TICCAD used by university teachers in the post-pandemic: student perspective

TICCAD utilizadas por el profesorado universitario en pospandemia: perspectiva del estudiantado

http://doi.org/10.32870/Ap.v16n1.2482

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Keywords
Training process; teachers; university; TICCAD

ABSTRACT

The objective of the research was to identify the perspectives of university students on the use of information, communication and knowledge and digital learning technologies (TICCAD) in the post-pandemic by teachers. It is a qualitative study with a phenomenological approach, 41 students from two universities participated in four focus groups through a semi-structured interview with eight questions. The results showed that the main TICCAD used by teachers to identify prior knowledge, process information, develop integrative projects, work collaboratively, undertake, reflect on achievements and provide feedback are: Canva, Google Drive, Kahoot!, Moodle and Google Docs. In addition, students recommend that teachers receive training and an open attitude towards the use of new tools. As limitations, the importance of conducting a greater number of focus groups with students from related careers, to obtain more information, was highlighted. Furthermore, due to the few studies on the topic in the post-pandemic, the research is an important contribution to the integration of ICTCAD in educational processes. It is concluded that technological tools are valuable support in the teaching-learning process, since they facilitate access to information, exploration and discovery of knowledge, to enrich the educational experience.

Palabras clave
Proceso formativo; profesores; universidad; TICCAD

RESUMEN

La investigación tuvo como objetivo identificar las perspectivas de los estudiantes universitarios sobre el uso por parte del profesorado de las tecnologías de la información, comunicación, conocimiento y aprendizaje digitales (TICCAD) en pospandemia. Es este estudio cualitativo con enfoque fenomenológico, participaron 41 estudiantes de dos universidades, divididos en cuatro grupos focales mediante una entrevista semiestructurada con ocho preguntas. Los resultados mostraron que las principales TICCAD que utilizan los docentes para identificar conocimientos previos, procesar información, desarrollar proyectos integradores, trabajar colaborativamente, emprender, reflexionar logros y realimentar, son: Canva, Google Drive, Kahoot!, Moodle y Documentos de Google. Además, los estudiantes recomiendan que los profesores se capaciten y tengan una actitud abierta hacia el uso de nuevas herramientas. Dentro de las limitaciones del trabajo destacó la importancia de aumentar el número de grupos focales con estudiantes de carreras afines para obtener mayor información. Debido a que son escasos los estudios sobre el tema en pospandemia, esta investigación da un aporte significativo sobre la integración de las TICCAD en los procesos educativos. Se concluye que las herramientas tecnológicas son un valioso apoyo en el proceso de enseñanza-aprendizaje, pues facilitan el acceso a la información, la exploración y el descubrimiento de conocimientos para enriquecer la experiencia educativa.

Received: September 30, 2023
Accepted: February 23, 2024
Online Published: March 22, 2024

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INTRODUCTION

Currently, technology is an important part of human social and educational activities, since the ease and speed it provides enriches knowledge (Ariza, 2018; Montoya, 2019). In this sense, the incorporation of information, communication, knowledge and digital learning technologies (TICCAD) has increased teaching-learning interaction in the classroom, promoting knowledge management, collaborative work and comprehensive training. This has presented a challenge for teachers due to a lack of accessibility and training to take advantage of the resources that these tools provide (García *et al.,* 2017; Moreno and Trigo, 2017; Maguino *et al.,* 2020).

Teaching practices through TICCAD are influenced by the teacher's high or low level of mastery of technological tools. For this reason, it is necessary to develop favorable skills and attitudes towards technology, to encourage and enable recreational, innovative and participatory processes in the classroom (Cruz, 2019; Escudero *et al.,* 2020; Solis *et al.,* 2021).

Research has been carried out to identify the main TICCAD that teachers have incorporated into their teaching-learning processes during and after the pandemic. In his study, Ortega (2021) analyzed the didactic strategies used by teachers during the health crisis. The sample consisted of 200 participants from the University of Guadalajara, to whom a 20 item Likert scale with three dimensions was applied through Google Forms: a) technological knowledge, b) technological tools and c) use of technological tools. The main results show that 89% of teachers used videoconferencing to support their classes, 58% used Zoom, 32% Meet, 8% Telmex and only 2% Skype. Other course support tools were also identified, such as Google Classroom, Google Drive, Dropbox and Moodle as an institutional platform.

