

Virtual tutoring in subjects on computer Networks: experience evaluation in a pandemic context

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Abstract:

An educative research is presented in this paper where a virtual tutoring model, performed in two subjects related to computer networking, is described. The first subject is taught in a public university and the second one in a private one. The utility and efficiency of the method is inferred from the students' evaluation. This study was framed within a quantitative and qualitative research paradigm. Twenty five students took part. All the activities proposed were tracked and, with the information collected, a content analysis was made. Results obtained indicate that virtual tutoring had a good acceptance by the students. It has to be highlighted that not only work organization is easier but also teacher-student communication and interaction is. Therefore, it could be considered an interesting practice for upper education.

Resumen: *en este trabajo se presenta una investigación educativa en la que se describe un modelo de tutorización virtual realizada en dos asignaturas con temática sobre redes de computadoras, la primera en una universidad de carácter público y la segunda en una universidad de carácter privado. Se pretende conocer la utilidad y eficacia del método a partir de las valoraciones de los estudiantes. El estudio se enmarca en el paradigma de investigación cualitativa y cuantitativa. Participaron un total de veinticinco estudiantes, donde se realizó un seguimiento de las actividades propuestas, de cuya información se hizo un análisis de contenido. Los resultados indican que la tutorización virtual tuvo una buena aceptación por parte de los estudiantes. Se destaca que facilita la organización del trabajo, así como la comunicación e interacción docente-estudiante. Por tanto, se considera que podría ser una práctica de interés para la educación superior.*

1. Introduction

Tutoring processes evolved from the traditional teacher's role of being the main source of communication and information towards approaches that encourage the use of active methodologies and independent learning [Giner, Muriel & Toledano, 2013]. At the same

time, while working methods conferring the protagonism to the student are promoted, tutoring can be postulated as one of the essential competences in higher education since it includes the formative action as well as the tutorial function and cannot be separated [Álvarez & Álvarez, 2015]. This kind of approach requires a change in the teaching-learning processes where teachers assume a role in the management process and students take an active and protagonic role in the adquisition of knowledge, learning and competences.

During the last years, in tutoring participative dynamics, different authors have introduced the idea of revitalizing tutoring processes in semi-presential ways, as well as in completely virtual ways [Araujo, Giner, Piñero y Vélez, 2005][Subiela et al., 2018]. Virtual platforms are supposed to be a propitious environment for the implementation of independent learning methodologies [Suárez y López-Meneses, 2011][Rue 2007]. However, virtual communication dynamics requires the development of a networking ecosystem that, far from preserving traditional approaches taken to distance training, develops learning options which really take advantage of the numerous possibilities that virtual environments offer as a teaching learning means [González-Pérez y Pons, 2015] [Suárez y Gros, 2013].

Of all the advantages of this kind of virtual tutoring, communication fluency and effectiveness, information exchange and synchronous and asynchronous tracking can be outlined [Molina, 2012]. Also, a more personalized teaching improves student's motivation [Pozo e Iglesias, 2013]. These experiences were well accepted by the students. But it must be said that work success rates were the same as the ones observed years before.

So, having in mind all what it has been explained here, this paper has two fundamental objectives to be achieved. The first one consists in the description of the virtual tutoring model followed in the work done in a university level subject. The second one is related to the evaluation of the usefulness and efficacy of the method considering the participant students's opinions.

2. State-of-the-art/background/related work

The pandemic and social isolation context requires changes in virtual teaching and tutoring activities. This situation demands new strategies and interventions in order to stimulate disciplinary content constructive learning and cognitive strategies in the students. In relation to this, it could be seen that students academic development was modified since not all of them were able to access effectively to the new ways of virtual learning due to connectivity difficulties and lack of efficiency in the use of technological tools.

Many other papers present similar topics to the ones analysed in this case-study.

In [Guerra, 2018] it is concluded that tutoring is an effective strategy while trying to improve academic performance, but it is important to have good tutors who are not overwhelmed with their responsibilities, and who are capable of developing a close bond with their students besides a right environment.

