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Learning of University Students in Remote Education During The Covid-19 Pandemic: A Case Study

Patricia Inês Schwantz[1], Gabriel Adolfo Garcia[2], Vanessa Tamires Borba[2], Ingridi Vargas Bortolaso[3], Estela Maris Giordani[4]

[1]*Postgraduate Program in Management, Federal University of Santa Maria, Av. Roraima 1000, Santa Maria 97105-900, Brazil. E-mail: patyschwantz1991@gmail.com*
[2]*Master's Program in Public Administration, Federal University of Santa Maria, Av. Roraima 1000, Santa Maria 97105-900, Brazil.*
[3]*Professor of the Postgraduate Program in Social Memory and Cultural Goods and in the Education Program, La Salle University, Av. Victor Barreto, 2288 - Centro, Canoas - RS, 92010-000, Brazil.*
[4]*Professor of the Master's Program in Public Administration, Federal University of Santa Maria, Av. Roraima 1000, Santa Maria 97105-900, Brazil.*

ABSTRACT
In the face of the COVID-19 pandemic, with the temporary closing of educational institutions, over 1.6 billion students were affected, causing a swift transition to the remote modality. Teaching work became even more challenging because it required the fast adaptation to technology, the use of digital tools, and new ways to engage students in the teaching-learning process. This study aimed to analyze the engagement, exploitation, and suitability of the tools in learning units and evaluation procedures. This study employed a qualitative approach and was conducted through a case study with narrative elements. The collected data were accounts by the professor and reports generated by the digital tools used in undergraduate programs in management and business of two universities in Rio Grande do Sul, Brazil, and the content analysis technique by Bardin (2015) was employed. A time frame of three academic semesters was adopted: the two semesters of 2020 and the first of 2021, totalizing six classes. There was a significant rise in engagement and participation, analyzing the reports at three different times. It was found that learning takes place playfully through gamification, enabling individual and collective reconstructions. The contribution of this study was in demonstrating that digital tools may be used in specific pedagogical moments determining goals and improving the teaching work with positive results in learning.

Keywords: *Remote Education. Higher Education. Gamification. Teaching-Learning. Engaged Learning.*

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I. INTRODUCTION

The 21st century brought an accelerated amplification of information and digital knowledge, together with the new demands and complexities of the work and teaching environment. However, the propagation of the COVID-19 pandemic required a swift transformation not only of the economy and health but also of education. In the face of this scenario, educational institutions worldwide were forced to suspend in-person learning to contain the propagation of the virus, which required thinking of alternative strategies to engage the students and maintain the quality of the teaching-learning.

In 2020, with the temporary closing of the educational institutions due to the pandemic, over 1.6 billion students were affected, representing about 91% of all those enrolled (Unesco, 2020), leading the education systems worldwide to attempt a fast transition to remote education. The complex teaching work became even more challenging during the pandemic period because it required the fast adaptation to technology, the use of digital tools, and new ways to engage students in the teaching-learning process.

During the COVID-19 pandemic, remote education presented technological, pedagogical, and social challenges. According to Ferri, Grifoni, and Guzzo (2020), the technological challenges are related primarily to the lack of reliability of Internet connections and the lack of electronic devices for many students. The pedagogical challenges are associated mainly with the inaptitude of students and teachers to use digital tools, the lack of structured content and abundance of online resources, the lack of interactivity and motivation of students, and the lack of the social and cognitive presence of teachers. Also related are the social challenges,

especially the lack of human interaction between teachers and students, the unavailability of physical space at home to participate in the classes, and the lack of support from parents.

For this reason, this study aimed to analyze the engagement, exploitation, and suitability of the tools in learning units and evaluation procedures with learning in a case study from digital tools during the remote class period in Higher Education.

II. DIGITAL TOOLS IN LEARNING

Learning assumes the capacity of each individual to carry out a reconstruction effort (Demo, 2004). This movement involves both the re-elaboration and overcoming of previous learnings regarding the introduction of new elements. It occurs in such a way that each individual recreates within themselves and makes their own what they do not yet have; therefore, it is not a reproduction (Saint-Onge, 2001). This author understood that intentionality permeates the relationship between teaching and learning. For this reason, the attitude of openness in recognizing that of which one has not yet appropriated is fundamental (Demo, 2004). The teaching activity, which organizes the conditions for learning to take place, is implicit from this understanding (Saint-Onge, 2001).