In a study by Gómez *et al.* (2021), the level of use of information and communication technologies (ICT) was determined in 100 university teachers in Peru, through five questionnaires that assessed the use of technological resources in the classroom, self-efficacy in their use, access and support, as well as culture and technological leadership. The results showed that 25% of the teachers were located at a high level, while 47% were at a regular level, and only 28% at a low level. It was concluded that teachers have skills to use technology on a regular and general basis; however, more training is necessary for its pedagogical use.

In the same sense, Zolano and León (2020) surveyed 75 teachers to identify the challenges they faced when incorporating technologies in the teaching-learning process during the pandemic. The results showed that 54% used email, WhatsApp and a mobile phone as a means to develop the teaching-learning process; 22% used Moodle, 15% Google Classroom, 7% SIVEA, an institutional platform; and 2% Microsoft Teams. Regarding

communication with their students, 52% of teachers used email, 18% WhatsApp, 5% forums, 3% blogs; and 2% mentioned other means. In conclusion, the authors highlighted a need for university teachers to reflect on their performance in order to rethink strategies that favor the educational process.

Studies such as those by Chakraborty *et al.* (2020), González (2021), Weaver *et al.* (2020) and Pérez López *et al.* (2021) focused on the students' perspective. This research shows that in the virtual modality caused by the pandemic, one of the factors that affected student motivation and learning was the low-quality use of technological tools by teachers, who, although showed willingness to use technological resources during classes, were not familiar with new technologies and lacked knowledge, as well as methodological and pedagogical experience to implement the resources. This results in low innovative use of the tools that TICCAD offer and does not favor significant learning.

Likewise, various research has identified the importance of continuous training for teachers so they may consider potential needs in a differentiated manner, as the experience of adopting technological tools varies for everyone, both in their role as users and as facilitators of learning in virtual or hybrid environments. Therefore, awareness and a change of mindset among teachers is essential to achieve a greater willingness to develop digital competence and promote learning in the classroom (Alfaro-Hernández, 2022; Centeno-Caamal and Acuña-Gamboa, 2023; Garduño, 2021; Torres-Hernández, 2023).

THEORETICAL FRAMEWORK

Considering the challenges faced during the health crisis, in the process of returning to the classroom, discussions are needed to enable teachers to identify the true value of technologies in the educational process. These tools will remain a means to support learning, therefore it is necessary to continue integrating new curricular strategies and methodologies that cognitively challenge students (Mendoza, 2020; Puche-Gil, 2019). Thus, a socio-formative approach emerges as a response to current demands, with the objective of promoting a systemic vision and complex thinking while committing itself to the integral development of its students, contemplating the historical moment and the context of the subject through attention to social problems. (García *et al.,* 2014; Montes de Oca and Machado, 2014; Tobón, 2017).

Socio-training favors the incorporation of principles that allow students to develop personally and professionally in a participative and committed manner to face social challenges in order to improve their quality of life. Among these are knowledge management, collaborative work,

entrepreneurship and metacognition (Arreola *et al.,* 2019; Tobón, 2017). The principle of knowledge management emphasizes the stimulation of research processes, the integration and innovation of knowledge, to analyze situations or problems of everyday life, considering different perspectives and increasing the degree of mastery of skills (García *et al.,* 2014; Tobón, 2017). Collaborative work is a highly important strategy for students, since it provides them with the opportunity to develop in conjunction with others, make decisions, resolve conflicts, apply values and be committed to others (Herrada and Baños, 2021; Leiva *et al.*, 2020; Tobón, 2017; Zangara and Sanz, 2019).

As for entrepreneurship, the approach aims to provide opportunities for students, enabling experiences where they can apply the knowledge acquired through projects that address specific situations within a given context, which favor the quality of personal, family and social life in an ethical manner, while, simultaneously, becoming a source of self-employment and continuous learning (Fleith, 2019; Tobón, 2017). Finally, metacognition is conceived as a process of utmost importance in teaching and learning, as it allows the student to be aware of the challenges he/she will face in order to achieve knowledge, that is, to learn how to learn. To this end, guidelines must be followed to recognize achievements and areas of opportunity, to establish progress towards an educational goal (Romo *et al.*, 2020; Tobón, 2017).

