HOW TO STRUCTURE A KNOWLEDGE-SHARING PROCESS BASED ON DIFFERENT CONFIGURATIONS OF TIME AND SPACE DIMENSIONS: A DIGITAL LITERACY PERSPECTIVE

COMO ESTRUTURAR UM PROCESSO DE COMPARTILHAMENTO DE CONHECIMENTO A PARTIR DE DIFERENTES CONFIGURAÇÕES DE DIMENSÕES DE TEMPO E ESPAÇO: UMA PERSPECTIVA DE LETRAMENTO DIGITAL.

Recebido em: 10 de abril de 2022
Aprovado em: 15 de junho de 2022
Sistema de Avaliação: Double Blind Review
RCO | a. 14 | v. 2 | p. 69-88 | jul./dez. 2022
DOI: https://doi.org/10.25112/rco.v2.2990

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Revista CONHECIMENTO ONLINE

ISSN: 2176-8501

ABSTRACT

The availability and progress of information and communication technologies opened new possibilities for learning processes. Even though there are recent studies about the use of technologies in learning processes, a more systematic and deep debate about the forms of knowledge sharing in teaching processes and how technologies can be used in different educational contexts is still necessary. This paper investigates forms of knowledge sharing used in an education setting and introduces a method to the analysis of the knowledge sharing process based on four possible configurations of knowledge sharing (same-time same-place, same-time different-place, different-time same-place, different-time different-place) under the perspective of digital literacy. As the study object, teachers of an engineering course were interviewed with respect to the pedagogical practices adopted in the context of the Covid-19 Pandemic and the feasibility of continuing some of them after this period. The coding of these experiences and the reflection on them permitted the introduction of a framework for the structuration of knowledge-sharing practices in educational environments that employ different configurations of space-time in the educational process, under the conceptual lenses of digital literacy. This method seems to be a feasible tool for analysis of different situations where there are different practices of knowledge sharing.

Keywords: Digital literacy. Knowledge sharing. Learning. Teaching. Higher education.

RESUMO

A disponibilidade e o progresso das tecnologias de informação e comunicação abriram novas possibilidades para os processos de aprendizagem. Embora existam estudos recentes sobre o uso de tecnologias nos processos de aprendizagem, ainda é necessário um debate mais sistemático e profundo sobre as formas de compartilhamento do conhecimento nos processos de ensino e como as tecnologias podem ser utilizadas em diferentes contextos educacionais. Este artigo investiga as formas de compartilhamento de conhecimento usadas em um ambiente educacional e apresenta um método para a análise do processo de compartilhamento de conhecimento baseado em quatro configurações possíveis de compartilhamento de conhecimento (mesmo tempo mesmo lugar, mesmo tempo lugar diferente, tempo diferente mesmo lugar, tempo diferente, lugar diferente) sob a perspectiva da alfabetização digital. Como objeto de estudo, foram entrevistados professores de um curso de engenharia a respeito das práticas pedagógicas adotadas no contexto da Pandemia da Covid-19 e a viabilidade de continuidade de algumas delas após esse período. A codificação dessas experiências e a reflexão sobre elas permitiram a introdução de um arcabouço para a estruturação de práticas de compartilhamento de conhecimento em ambientes educacionais que empregam diferentes configurações de espaço-tempo no processo educativo, sob as lentes conceituais do letramento digital. Este método parece ser uma ferramenta viável para análise de diferentes situações onde existem diferentes práticas de compartilhamento de conhecimento.

Palavras-chave: Alfabetização digital. Compartilhamento de conhecimento. Aprendizado. Ensino. Ensino superior.

ISSN: 2176-8501

1 INTRODUCTION

Knowledge sharing is a fundamental pillar in different organizational processes, including teaching activities. Nevertheless, the sharing of knowledge is shown to be a fundamental element for the development of the various organizations existing in contemporary societies (SMALL & SAGE, 2005). In this sense, information, and communication technologies (ICTs) stand out as fundamental tools for knowledge sharing, creating opportunities for higher education sectors by bringing new methodologies into classrooms (AL-EMRAN & TEO, 2019). Furthermore, classes mediated by information and communication technology, in the context of the Covid-19 Pandemic (MISHRA *et al.*, 2020), with direct impact on education (HEBEBCI *et al.*, 2020), which compelled the adaptation of educational processes to this new reality (BATAINEH *et al.*, 2020; LOPES *et al.* 2021; RAES & DEPAEPE, 2020).