2.1 Teaching-learning relationship

The educational process originates from the constant interaction of various fields in which the subject is inserted: family, society, the historical moment, and technologies, among others. Hence, it is in constant motion, with the educator not being that who only educates but that who, during their mediation, is also educated in the dialogue with the pupil because, in being educated, one also educates (Freire, 1987).

Demo (2010) stated that teaching-learning only occurs if there is teaching quality, and, for this, it needs to be verified from various perspectives among educators. Hence, there is a need to evaluate it to ensure that this relationship is in concert with the educational goals, i.e., that learning is indeed taking place within this relationship. To Luckesi (2000), to evaluate is to be willing to accept the student according to their way of being, an attitude opposite to exclusion. To the author, the act of evaluating implicates two processes: diagnosing and renegotiating the best path for the development of the pupil in an inclusive, democratic, and loving manner. The evaluation of learning does not implicate approval or disapproval but rather the permanent guidance with the purpose of development for life.

Traditional teaching techniques are part of every intellectual community that seeks to identify deficiencies and propose new teaching-learning methodologies that are more and more efficient and appropriate (Paiva et al., 2016). Hence, the teaching procedures are as important as the learning contents themselves. Given this context, the focus of education and the way of educating need to be reconsidered. This is because the informational flows changed due to the democratization of Internet access and the speed and reach of the shared information, thus requiring a change in the way of associating and practicing teaching-learning (Silva and Sales, 2017).

Consequently, within the scope of the teaching-learning process, transformations are constant, and, with technological tools, this process may be reconsidered to be adapted to the new realities. With the use of active methodologies, considering the characteristics of the pupils, there is greater flexibility for inserting new tools with the purpose of maximizing the efficiency of the teaching-learning process, following the fast changes that occur.

2.2 Active learning methodologies

One of the major challenges for contemporary education is integrating the current technological resources into the educational contexts (Silva et al., 2018). In this sense, when used as learning tools, technological devices influence all those involved in this process, given that technology has transformed and influenced various factors of society. According to Silva and Sales (2017), the consequences of such changes cannot be ignored by the educational environment, nor their implications within the education process.

However, choosing and inserting technology into an educational environment such as the classroom is not a trivial task, a fact that generates obstacles for the teacher in applying such tools (Webber, 2016). However, it is necessary to create learning spaces in which the new teaching methodologies are combined with digital tools, focusing on maximizing the success in the teaching-learning process between teacher and student.

The ever-greater proliferation of electronic tools leads to the proposal of replacing the traditional model of expository classes with another model that achieves the pedagogical goals at the university (Masetto, 2004). By using active methodologies, both learning and knowledge absorption may be more fruitful and, thus, generate more considerable success in this process.

2.2.1 Digital tools: gamification

With the expansion of digital resources and their insertion in the education context, new means for building knowledge in contemporary teaching are verified, which may render learning richer, more motivating, and more significant. The use of gamification is growing in educational processes because of its capacity to influence student learning (Göksün and Gürsoy, 2019). It is an approach aimed at facilitating learning, increasing motivation and engagement, qualifying student participation, providing class interactivity, and stimulating students in a way that leads to the expansion of their knowledge (Göksün and Gürsoy, 2019; Lopez and Tucker, 2019).

The appropriate use of gamification in education may increase intrinsic motivation and engagement, becoming a powerful tool capable of being used at different education levels (Jurgelaitis et al., 2019; Kuo and Chuang, 2016). Among the tools inserted in the gamification context, one may mention Socrative, Kahoot!, Jamboard, Mentimeter, Padlet, Miro, Powtoon, and Youtube/Vimeo, for example. In addition to these, many others are available and may be used to simplify the construction of knowledge in the teaching-learning process.

Mentimeter is a digital resource for interactively creating polls, questions, collecting words, idea clouds, and charts, among others. The most significant benefit of this tool is to be able to create interactions for large student groups and make the results visible to all (Safetec, 2019).