From the socio-training perspective, technologies play an important role, being tools linked to the formative process. Their purpose is to stimulate knowledge through a more didactic, collaborative, and ethical learning approach, while also diversifying evaluation methods (April *et al.,* 2021; Buendía, 2020; Escudero, 2019).

The research case studied a public and a private university in southern Sonora, Mexico. It identified that not all teachers had technological competencies, leading to the development of various training and updating programs during 2020, 2021, and 2022, with the goal of enhancing learning processes. At the same time, we sought strengthen the development of adequate didactic strategies and evaluation processes that would enable the identification of students' attainment of competencies, considering the virtual modality with remote sessions or video calls.

In both universities, the official return to classrooms took place in August 2022, with 80% of the courses taught face-to-face. Given this, it is important to identify whether teachers continue to use and incorporate TICCAD in their classes, or if they have returned to the traditional, pre-pandemic work dynamics of their courses. This established the importance of this study, with the goal of identifying higher education students' perspectives on post-pandemic use of TICCAD by faculty.

METHODOLOGY

A qualitative phenomenological study was conducted, characterized by describing and interpreting lived experiences objectively and correctly, without engaging in ethnocentrism or codifications that distort these. In this sense, phenomenology considers the anecdotes narrated by participants, through questions focused on a specific topic: the TICCAD used by educators in the teaching-learning process (Castillo, 2020; Fuster, 2019; Martín-Alonso *et al.,* 2021).

Participants

The participants in this research were 41 students from 2 higher education institutions: the Instituto Tecnológico de Sonora (ITSON), from the public sector, and the Universidad La Salle Noroeste (ULSA), from the private sector. These belonged to 2 educational programs (EP) in the area of social sciences: at ITSON it was the bachelor's degree in educational sciences, and, in the case of ULSA, the bachelor's degree in educational psychology. Both educational programs follow a competency-based model and aim to train professionals to become aware of social needs and be ethical when working in educational or corporate areas.

The students were divided into 4 focus groups. 18 students participating in the ITSON were completing their 2nd, 4th, 6th and 8th semesters regularly. These were organized into 2 focus groups: 6 students participated in the 1st, 3 women and 3 men; and in the 2nd, 12 students, 5 men and 7 women. From ULSA there were 24 participants, who were also completing their study plan regularly. This was divided into 2 other focus groups: the 3rd with 11 students, 7 women and 4 men; and the 4th with 12 students, 11 women and 1 man.

Instrument

The focus group technique was used to recover information, which was applied through a semi-structured interview. The focus group is a discussion group guided by a moderator who is assisted by a set of carefully designed questions with a particular objective; resulting in a valuable source of knowledge by providing an opportunity to socialize and discuss relevant topics. (Hamui-Sutton and Varela-Ruiz, 2013). At the same time, the semi-structured interview favors the participant's freedom of expression and allows their perspective to be highlighted (Sautú, 2003).

The questions were recorded in a semi-structured interview guide, which was validated by 3 experts in the area of educational technology. To achieve the study's objective, the guide includes 8 questions based on the principles of socio-formation:

1) What technological tools do teachers use to identify your prior knowledge about the topics that will be covered in class?
2) What technological tools do teachers promote for searching and processing information on new knowledge obtained in your courses?
3) What technological tools do teachers use in your classes to develop integrative projects?
4) What tools do teachers use in courses for collaborative work with your classmates?
5) What technological tools do teachers use to promote entrepreneurship or self-employment?
6) What tools do teachers use to provide feedback or explain a topic that needs to be reinforced?
7) What tools do your teachers use to encourage reflection on your achievements?
8) Which recommendations do you give your teachers in order to improve or enhance their use of technological tools?

As can be seen, questions 1 through 3 refer to knowledge management, in the 4th the collaborative principle is reiterated, in the 5th so is the entrepreneurship principle, from 6 to 7 the focus was on the principle of metacognition, and the last question was established to identify the recommendations made by students for teachers.

Procedure

The information analysis was divided into 3 stages. As a first step, and with the intention of addressing the ethical considerations necessary for qualitative research in the 2 participating universities, 2 steps were completed. First, approval of the research project was requested by the university's Institutional Ethics Committee, obtaining an approved response with opinion number 191; second, once the previously mentioned inclusion criteria was met, students accepted from both institutions were sent informed consent letters.