As such, still the recent adaptation of education scenarios to cope with the emergent challenges of Covid-19 pandemics, this recent experience in the educational context permitted open new perspectives in the educational practices (LOPES *et al.* 2021). Online room tools, group chats and instant sharing have become a necessity for students from various universities worldwide, and the internet has become, more than ever, the main source of knowledge for teachers and students (BARTUSKOVA & KREJCAR, 2014). Despite these recent experiences, to improve the efficacy of educational settings, it is necessary for a deep analysis of the educational processes and how digital technologies should be adequately combined and incorporated into them. In this context, the theoretical lenses of digital literacy can be used as a conceptual filter for the development of adequate teaching environments.

In a general form in contemporary societies, digital literacy seems to be a fundamental means to the development of activities by persons in several levels of their personal lives using information and communication technologies in several environments and circumstances (SPANTE *et al.*, 2018). Despite the broad scope of this term, recently there was presented several articles about digital literacy in the educational context. For example, there are investigative studies with the purpose of verifying behavioral aspects and the efficacy of digital literacy in the context of post-graduating education (PRIO *et al.* 2016) and undergraduate courses (GUZMÁN *et al.*, 2017). In this same vein, Tang *et al.* (2016) state the importance of digital means as effective learning instruments. As such, the students may develop digital literacy competencies for the effectiveness of the use of technologies in learning (BLAU *et al.* 2020). In the field of normative instruments, SIDIQ *et al.* (2017) present an instrument to measure the level of digital literacy of students. Despite these recent efforts, it is still necessary more debate how digital technologies and digital literacy tools can be used to improve the learning processes. For this purpose, a starting point

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can be to investigate the knowledge exchange in learning experiences considering the space and time dimensions to understand how information technologies can be used for sharing knowledge.

Based on the possibility of contributing to the debate about the development of more effective teaching environments, this article investigates forms of knowledge sharing used in a higher education setting and introduces a method to the analysis of the knowledge sharing process based on four possible configurations of knowledge sharing (same-time same-place, same-time different- place, different-time same-place, different-time different-place) under the perspective of digital literacy. The data was obtained through interviews with teachers of an engineering course. Based on the analysis of the learning practices used in the Covid-19 Pandemic, a model for the structuration of an educational environment, based on different forms of knowledge sharing according to the four space-time variations (same-time same-place, same-time different- place, different-time same-place, different-time different-place (GRUDIN, 1984; ELLIS & GIBBS, 1991). This model seems to be feasible to design different forms of knowledge sharing, according to the necessity of a knowledge-sharing process. Accordingly, there is also considered the digital literacy capabilities necessary for the teachers and students adequately operate learning environments that use different instruments of learning, considering the variations of the space and time dimensions.

The remaining of this article is organized as follows. The Literature Review is presented in the next section approaching the knowledge sharing processes in educational situations and the role of digital literacy in them. The third section, Method, presents the activities of recovering and data treatment. The fourth section presents empirical data from the interviews in the researched educational setting. In the fifth section, a framework for the design of learning environments based on different configurations of space-time is introduced and analyzed. The sixth section presents the main contributions of the article and theoretical and practical implications for future studies.