When investigating differences in student performance and involvement using two types of pedagogical intervention, Zainuddin et al. (2020) suggested that finding ways to apply games or gamification concepts in the classroom may be a promising and innovative way for educators to involve their students in creative learning skills and attractive competition.

When discussing the Socrative tool, Zainuddin et al. (2020) described that it allows the teacher to not only make questionnaires available in the classroom through various types of electronic devices but also to visualize and monitor student learning. The authors also claimed that Socrative allows creating reports and seeing the responses of the class in real-time, making the evaluation of student progress easy.

Regarding Kahoot!, Alawadhi and Abu-Ayyash (2021) suggested that it has the potential to retain student attention, improve classroom engagement, boost motivation, and create a pleasant learning experience. Also, it is fun and involving, and competition is motivated by the ranking generated in the tool and emerged as a significant variable that contributes to intrinsic student motivation.

Lima et al. (2020) carried out a survey to verify the student assessments of the online tools to promote involvement during the quarantine stemming from COVID-19. The authors described that, upon being asked about the tools they most liked to use, 60% of the respondents pointed to Mentimeter. The authors proceeded with their collocations by indicating that the survey participants reported that, through interactive questionnaires, the tool helped understand the previously studied content better.

Sweeney, Beger, and Reid (2021) discussed the use of Jamboard for virtual education in anatomy, claiming that the tool allows educators the freedom to explore options in collaborative virtual education without the restrictions of cost and geographical location. Moreover, the authors pointed that the tool offers a versatile collaborative experience that may be used in higher education and has additional potential within the interprofessional discussion areas such as research, professional development workshops, and other creative environments.

The digital resource Miro offers multiple opportunities that surpass the classroom walls, allowing to prepare the board beforehand and expand as the learning moments evolve (Ceduc, 2021). In remote education, the tool allows teachers and students to visualize, share, and present an online mental map, helping the construction of a critical and concise posture of the pupil, besides rendering learning more transparent, helping in the memorization and knowledge acquisition process (Barbosa and Nascimento, 2021).

Korkealehto and Siklander (2018) stated that Padlet is an interactive virtual tool in which links, photos, documents, and presentations may be shared, favoring the academic performance of the students relative to traditional virtual tools. Moreover, through Padlet, one may create digital murals incorporating texts, images, videos, audio, and hyperlinks, among others.

In addition, tools that use videos such as YouTube and VIMEO are being inserted into educational environments more and more because it is possible to create, manage, and share videos with them. When analyzing the use of YouTube tutorials as non-formal learning strategies among university students, Rodriguez (2021) identified that students use it for four main reasons: understanding a subject, easy access, saving time, and using the tool as a guide to doing something.

Regarding audiovisual tools, Powtoon is a visual communication platform that provides the freedom to create professional and personalized videos (Powtoon, 2021). Awalia, Pamungkas, and Alamsyah (2019) stated that Powtoon may provide a better view of the content worked, and its practical application is highly viable. According to Oktaviani and Mandasari (2020), to learn English, the tool boosts the student's learning of the language, besides improving skills of using technology.

III. RESEARCH METHOD

This exploratory study employed a qualitative approach and was conducted through a case study with narrative elements. This strategically chosen design aims to break with traditional models, bringing to light the subjectivity of the researchers, to which the reconstruction of knowledge is imbricated. The involvement of the researcher is fundamental in the practice of the study because it allows "handling the research as a scientific and educative principle and maintaining it as an everyday attitude" (Demo, 2003, p. 2).

The assumption follows that people act according to their beliefs, perceptions, feelings, and values, demonstrating, through behavior, a meaning that is not immediately known, needing to be unveiled (Mazzotti, 1991). Also, it makes possible the reconfiguration of the understanding of learning, of the internal and external relationships in the institutional instances, of the historical-cultural understanding of the requirements of a more dignified education for all, and the understanding of the importance of the educational institution in the humanization process (Zanette, 2017). Therefore, the construction and planning of qualitative research in education aim to surpass the meanings attributed before, based on judgments built on views that permeate the teaching *habitus*, which could conduct to misleading understandings.