With the total number of participants contemplated, the 4 focal groups were established, and the requirements of both institutions were considered. As the third step, a verbatim transcription of the four focus groups was carried out, and a key (P) was assigned, numbering each participant to identify them. In addition, the key (G) was added along with the number according to the focal group of which participants formed part of, along with the participant number, to always ensure the confidentiality and protection of every student's identity (Manig *et al.,* 2018).

Later, the transcripts were analyzed using the 2022 version of the MAXQDA qualitative research support software, in order to identify the most used TICCAD by teachers, following the categories established in the semi-structured interview, which was based on the principles of socio-training: 1) identification of prior knowledge, 2) information processing, 3) integrative projects, 4) collaborative work, 5) entrepreneurship, 6) reflection of achievements and 7) feedback. Similarly integrating segments of the codes identified in the narrative of the participants. Subsequently, MAXmaps were obtained to organize the information visually.

RESULTS

The transcripts of the four focus groups from the two higher education institutions were analyzed with the aim of identifying the technological tools used by teachers in the teaching-learning process. The questions consider the principles of socio-formation, organized as follows: 1) identification of prior knowledge, 2) information processing, 3) integrative projects, 4) collaborative work, 4) entrepreneurship, 6) reflection of achievements and 7) feedback. Likewise, the TICCAD most used by teachers and recommendations to improve their application in the teaching-learning process according to the students are comprehensively integrated.

Knowledge management

Knowledge management, the first aspect related to TICCAD used by teachers, seeks to know which tools are used to identify prior knowledge, search and process information, as well as to develop integrative projects. Regarding prior knowledge, students mention that the tools most used by their teachers are Kahoot!, Moodle and Google Forms, which are appealing and easy to use. Figure 1 integrates the coded segments of the students' narrative.

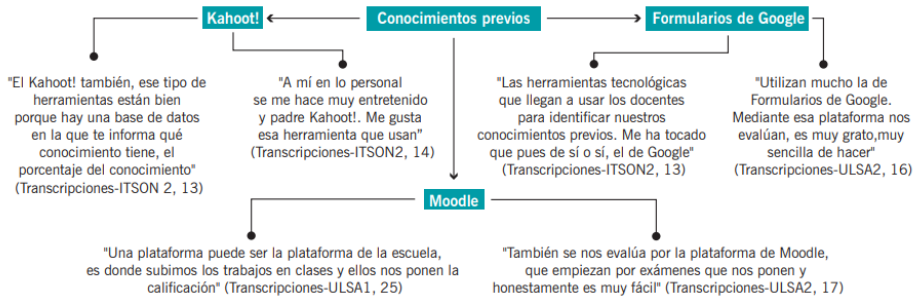

Figure 1. Coded segments on prior knowledge.

In relation to the search for and processing of information, the participants indicated that the TICCAD most used by their teachers are Google Scholar, School Library and Redalyc, as they enable the analysis of reliable and scientific information (see Figure 2). Regarding problem solving, another of the principles favored by the socio-educational approach through the development of projects that address real context needs, students mentioned that their teachers encourage the use of tools that allow them to integrate their progress and report it, such as Canva, PowerPoint, Word, Excel, Google Drive and Google Meet (see Figure 3).

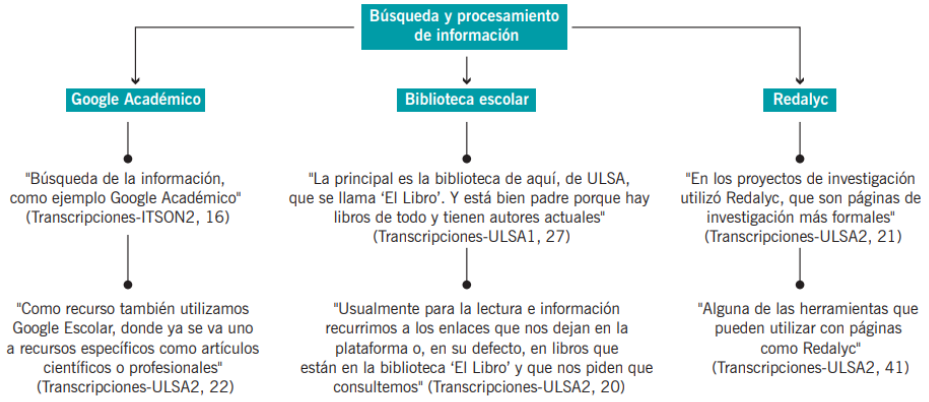

Figure 2. Coded segments about information seeking and processing.