2 LITERATURE REVIEW

2.1 KNOWLEDGE SHARING AND SPACE-TIME

Knowledge manifests as forms of view of several phenomena of life, models about the functioning of nature, social relations, and related to the self (ELLESTRÕM, 2014; SILVA *et al.*, 2019). As such, knowledge firstly manifests through the abstraction process in conscience (RIEMER AND JOHNSTON, 2017), having a metaphysic or immaterial nature. In the process of knowledge creation, the language is

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the basic realm that permits the expression of knowledge through interconnected categories related to a given landscape of life (SHEPHERD AND SUDDABY, 2017; QUER, 2018). The philosopher Michael Polanyi (POLANYI, 2009) introduces the distinction between tacit and explicit knowledge, posteriorly developed by NONAKA & TAKEUCHI, 2009; SMALL & SAGE (2005) in the field of organizational studies. Tacit knowledge consists of portions of knowledge that are not linguistically translated and are embedded in the conscience of the individual (POLANYI, 2009). Contrarily the explicit knowledge is expressed through the signs of languages in textual form (NONAKA & TAKEUCHI, 2009). As such, knowledge is created and shared in social processes. There are four forms of knowledge sharing: socialization, where tacit knowledge is transferred among persons; externalization, where tacit knowledge is converted into the explicit combination, where explicit knowledge is changed; and internalization, where the individual absorbs the explicit knowledge converting it into tacit knowledge in conscience (NONAKA and TAKEUCHI, 2009).

Given its metaphysic essence, knowledge has a transcendental nature; that is, it is not directly attained in a space-time situation. In other words, there are four possibilities of knowledge sharing: in same-time/same-place, same-time/different-place, different-time/same-place, and different-time/different-place (GRUDIN, 1984; ELLIS & GIBBS, 1991). As such, the emergence of information and communication technologies amplified the possibility of knowledge sharing forms with different configurations of space-time dimensions. Indeed, the use of technologies has contributed to the development of new forms of learning processes (BARTUSKOVA & KREJCAR, 2014). However, it is necessary to choose the better technology for each knowledge sharing form (AL-EMRAN; TEO, 2019; DUVALL *et al.*, 2020; KHOSRAVI & AHMAD, 2016). Distance learning can be an adequate and efficient form of learning (BATAINEH *et al.*, 2020). But currently, it has been verified that pure distance learning is not capable of leading to the several exigences of educational processes, whereas in the hybrid educational process, there is a combination of the modalities of same-time/same-place and different-time/different-place learning processes are required (RAO, 2019; SILVA *et al.*, 2021). In the hybrid learning model, parts of the content could be asynchronous and remote, as discussed in the inverted classroom methodology (STRAYER, 2012; MASON *et al.*, 2013).

Regarding the learning processes, in essence, they are social activities (ROHMAN *et al.*, 2020). The social process should be guaranteed as a form of improvement of existing knowledge through the logic of the knowledge-based on several points of view goes beyond the individual perspective (CHEDID *et al.*, 2020). In this vein, in the educational environment, the sharing process becomes effective when it is possible to create a collaborative teaching environment, in which students and teachers become

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collaborators, as they are the main sources of the knowledge creation process (BARTUSKOVA & KREJCAR, 2014; LO & TIAN, 2020).

2.2 DIGITAL LITERACY IN LEARNING ENVIRONMENTS

Digital literacy involves the capability of persons to use information and communication technologies to reach their goals (SPANTE *et al.*, 2018). This involves activities in the varied fields of human activity, including the important opportunities opened in the educational landscape. Indeed, new information and communication technologies, henceforth digital technologies, are important means of learning activities (BLAU *et al.*, 2020; TANG and SHAW, 2016). However, the availability of digital technologies *per se* does not guarantee their effective and adequate use. For obtaining good results in the educational process, it is necessary that the main actors of this process dominate these technologies. In other words, digital literacy is directly related to positive performance in educational activities mediated to digital technologies (LOPES *et al.*, 2021; TANG *et al.*, 2016). According to Prior *et al.*, (2016) high levels of digital literacy improve the efficiency of agents in learning activities.

Among the several levels and modalities of educational activities, some recent studies investigate the role of digital literacy in the context of university education (GUZMÁN-SIMÓN *et al.*, 2017; PRIOR et a. 2016; SPANTE, 2018). Literature has presented some examples of technologies used in educational contexts. Despite the importance of digital literacy as a precondition to the successful use of digital technologies in under graduating courses, there is a lack of some universities in giving adequate training to their students. According to Guzmán-Simón *et al.* (2017) the capacitation of students to use digital technologies is still carried out from an informal perspective.