In the search to overcome the assumptions of the objectivity of knowledge, a more dynamic approach was chosen in considering the subjective aspects of both the researchers and those surveyed, implicating in a discovery process. This research was conducted from a case study in undergraduate courses in the field of management and business of two universities in Rio Grande do Sul, Brazil, with a time frame of three academic semesters encompassing the two semesters of 2020 and the first of 2021, totalizing six classes of the same curricular component, taught by the same professor.

Data collection took place through testimonies of the professor assigned to the course of Innovation Management and reports generated by the tools. Initially, the retrieval of the experiences experimented in classroom practice was carried out, followed by the transcription of the accounts. Having the reports of the digital tools, the analysis was performed regarding student engagement and performance and the suitability of the tools in learning units and evaluation procedures.

The data analysis began from the experiences practiced while exercising higher education teaching, with the content analysis technique by Bardin (2015) being employed. A matrix of learning moments, a summary table about the learning unit organization, and a description of the evaluative process carried out through the engagement and exploitation of the pupils are presented.

To guide the discussion of the results, the narrative by the professor about the procedures used for developing content in the field of management and business is presented. Next, a matrix of the employed digital tools is exposed, followed by the structuring of their application in learning units. Lastly, the data relative to engagement, participation, perceptions, and evaluation in the teaching-learning process is presented.

IV. ANALYSIS AND DISCUSSION OF THE RESULTS

The challenge of conducting learning processes and getting students and classes to achieve it is the purpose of the professional activity of higher education teaching. In remote education, since the beginning of the pandemic in 2020, university professors have been even more challenged because the teaching-learning relationship practices are based on the instructional model, in which the professor is active and the student is passive. In the face of this, some professors noticed the need to render the pupil proactive, making efforts for them to assume a responsible protagonism in their learning process (Meneghetti, 2019). O the same line, the following was verified in the account by the professor of the course Innovation Management, in which the tools were applied:

> In the second semester of 2020, the professors found themselves thinking and then had an immersion searching on their own or for universities offering teaching training courses to contribute to the conduction of the course in the remote modality. Hence, several tools were presented. We, professors, in this eagerness, then sought a series of tools and identified that the best and friendlier ones for us to work in this experience would be Socrative, Jamboard, Kahoot, among others... (Professor)

Given the account, one may notice the need to broaden the knowledge repertoires concerning teaching means, in addition to the mobilization of universities offering courses. At this moment, the discovery of new tools that may be incorporated into the teaching activity is verified. However, these instruments require a pedagogical reflection by the professor regarding how, when, and why use them. This is a complex route of discoveries that the professor must make; however, it is not always easy and, for this reason, not everyone is willing to traverse it.

Analyzing the context of teaching practices in remote education, Nienov and Capp (2021, p. 19) understood that "it is not a simple transposition of in-person educative models into virtual spaces, because it requires the adaptation of didactic, chronological, and evaluative planning, besides the use of educational strategies, methodologies, and resources to support students in building learning". Added to the complexity of

the teaching activity, which is work with human learning, the mastery of new tools and platforms that mobilize students to carry out the apprehension of educational contents more dynamically was incorporated during the pandemic. Throughout 2020 and the first semester of 2021,

we managed to identify that, when introducing a new concept, the best to do is to use tools such as Mentimeter and Kahoot when raising awareness on the content. Furthermore, when working the theoretical connection with real life, deepening concepts, the best to do is use tools such as Jamboard or Miro, both enabling the creation of mental maps on the worked contents (Professor).

One may notice that the professor used in her pedagogical practice multiple tools in a combined manner as if they were different ingredients to compose dynamic and flexible interactivity scenarios. In the context of the need to transform pedagogical practices, Bicich and Moran (2018) claimed that "the combination of active methodologies with mobile digital technologies is strategic nowadays for pedagogical innovation" (Bicich and Moran, 2018, p. 51). Hence, the possibilities of amplifying and modifying the ways of teaching and learning are potentialized with such tools.

Nienov and Capp (2021, p. 23) understood that using digital tools is the trend of the current conjecture in which "online education emerged as a phenomenon of cyberculture [...] with mobility and connectivity, the process is much more perceptible, broad, and deep: it is a more open and creative ecosystem". In her account, the professor also explained that she uses each tool at specific moments of the interaction and learning process with her students.

