1.2090

[25] Marcus, J. (23 de abril de 2020). «Will the Coronavirus Forever Alter the Collage Experience?». New York

[26] Times. https://www.nytimes.com/2020/04/23/edu- cation/learning/coronavirus-online-education- college.html

[27] Sáez López. J. M. (2017). Investigación educativa. fundamentos teóricos, procesos y elementos prácticos (enfoque práctico con ejemplos. esencial para tfg, tfm y tesis). Editorial UNED.

[28] Sánchez Rivas, E., Colomo Magaña, E. y Ruiz Palmero, J. (2020). Tecnologías educativas y estrategias didácticas. Universidad de Málaga (UMA). España. https://dialnet.unirioja.es/servlet/libro?codigo=788134

[29] UNESCO (25 de marzo de 2020). Global Education Coalition. Mensaje de Audrey Azoulay, directora general de la UNESCO. https://youtu.be/St_BQRSXmew

[30] Viñas, M. (2021). Retos y posibilidades de la educación híbrida en tiempos de pandemia. Plurentes. Artes y Letras, (12), 027. https://doi.org/10.24215/18536212e027