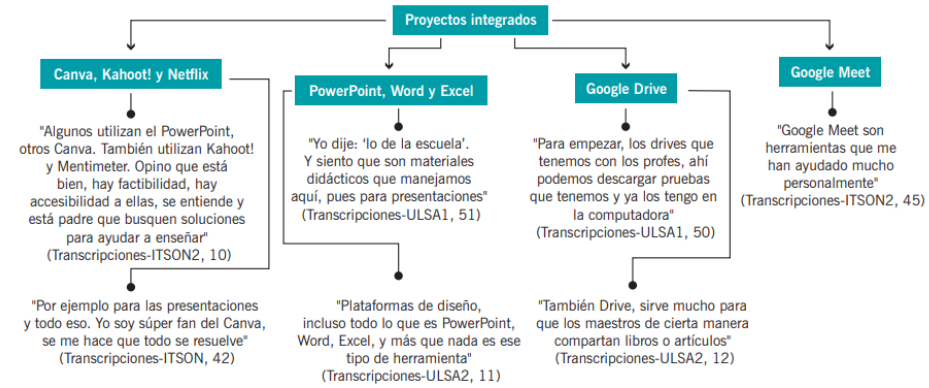

Figure 3. Coded segments on integrative projects.

Collaborative work

Students indicated that their teachers encourage collaborative work through tools such as Google Meet, Google Drive, Zoom, Google Forms, Canva and Mentimenter. They find these to be practical tools that facilitate teamwork in a useful and flexible way (see figure 4).

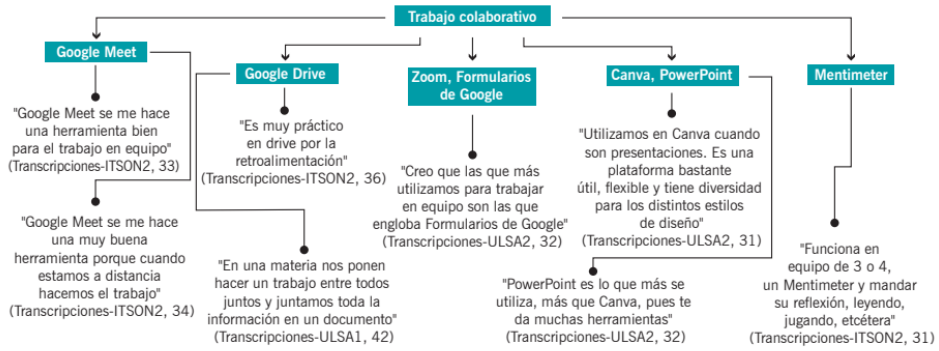

Figure 4. Coded segments on collaborative work.

Entrepreneurship

Entrepreneurship is a principle that should favor university students and have the purpose of promoting self-employment, creativity and innovation. The participants indicated that their professors use technological tools such as Google Drive, Zoom, Moodle, social media and various programs for developing web pages as support for the development of this competency, functioning as easy and accessible tools (see Figure 5).