For each of the tools used, the professor identified their characteristics and how they could be used in different situations relative to the three pedagogical moments, as per Delizoicov and Angotti (1990), namely the initial problematization, knowledge organization, and knowledge application.[1] Following the dialectic understanding of education and inspired by Paulo Freire, the authors understood that the first moment (problematization) consists in connecting the students to what will be worked; for this reason, one performs the survey of previous learnings and elaborations that the students have about what will be studied.

This moment seeks to investigate the perceptions, values, know-how, etc. of the students, elements on which new acquisitions and re-elaborations occur. It is about recognizing the pupils in their singularities. At the same time that the previous learnings are valued, it aims to break with the initial understanding and evolve qualitatively in constructing the new content that will be studied. According to the practice of the professor, this first moment is experienced by two characteristics, which she denominates raising awareness and connection.

At the second moment of learning, knowledge organization occurs, according to Delizoicov and Angotti (1990). It consists of the process of acquisition and elaboration of the learnings. To the professor, this moment is characterized by the exploration of concepts, providing opportunities for the speaking space and the reviewing of the learning.

Lastly, the third pedagogical moment is the application of the educational content, which consists of establishing more complex correlations among the initial learnings, the new ones, and real-life experiences, verifying if the intended learnings were incorporated by the students. In this step, the professor characterized the use of technology to transcend the space-time of the interaction that occurred in the classes.

Therefore, the pedagogical moments were worked by the professor in six complementary movements: 1) raising awareness; 2) connection; 3) exploring the concept of the content; 4) making sense - providing opportunities for the student speaking space; 5) reviewing the learning; 6) transcending the classroom. From the narratives of the professor, Table 1 exposes the moments in the organization of a learning unit with digital tools.

Table 1 - Organization of the Learning Unit

Moments	Goal of the step
Raising awareness	Insert a story, video, or podcast that awakens student curiosity. The story or video works as a pleasant experience that instigates the student to want to know more.
Connection (Connect subjects already worked to the new content)	Elaborate polls, construct word clouds, and demonstrate examples to help the student connect the presented content and the learning units, constructing a common thread preventing the absorption of the knowledge in blocks (with no connection).
Exploring the concept of the content	Present the concepts that involve the learning unit by conducting a dialogue that presents and describes the concepts in detail, explaining the application of each one. The professor uses educational technologies to render the class interactive and allow each student to identify the best path for their learning.

[1] Here, instead of just knowledge, it is deemed appropriate to adopt the concept of content.

Making Sense - Providing opportunities for the student speaking space	Space is opened for the deliberate manifestation of the students. The construction of a collective conceptual map, exercises via Kahoot, and the presentation of a summary video elaborated by the professor are examples that contribute to the development of this process, leaving a matter for reflection.
Reviewing the Learning	Assess the learning of the student and identify knowledge gaps and misunderstood concepts. With the educational technology, questions are formulated and, after verifying the number of hits and mistakes, there is a review of the questions for which content assimilation was difficult.
Transcending the Classroom	Encourage the student to continue their learning. Indications of articles for reading and Padlet are carried out. Padlet is a panel used to indicate various materials complementing the learning track.

Source: Author's (2022)

Table 1 demonstrates that the professor has clear goals at each pedagogical moment, which facilitates selecting the most appropriate interaction tools for her work to become more consistent with the learning goals to be achieved by her students. Also, in her report, the professor explains what tool she noticed is more appropriate for each moment of the learning:

For introductions, we use a simple tool [...]. When developing the theoretical content, we use Miro, Jamboard as a mental map for the student to be able to participate in this construction of knowledge. When synthesizing the learning or when one wishes to survey or assess what was said and actually learned/understood, Socrative is used, a tool that allows deepening, creating questions, and including questions of the Enade. It allows verifying the number of hits and misses, enabling the professor to return to the exposition reviewing the questions, explaining the content from the determination of a learning failure (unlike in-person classes). Socrative allows a more profound analysis/perception of the learning process and knowledge fixation. (Professor)

Compared to the traditional interaction methods, Guarascio, Nemecek, and Zimmerman (2017) reported that Socrative helped students participate more actively in the classes, with a better environment to ask questions and receive answers to their questions. In the same sense, Zainuddin et al. (2020) indicated that exercises using gamified questionnaires work positively to involve the students in the learning. They also reinforced that competition is an important element in implementing gamification, providing visible incentives for student behavior, impacting classroom performance. When analyzing the reports of the digital tools generated during their interactions, an increase in student interactivity was noticed.