A study carried out in Mexico, [Espino, 2015], determines that the main tutoring activity it is focused on solving academic problems leaving the personal ones aside and

that the tutoring and consultant's office labor of directing students towards the corresponding instances are satisfactory.

Another paper from Ecuador, [Frias, 2017], suggests that it is necessary to perform academic tutoring through face to face and virtual monitoring using technological media. In this way, student performance will improve and student academic repetition and dropping out will decrease.

In [Caram, 2020] it is stated that there is still a long way to walk and discover. Equipment and platforms have to be improved, some areas related to evaluation and student internet access have to be solved. Within these new requirements, teaching team has to be strengthened so it can face these activities with new working roles, continuous communication and monitoring and with frequent formative evaluations during the whole teaching-learning process.

Finally, in [Montoya Lunavictoria, 2021], the article comes to the conclusion that virtual tutoring influences significantly the academic performance of the students observed. The suggestion made is that if an academic improvement is wanted, the teaching team has to focus on academic virtual tutoring because the learning-teaching processes intercommunication depends on it. Teachers can motivate student participation through forums and collaborative work.

3. Methodology

This paper is part of an educative research. It pretends to influence the learning and teaching processes directly with the intention of improving them [Blández, 2010]. The educative research analyses virtual tutoring from an inner perspective, that is, from the teachers' own practice, considering the teaching team and the students as active participants of the process. Furthermore, the proposal is immersed in an action-research project where the researcher studies a first version of the model. That model can be adapted and modified while it is put into practice with the objective of improving and adjusting it to the circumstances of each educative context. [Blández, 2000] [Carri, Kemmis, 1988].

3.1. Experience description

In previous years, tutoring was always carried out in a presential or semi-presential way. The virtual tutoring idea came up in 2020 due to the circumstances of not being able to have the usual student presential attendance and the teachers' adquired experience. Considering the time required to monitor different activities proposed and the fact that some activities, such as simulation, can be devepoled by the student in an autonomous way, the research team came to the conclusion that the use of ICTs (information and communication technologies) applied to learning and knowledge (Technology for Learning and Knowledge -TLK) would improve the process management compared with that carried out in a presential or semi-presential way. In the same way, it was considered that through this method, strategies would empower students in the different activities carried out and also in the decision making necessary for those activities.

The method was based on practicing and consolidating a virtual interaction system through web 2.0 related to formal and informal communication systems [Kitsantas & Dabbagh, 2011] using sis contact channels:

1- Formal communication:

- Moodle® as an interchange platform resource (lessons, questionnaire, wikis, etc.)
- Moodle® Forums as a linking device between students and teachers to generate discussions and evacuate doubts.
- Interactive online classes with Zoom® platform to expose most important content topics.
- Interactive online classes with BigBlueButtonBN Moodle® module as an alternative to the availability of Zoom® platform.

2- Informal Communication:

- Instant messenger services with WhatsApp®. Specific Group with students and teachers to coordinate the different activities.
- Moodle® platform own chat for questions.

In 2019, the teacher team decision was not to use Tools external to Moodle® platform. But in 2020 the urge of using a more dynamic way of coordination revealed the need to handle the students' group through WhatsApp® .

The course in Moodle® was divided in topics according to the units of the syllabus plus a general Introduction at the beginning. As it can be seen in Figure 1, the current analytic syllabus, basic bibliography, activities schedule and general aspects about the way of studying with the available material were published via Moodle® platform in the Introduction.

Also, the main basic purpose of the Moodle® platform was to be a repository of all the needed material for the progressive development of the coursework proposed. In each unit, the student had available the following material:

- A PowerPoint presentation as a reading guide to the correspondent chapter of the main bibliography book. It just contained all the topics that the professorship included in the syllabus.
- A Homework Guide in PDF format for theoretical development, as a set of questions and exercises to be solved.
- The chapter of “Network computing I with Packet Tracer” related to the topic on an e-book format. This book was another useful resource that included, not only the exercises guide to be solved using Cisco® Packet Tracer networking Simulator, but also, a possible solution to them, turning the book into a self-contained material designed for student self-learning. The objective of this material was to show the abstract concepts of data networking in a concrete way. Although the simulator is in some aspects limited, it was considered appropriate to acquire networking computer concepts and fundamentals.