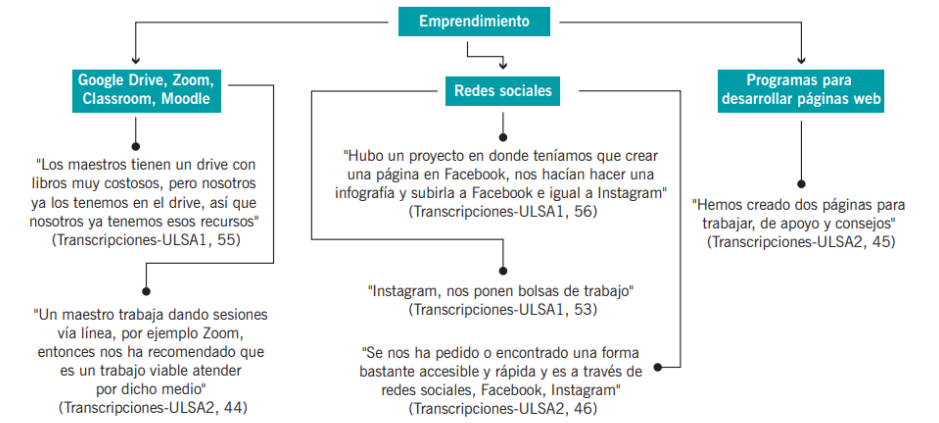

Figure 5. Coded segments on entrepreneurship.

Metacognition

Within metacognition, it is necessary that teachers allow students to pause to assess the goals achieved, in addition to providing timely feedback in their training process. Regarding the first aspect, students comment that their teachers use tools such as Word, Excel, e-mail, school platforms or the delivery of digital awards, in addition to giving points of view on topics and

knowing the progress of their achievements to reflect (see Figure 6). As for feedback, they indicated that their teachers use school platforms, e-mail, Quiz and PowerPoint, where they comment on achievements and areas of opportunity, as well as verify who met the established goals (see Figure 7).

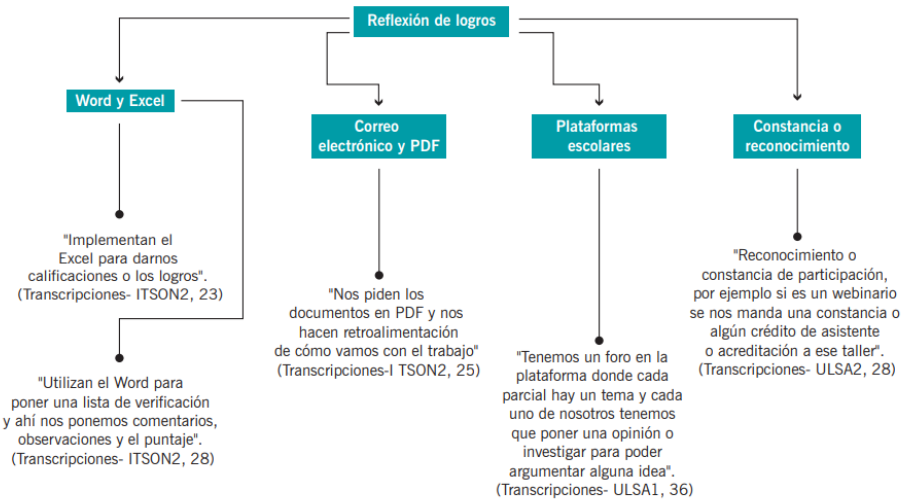

Figure 6. Coded segments on reflection of achievements.

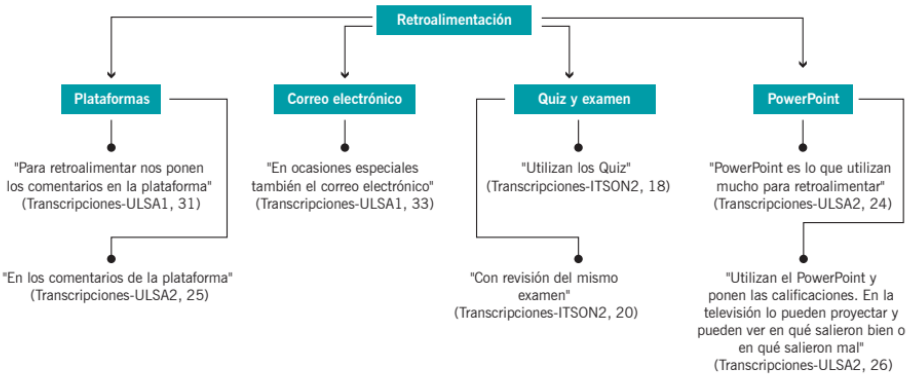

Figure 7. Coded feedback segments.

Most used TICCAD and recommendations

Using the data in the coded segments, the most mentioned TICCAD in the focus groups were identified. It was determined that Canva is the most used by teachers during class, followed by Google Drive, Kahoot!, Moodle and Google Documents (see Figure 8). Lastly, students were asked what recommendations they would give to their teachers regarding the integration of TICCAD in their classes. In their responses they highlighted

training, guidance, improving the use of academic activities and maintaining an openness to the use of new tools (see Figure 9).