Through the reports produced by Socrative, using descriptive statistics, it was noticed that at the first moment using the tools in all analyzed semesters, few students engaged, and the result was low. At the second moment, there was greater engagement, and the results were better. In turn, at the last moment of using the tool, everyone engaged. Given the above, it is possible to demonstrate that the increased participation of the students in the classes is associated with the use of digital tools. The professor expressed that "the students noticed that the class was no longer a monologue where the professor publishes the screen, pushes play, and keeps talking. On the contrary, the classes become more interactive".

On the same line, Guarascio, Nemecek, and Zimmerman (2017) mentioned that Socrative has good acceptance by students due to the ease of use, reflecting the simplified convenience of using smartphones and tablets, which they may consider more up-to-date technology they already bring to the classroom. Likewise, Zainuddin et al. (2020) maintained that students who never experienced a gamified instructional approach are attracted by tools that fulfill this role. By including resources similar to those of games, there is an increase in student involvement through a pleasant experience aligned with the skills and innovations capable of supporting learning in the 21st century.

Beyond the possibilities of improving the interactions in the learning processes, Bicich and Moran (2018, p. 63) noticed that using such tools "[...] helps students to face challenges, phases, and difficulties, deal with failures, and take risks safely". The professor noticed such transformations, indicating the socioemotional skills of the educative process, as per the following speech.

From the experiences and the several tests of scenarios (scenarios were created) carried out, in the best logic, through experience, it is important to use Mentimeter for matters of raising awareness, to create, for example, word clouds about the subject, raising awareness of the content. After raising awareness, you come in with the theory using Miro, showing the relationship of the research with practice (allows the student to confront and build together the absorption/construction of knowledge). (Professor).

Upon exploring the potential of Mentimeter as a platform to qualify teaching and learning within political sciences, Mayhew (2019) claimed that the tool is simple, efficient, and has an array of use possibilities,

allowing the adoption of an approach pedagogically centered on the student, thus gaining engagement, motivation, and learning. Similarly, Moorhouse and Kohnke (2020) stated that Mentimeter may be used at both the beginning and the end of each class to verify the prior knowledge and expectations of the students and assess their opinions on the learning, as well as gather doubts about the worked theme.

Regarding the tool Miro, Marques (2021, p. 77) emphasized that the application in the classroom "is based on student-student and student-teacher interactions, allowing the systematization of knowledge through the joint construction of diagrams, information flows, conceptual maps, timetables, and research planning". However, to use the tool, the activity of the professor in supporting and guiding the activities in the teaching-learning process is essential.