Figure 1: Moodle® Plataform printscreen for the UNSa subject

Next, the four activities proposed to the students to complete the topic review are described. They followed a task sequence that has been considered logical and adequate according to the accumulated experience on tutoring.

1. *Reading a chapter of Kurose and Ross main book.* Doubts and queries could be addressed through a specific forum created in Moodle® platform, where responses were not exclusively given by teachers but also by classmates who knew the answers. Also, in order stimulate interactions, questions related to the topic were generated.
2. *Resolution workbook,* used as long as the previous task was performed. Also, students were provided with another forum to make queries for this purpose. The students' resolution had to be uploaded to the platform at a specific date so the teaching team could correct it and send it back.
3. *Use of Packet Tracer.* The idea was to show the learning concepts in a controlled simulation environment solving a specific problem. The material was provided on an e-book format describing the problem to be solved and a step by step guide to sort it out. The student had the possibility to contrast the solution found with a possible solution proposed on it. The student could download a pkt extension file (simulator specific format) and validate its execution.
4. *Evaluation.* It was implementend in a Moodle® questionnaire via multiple choice and open questions.

These activities were part of the regulatory framework agreed with the students wich allowed to monitor the fullfilment of evaluation deadlines according to schedule.

It has to be highlightedd that, in 2020, the most important topics of the syllabus were given on a synchronous way through videoconferences using Zoom platform and some others with the Moodle® BigBlueButton plugin.

3.2. Participants in the virtual tutoring experiences

The study was carried out in the context of two subjects at university level: Networking I belonging to the Telecommunications Engineering degree curriculum at the Salta Catholic University (USACAL) and Networking Computing I belonging to the Systems Analyst Bachelor degree curriculum at the Salta National University (UNSa). In total, in

2020, 25 students participated in the virtual tutoring activities in order to get ready to proceed to the final examination. In both contexts, the teaching team as well as the material used was the same.

3.3. Data collection tools

At the beginning of the experience, students were asked to voluntarily write a diary alongside the activities. The purpose was to allow them to highlight the positive aspects of the process as well as the possible improvements on it. In this way, students would give direct feedback to the teacher-team and would be able to express their opinions in the continuous process of the method pedagogic reflection. At the end of the experience, students were asked to answer a digital questionnaire based on the diary. Both activities were designed ad-hoc to be used as an evaluation and experience analysis tool.

3.4. Data analysis

After the experience, with the information obtained from the diary requested to the students, a deductive analysis was made. That gave the research group the possibility to create information categories. Those categories allowed the design of an attitudinal test where a 5 points Likert valuation scale was assigned to each variable or question. The main goal was to measure attitudes and to know the student's degree of consent with the proposed assertions.

A Cronbach's alpha coefficient was used in order to guarantee the instrument reliability. The coefficient assumes that the items measure the same concept and are highly correlated [Welch & Comer, 1988]. The closer the Alpha value is to 1, the greater the internal consistency is in the analyzed items. As a general criterion, a value of 7 is suggested as acceptable [George & Mallery, 2003, p. 231].

The test was divided in four sections. The main objective of the first section was to look into the specific material available to the students. A second section presented questions about the technology used. The third one inquired about the implications of the teacher's team. The last section investigated the simulation tool used

For both data sets collected, the arithmetic media surpassed the middle value of the scale (3,00). That confirmed the content validity of all the items included in the surveys.

The Cronbach's Alpha coefficient for the first data set was 0,87 and 0,79 for the second set. In both cases the value exceeded the 0,70 value. That allowed assuring the reliability degree of the questionnaire. Therefore, a high polarization of the students' reliable answers could be appreciated.