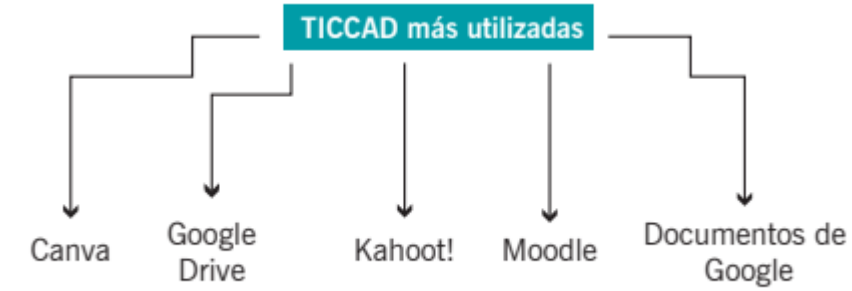

Figure 8. Segments of TICCAD use.

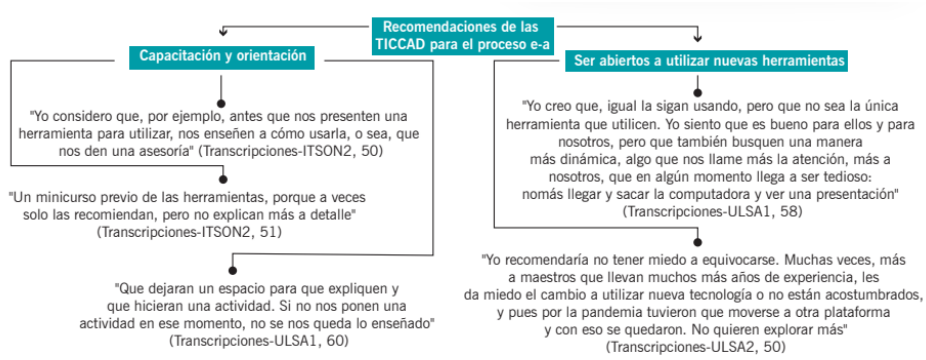

Figure 9. Segments of TICCAD use.

DISCUSSION

When analyzing the results of the four focal groups, crucial findings were obtained about the use of TICCAD by university teachers in the post-pandemic. It was found that the most used TICCAD by teachers to identify their students' prior knowledge were Kahoot!, Google Forms and Moodle. These results are consistent with the findings reported by Puche-Gil (2019) and Zolano and León (2020), who highlight the importance of free and accessible technological tools (such as Kahoot! and Moodle), which can encourage participation and evaluation of students' knowledge in a more dynamic and effective way.

In relation to the technological tools used by teachers to search for information, students mentioned search engines such as Google Scholar and virtual libraries such as ITSON Libraries, from La Salle Noroeste

University; however, they point out that it is difficult to identify which pages are official or which sites have reliable information. The latter agrees with the approach of Escudero *et al.* (2020), where it is found that 81% of students still do not know how to select relevant information, create products with controlled design and exposure, and be aware that the information they access may be partial, inaccurate or unreliable.

Likewise, the main TICCAD that teachers use to develop integrative projects are Google Drive, PowerPoint, Word, Excel, Canva, Kahoot! and Netflix, which allow them to create or use innovative and dynamic educational content, to promote a more effective education for students. These results are comparable to those obtained by Ortega (2021), who indicates that technological tools such as Google Classroom, Drive, Dropbox and Moodle are used as support to improve learning through meaningful experiences for students.

Regarding TICCAD, which promotes collaborative work, students mentioned Google Drive, Canva, Google Meet and, to a lesser extent, Zoom, Google Forms and Mentimenter. These results are consistent with the findings of Herrada and Baños (2018), Leiva *et al.* (2020) and Ortega (2021), who highlight the importance of communication tools and synchronous and asynchronous work platforms, such as Google Docs, Canva, Mentimeter, Google Forms, among others.