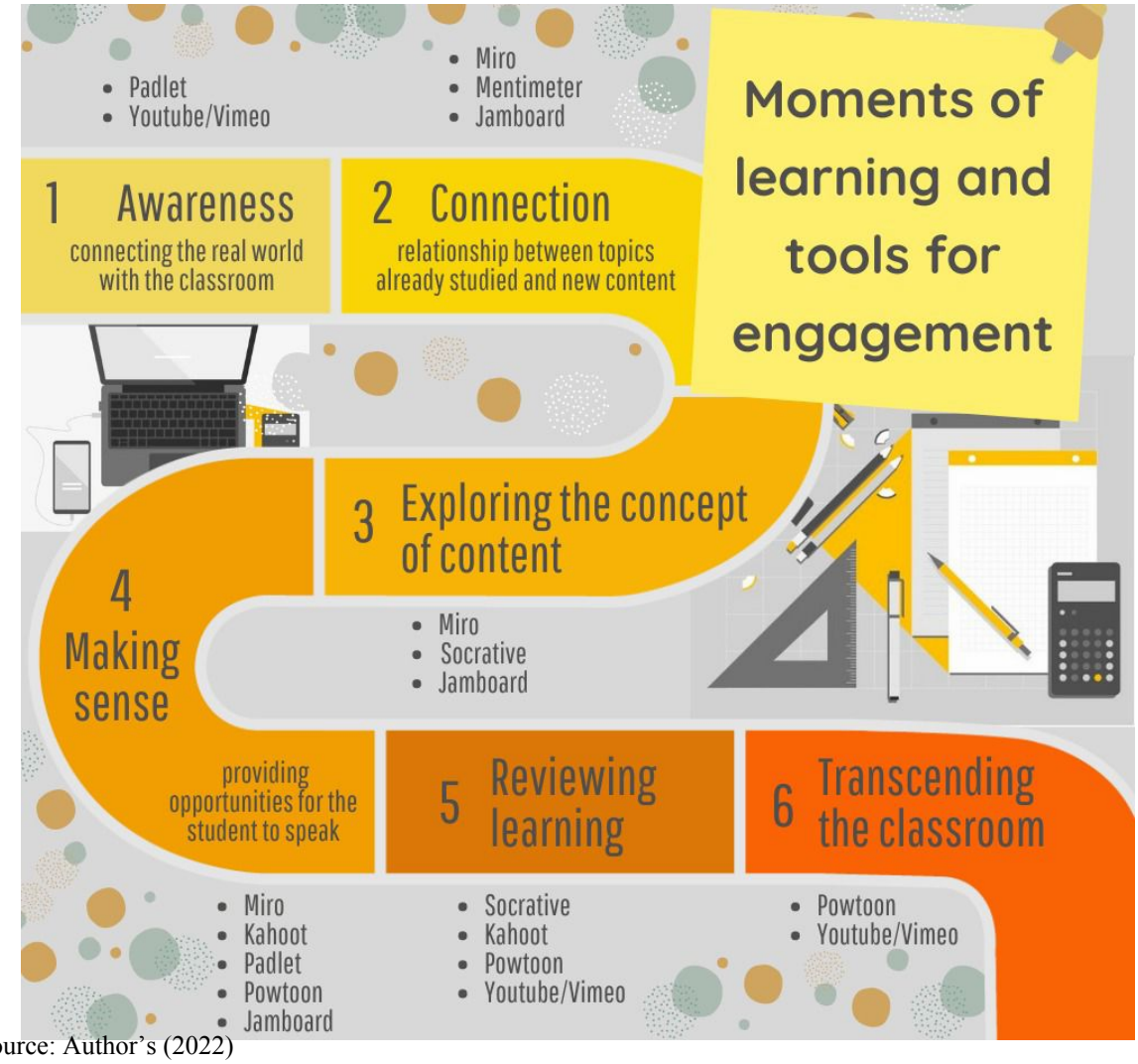
Relative to the perception of professors who use Kahoot!, Wang and Tahir (2020) pointed out that most have a positive perception of the tool. They also highlighted that the tool evokes more motivation given the ease of use, the support to classroom work, the possibility of assessing the content assimilation in real-time, and the promotion of the participation of the student in the discussions proposed in the classroom. In this direction, the surveyed professor explained the following:

For evaluations and for reviewing tests with dynamic moments to assess performance and learning, Socrative is used. When one wants engagement, the playful, to arouse creativity in the student or evoke teamwork, Kahoot! is used. Moreover, it is possible to suggest, for example, using stories and videos to cheer up the classes. (Professor)

Upon using the Kahoot platform in the university context, Aquino (2021) identified more active and critical participation of those involved, promoting and contributing to the teaching and learning process, besides enabling the discussion of the questions and answers of the quiz.

Given the experience reported in this article from remote classes in higher education, Figure 1 shows a map elaborated to represent the route of the learning moments associated with each tool used by the professor in developing the didactic units.

Figure 1. Moments of learning and the digital tools for engagement.



Source: Author's (2022)

With the system presented in Figure 1, the professor explained that the tools are typically used at three different moments in the semester, according to the development of the learning units, depending on the dynamic and progress of each class. In other words, such tools are not used in every class but rather in those in which such six moments occur.

Another important issue of the case study performed was understanding how the professor carried out the learning evaluation process using the strategies of the digital tools. It was observed that the evaluation stems from the engagement, participation, and execution of the activities. Performance is not measured but rather the engagement and participation of the student in the activities proposed throughout the learning units.