Even though digital technologies have strongly enabled the development of distance learning (BATAINEH *et al.*, 2020; HEBEBCI *et al.*, 2020), it does not imply the complete substitution of presential activities for virtual. This can be seen in the study of Lopes *et al.*, (2021) that in the virtualization of courses in a university context, due to the emergent situation of the Covid-19 Pandemic, whereas the pure virtual teaching mode can negatively impact the interpersonal interaction in a learning process. To face these challenges, it is necessary for a deliberate process to improve the digital literacy competencies of the actors of students and teachers (BLAU *et al.*, 2020). In other words, it is necessary for a digital literacy strategy (LOPES *et al.*, 2021).

In fact, currently, there is a bulk of technologies and different mechanisms in learning activities (TANG *et al.* 2016). Although several technological tools use in the context of learning, there are still recent efforts to the development of best practices to digital literacy (RODRIGUEZ *et al.*, 2021). It requires

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the adequate design of learning activities and the training of teachers for new modes of teaching (AL-EMRAN; TEO, 2019; AL-ARAIBI, 2019; AL-FRAIHAT *et al.*, 2020; MERIEM, 2019). For example, one of the results of these transformations can cite as the adoption of distance learning practices which, had its use increased, is a direct result of the integration of technologies and teaching methods for sharing of knowledge (AL -FRAIHAT *et al.*, 2020; LUO, 2020) that can use the approaches of learning same-time/ different-place and different-time/ different-place.

As a result of digital literacy strategies, there are designed training programs that help the actors of an educational context attain efficiency (BLAU *et al.* 2020). For example, in the context of distance learning, it seems to be essential that teachers receive the training and knowledge necessary for them to know how to use the technologies in their favor in distance education towards their continuous improvement (HEBEBCI *et al.*, 2020; AL-ARAIBI *et al.*, 2019). Finally, in the context of strategies for digital literacy, it is necessary to design measurement instruments to measure the levels of proficiency of actors in the use of digital technologies in the educational context (SIDDIQ *et al.*, 2017).

Beyond cognitive and technical aspects, digital literacy also involves phycological processes that interfere in the behavior of agents, in aspects such as motivation, that contribute directly to the efficiency of the learning processes (PRIOR *et al.* 2016; TANG *et al.* 2016). In this vein, in digital learning environments, behavioral issues such as motivation should be considered (AL-FRAIHAT *et al.*, 2020; TIBA & CONDY, 2021; DUNN & KENNEDY, 2019). There are strategies to improve the motivation and self-regulating of students in distance learning (NERONI, 2019). Even though digital technologies open avenues to new learning forms, some of these technologies can interfere negatively with the learning process due to the loss of attention of students. To cope with this, it is necessary the development of mechanisms to retain students' attention in environments with the use of mobile (AL-FURAIH *et al.*, 2020).

3 METHOD

In view of the objective of proposing a model for the use of different forms of knowledge sharing in teaching-learning processes based on the use of information technology, this work made use of qualitative research that sought to understand how a group of professors from an engineering course understand the use of EAD in the teaching-learning processes that they conduct.

The teachers interviewed for this research work in a Brazilian public university. Until the Pandemic caused by Covid-19, all courses were offered in the face-to-face model, whereas ICTs were the only support tools.

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For the development of the theoretical review, we sought works that addressed the themes of knowledge sharing, face-to-face and off-site, as well as issues involving the COVID-19 Pandemic, to understand different teaching scenarios around the world after the declaration of the Pandemic by the World Health Organization.

3.1 EMPIRICAL DATA COLLECTING AND ANALYSIS

For data collection, interviews were conducted with four professors who teach six disciplines in an engineering course. It is noteworthy that one professor works with qualitative disciplines such as organization theory, and three professors work with quantitative disciplines with Differential and Integral Calculus. Based on a semi-structured research script (LINNEBERG AND KORSGAARD, 2019) that opened up for professors to bring any positive and negative points, in addition to discussing issues related to distance learning and current hybrid teaching in universities in the face of the Covid-19 Pandemic, about the biggest challenges encountered, the relationship between students and the use of the University's physical infrastructure. All interviews were carried out individually through online rooms previously scheduled. All data obtained from the interviews were filed and described in documents after being recorded, serving as a basis for the current study.