4. Results and discussions

This section is organized in three topics. Each topic corresponds to one part of the survey carried out plus a subsequent reflection. The first topic refers to the specific networking resources available to the students. The second topic shows the variety of resources, working tools and uses that the network allowed. The third topic tackles the participants' degree of implication in the process and how the tutorization method itself benefits the implication in the work. Finally, some work limitations and some

implications and improvement proposals are described based on the educative research process developed.

4.1. Aspects about the specific material available

In Figures 2 and 3 it can be clearly seen that the three specific resources available to the students achieved a median of 4 (four) or over. Because of that, it can be said that resources were greatly adequate to students in similar subjects in both universities.

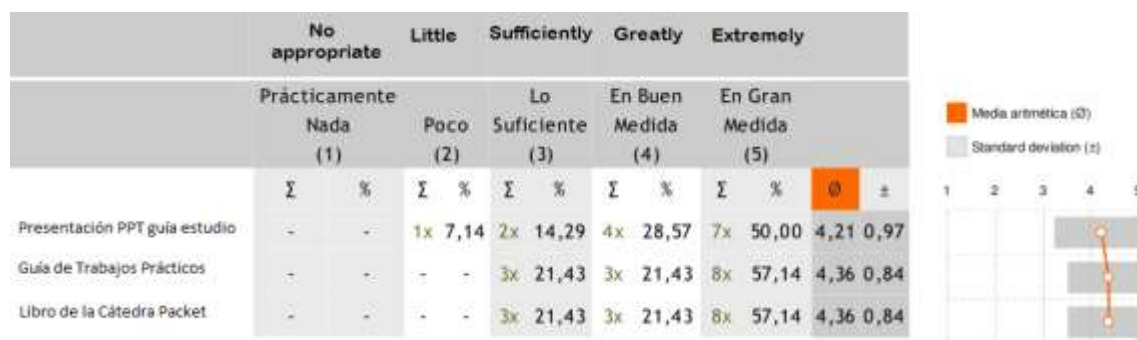


Figure 2: Computer Networking I – UNSa – Specific Resources

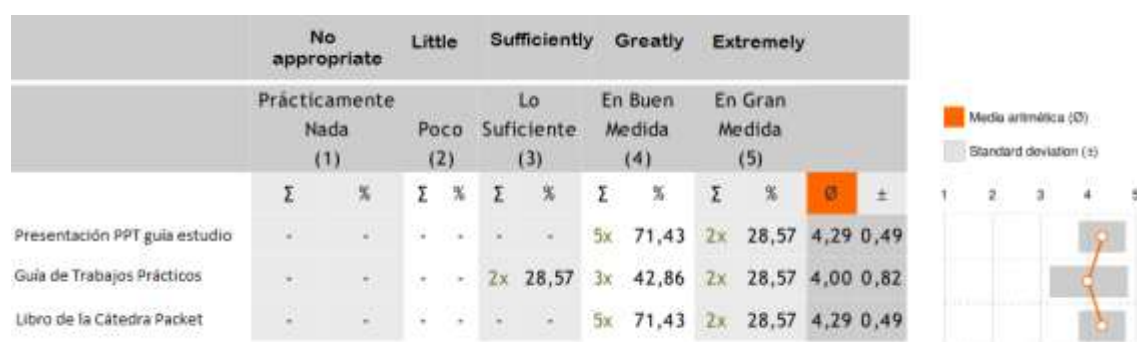


Figure 3: Networking I – UCASAL – Specific Resources

4.2. Aspects about technological resources

In Figure 4 it can be clearly seen that Moodle, Zoom and BBB platforms were greatly adequate to UNSa students. And, in Figure 5 it can be observed that the platforms were sufficiently appropriate to UCASAL students. The use of Whatsapp messenger service was highly appreciated in both cases. Therefore, it is worth considering this resource since it was well accepted in both study groups.