To demonstrate the evolution of student engagement and participation with the use of digital tools, three tools were chosen, with the respective descriptions in percentages. It is worth highlighting that the number of students who participated in each class in which the tool was used was considered for analyzing engagement and participation as the course progressed. Thus, to determine the engagement percentages, the number of students who executed the activities in the tool was considered. In turn, participation was calculated using Equation 1.

Participation (%) = (1)

However, participation does not guarantee that the student engaged in the classes. It merely means that they accessed the tool at the time indicated by the professor. As for engagement, one considers students who, besides participation at the moment with the tool, also executed the proposed activity in full, given that they may have started the task in the tool and not finished. Equation 2 is used to calculate engagement.

Engagement (%) = (2)

Table 2 presents the engagement and participation data with three different tools.

Table 2. Demonstration of the evolution of student engagement and participation with the use of digital tools.

Moments	Jamboard		Kahoot!		Socrative	
	Participation	Engagement	Participation	Engagement	Participation	Engagement
1st	100%	20%	65%	65%	85%	60%
2nd	100%	45%	100%	100%	93%	85%
3rd	100%	60%	100%	100%	100%	100%

Source: Author's (2022)

In Jamboard, the activities executed by the students occur in groups, and all those who are connected participate, then execute the task used to assess engagement (group activity). In the first participation with Jamboard, although all students were connected (100% participation), only some executed the tasks (20% engagement). There is an increase in engagement in the other activities, representing 45% in the first meeting and 60% in the third.

In Kahoot!, the students who are in the class participate in the game individually and, on the first time, they typically enter with nicknames for being ashamed to expose themselves if they present low performance in the ranking generated by the application, leading to low engagement (Professor). After the execution of the game, it is important for the professor to resume the content playfully, allowing the recovery and appropriate understanding of the knowledge. In the second and third times, the participation improved, reaching 100%, and those who did not interact had Internet connection issues.

At the first moment of using Socrative, although there was 85% participation, only 60% of the students engaged in the class. With it being a tool for quizzes and tests, the lower engagement may be associated with apprehension with the assessment of the hits. However, throughout the activities, the students noticed that it is a playful way of connecting the knowledge, and engagement increased little by little, reaching 85% participation in the second moment and 100% in the third.

Hence, the pertinence of using digital tools to obtain more considerable participation in remote classes and, consequently, increase engagement in the execution of the proposed activities was verified. The tools used also enable the professor to monitor the learning process of each student, which positively impacts their performance in the evaluative process.

The use of digital tools associated with the pedagogical work of the professor revealed the surpassing of the traditional methodologies of the teaching and learning process. The playfulness and the creative and active interaction of the students indicated a break with the passive model of student participation. Lastly, this research indicates that there was an advancement in the use of digital tools, given that didactic goals were planned and defined for their insertion at the pedagogical moments of the development of teaching-learning units. Those involved assumed active roles, and the interaction enabled the students to surpass the limits established in the teaching programs, an attitude rarely verified in university classes.

V. CONCLUSIONS

This article brings evidence that, although several studies revealed the pertinence of using digital tools in learning, the pedagogical teaching work in the context of remote higher education alone is not enough. A need is perceived for the professor to carry out a pedagogical reflection about the moment in which the tool was inserted and the reason for using it in that learning context.

From the accounts, it was verified that there was a reflection and a development of the understanding that each tool has a specificity, elaborating goals according to the pedagogical moments for each didactic unit. Hence, it was possible to describe the didactic route from the characteristics of each of the tools in the organization of the learning units. The pedagogical moments were identified as raising awareness, connection, exploration, oral expression of the pupil (mental elaboration), review, and search for learnings beyond those acquired in the class.

The fundamental contribution of this work consists of the presentation of possibilities of tools to be used at different moments experienced in the teaching-learning process. The fundamental contribution of this work consists of the presentation of possibilities of tools to be used at different moments experienced in the teaching-learning process. It was verified that gamification transforms the teaching-learning process into a playful, more attractive moment and enables reviewing the worked contents through student engagement. Such conclusions may come to be confirmed, refuted, or re-elaborated because they are not absolute truths but rather a proposal that may be adapted to different realities from the perspective of both professors and students.

Declarations

Competing interests: The authors declare no competing interests.

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