Regarding entrepreneurship, students commented that in class teachers encourage the use of websites and social media, and less frequently Google Drive, Zoom, Classroom, Moodle and PowerPoint. In this sense, Cruz (2019) indicates that the use of technological tools provides an opportunity to collaborate, communicate and manage content that can be promoted and positioned professionally, making these allied instruments of entrepreneurship.

Regarding metacognition, students indicated that the TICCAD tools most frequently used by teachers to reflect on achievements and provide feedback were Word, Excel, the school platform, email, PDF and PowerPoint documents, Google Documents, and, to a lesser extent, Jamboard, Mentimeter, YouTube, and forums. These findings align with those established by Cruz (2019), Puche-Gil (2019), Zolano and León (2020), and González (2021), who highlight that technological tools fostering reflection on student performance enable monitoring and support with the purpose of revising strategies to enhance educational practices.

When considering the previous results, it was determined that the most frequently used TICCAD tools in the teaching-learning process, according to students, are Canva, Google Documents, Google Drive, Kahoot!, and the Moodle platform. These findings are consistent with the results of Zolano and León (2020), Gómez *et al.* (2021), and Ortega (2021). However, it is important to emphasize that technological tools are merely means to

facilitate learning. Teachers must integrate them didactically into the educational process to encourage participation, motivation, and comprehensive evaluation among students. Their versatility and accessibility allow students to be creative, organized, and collaborative in building knowledge (Herrada and Baños, 2018; Leiva *et al.*, 2020; Ortega, 2021; Puche-Gil, 2019).

Regarding recommendations from students to teachers about integrating TICCAD into educational processes, emphasis is placed on the importance of diversifying these tools and continuing professional development to ensure they effectively facilitate learning. In this regard, Torres-Hernández (2023) highlights that teachers play a triple role when interacting with technologies: 1) user, 2) facilitator, and 3) educational professional. Therefore, these tools must be utilized within the training process to achieve comprehensive education that motivates students and yields positive outcomes (Alfaro-Hernández, 2022; Centeno-Caamal and Acuña-Gamboa, 2023; Escudero *et al.*, 2020; Garduño 2021; Solís *et al.*, 2021).

Study limitations identified the need to conduct at least two additional focus groups with students from programs related to social sciences and humanities. The goal is to gather more information to enrich the results. Additionally, the limited information available regarding the use of TICCAD in educational processes after the pandemic is emphasized.

CONCLUSION

This study identified university students' perspectives on the use of TICCAD by teachers in the post-pandemic context. The principles established in the socio-formative competency-based approach were considered, analyzing technological tools used to identify students' prior knowledge and evaluate their performance. Based on the data collected, it was concluded that the most frequently used technological tools in the learning process after returning to in-person classes were Canva, Google Documents, Google Drive, Kahoot!, and Moodle.

These findings underscore the importance of incorporating TICCAD into the educational process, as their didactic use promotes motivation, participation, and positive learning outcomes. The integration of TICCAD tools in teaching-learning processes after returning to classrooms has proven to be a valuable and effective strategy for increasing university students' interest in learning. Moreover, these tools are considered essential support systems, facilitating access to information, exploration, and discovery of new knowledge, thereby enriching the educational experience.

Nevertheless, it is crucial to acknowledge the significant challenges teachers face when returning to in-person classes. Teachers must integrate

TICCAD tools didactically and continue strengthening their digital competencies to determine which technological tools are most effective in stimulating student motivation and interaction. They must also select tools appropriate for the context, identify student characteristics, and address the types and levels of learning required.

Finally, this study contributes to the field of TICCAD in post-pandemic education, highlighting the limited research available on this topic after the return to classrooms. This issue is of utmost importance, as the experiences gained during confinement underscore the need for universities to provide teachers with the necessary conditions to continue incorporating technological tools into their classes. This approach promotes innovation and prevents a return to traditional practices.

ACKNOWLEDGMENTS

The authors would like to thank the Research Promotion Program of the Instituto Tecnológico de Sonora for funding this study as part of the research project identified under the code PROFAPI_2023_046 ACC.

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HOW TO CITE

Crespo Cabuto, A.; Mortis Lozoya, S. V. y Del Hierro Parra, E. (2024). TICCAD utilizadas por el profesorado universitario en pospandemia: perspectiva del estudiantado. *Apertura*, *16*(1), 126- 141. http://doi.org/10.32870/Ap.v16n1.2482