There are differences in the valuation of the Moodle Chat in both experiences. In the UNSa group, it obtained very low values with an arithmetic median that didn't reach 3 points (it is not considered sufficiently useful). On the other hand, analyzing the results obtained in the UCASAL group, this resource shows a median higher than the ones received by the Moodle, Zoom and BBB platform



Figure 4: Computer Networking I – UNSa – Technological Resources

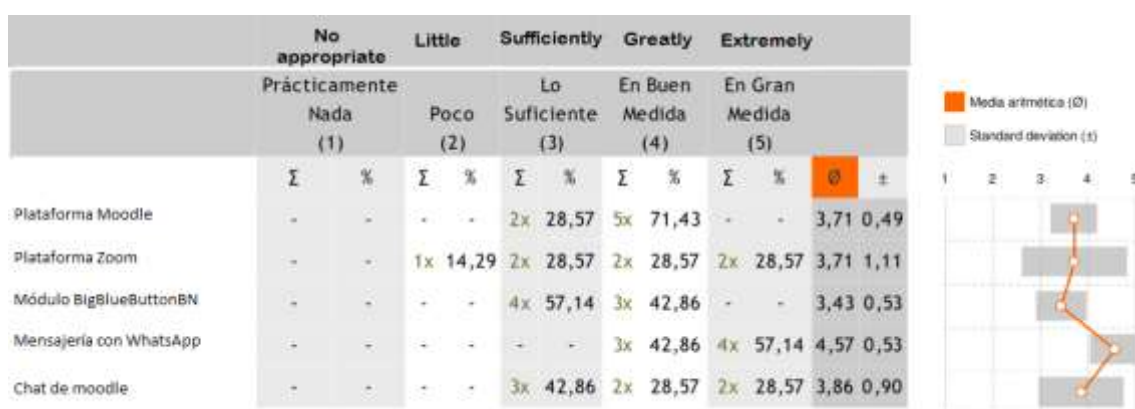


Figure 5: Networking I – UCASAL – Technological Resources

4.3. Aspects about teachers' participation

As it can be seen in figures 6 and 7, all items related to teachers' participation and proper environment for learning received good values, approaching 4 (four) points, although some slight differences can be detected.

The greater difference is found in fluid communication, rapid teacher's answers and teachers' staff commitment. The values were higher in the UCASAL experience. But even those differences are considered minimum analyzing the values. The teacher team and the material used were the same in both experiences, so it is concluded that the variation shown up is only due to student's appreciation related to the experience they had previously with other teachers in other subjects.

Although a priori the fact of reducing the presential interaction between tutor and tutorings could be understood as a teacher's lack of commitment, students realized that, with a structured virtual tutoring method, the objectives were, on the one hand, to rationalize the time given to students' assistance and, on the other, to facilitate the development of their self-sufficient work. However, in order to let students perceive

commitment from the teachers staff, monitoring and revision agreements of the working process should be accomplished by the teaching team.



Figure 6: Computer Networking I – UNSa – Teachers’ Participation



Figure 7: Networking I – UCASAL – Teachers’ Participation

4.5. Research limitations

These research results could suggest a bias interpretation of the experience due to the sample size (affective bond created with students during such a long and intense period of interaction) and the paradigm used. However, this action research shows very clearly how students experienced learning while doing their activities.

5. Conclusions

After analyzing the results shown in this paper, it must be concluded that virtual tutoring allowed organizing a process of coherent tutorial action. The strategies and activities

explained, as well as the communication system sustained through time, mobilized students learning resources in both experiences.

Besides, from the students' valuation, it can be inferred that the method is useful and was well accepted by the students. Specifically, it may be outlined that the dynamic work which was proposed for virtual tutoring facilitates activity organization and structuration, avoiding stress when deadline is getting near. Also, the variety of resources offered to the students together with daily communication tools, have made teacher-student communication and interaction easier. In addition, the commitment of the teachers as well as that of the majority of the students must be highlighted. That attitude and predisposition has been beneficial to teachers to be able to adapt themselves to the different needs students were having.

From the data analysis it can be concluded that students' performance and assessment in both universities were similar inspite of the differences between them, being one public and the other private.

Finally, virtual tutoring should be improved according to the new digital resources that could be added. Those digital resources would be focused on improving work dynamics and also virtual and semi-presential interactions with the main objective of emphasizing the growth of not only the quantity but also the quality of teacher-student communication.

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