The interviews were coded in which it was possible to form a vision about the opinions of professors from different disciplines on how to use different ways of sharing knowledge in view of the configurations. Through this codification process categories were identified that permit the establishment of relation among them e the generation of conclusions about data (GRODAL, ANTEBY AND HOLM, 2021).

4 RESULTS

In view of the results obtained in the interviews, it was possible to organize the results into three themes: the first one dedicated to explaining what the knowledge sharing processes were used before the COVID-19 Pandemic; the second dedicated to presenting how sharing processes have occurred during the COVID-19 Pandemic and; the third presents how teachers see the transformation of synchronous moments into asynchronous moments. It can be seen that digital literacy directly influences the teachers' perception of how to use the 'synchronous moments.

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4.1 FORMS OF KNOWLEDGE SHARING BEFORE THE COVID-19 PANDEMIC

At the University studied, the pre-pandemic scenario of the interviewed teachers is characterized by basically 100% same-time/same-place teaching, as shown in Table 1. Regarding the use of a platform for posting material online (different-time/different-place teaching mode), the interviewed teachers used it for posting extra material or delivering activities online, but most of the activities were done in the classroom. Given the usual familiarity of teachers and students with the basic use of digital technologies to access the internet and digital platforms, the availability and student access of this material do not present problems. Follows the statements about the use of an educational platform:

> "It was 100% in-person with some classes in laboratories and used the [platform] for support activities such as posting exercise lists, slides, text, software" (Teacher 4).

An important question, especially in subjects with practical content, is the infrastructure offered by the University, which was unable to be used due to the closing of the campus. Professor 4, who teaches Linear Programming, mentions that the use of computer labs at the University was beneficial for learning. The great benefit of laboratories like this is the amount of software already available to students, avoiding problems present in distance learning, such as difficulty in installing software, inefficient personal equipment, or even the lack of equipment on the part of some students.

Table 1 – Main issues about classes before COVID-19 Pandemic.

Professor	Discipline	Type of discipline	Mode of operation	Time of teaching
Professor 1	1	Applied quantitative	Presential	Synchronous classes
Professor 1	2	Applied quantitative	Presential	Synchronous classes
Professor 2	3	Applied qualitative	Presential	Synchronous classes
Professor 2	4	Applied qualitative	Presential	Synchronous classes
Professor 3	5	Theoretical Quantitative	Presential	Synchronous classes
Professor 4	6	Applied quantitative	Presential	Synchronous classes

Source: The authors.

4.2 FORMS OF KNOWLEDGE SHARING IN THE COVID-19 PANDEMIC

During the Pandemic, online communication methods have been crucial tools (ALMAIAH *et al.*, 2020). In the university-of-study scenario, an online platform was used for content distribution and delivery, in which students and faculty can communicate, create forums, take tests, and deliver activities.

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Even with the functionalities present in that platform, many of the teachers still use e-mail as a form of communication.

There was also the use of groups in an instant messaging application that provided the opportunity to create groups where students do not had access to the teacher's personal phone number and is used for general notices, reminders, and discussion surveys if necessary.

> "I have been using the [a message App.] group for a few years now, but it is not mandatory for the student to join. At the beginning of the semester, I leave the group there because I like [message App.] because you don't need to provide your telephone number" (Teacher 4).

Another synchronous off-site tool that is prevalent throughout distance learning at the University of the study was the use of an online communication platform – a tool that allows students and faculty to enter a virtual classroom and communicate instantly. In addition, it offers the option of recording and screen presentation, enabling dynamism during synchronous classes. This tool is used by all respondents. Based on the answers given by the interviewees and the analysis of the literature, Table 2 was elaborated, in which different forms of teaching have presented the combination of different possibilities of time-space used.

Table 2 – Combination between synchronous and asynchronous activities before the COVID-19 pandemics.

Time	Space	Used technologies
Synchronous	Physic	Physical spaces equipped for classes
	Virtual	Online communication platform.
Asynchronous	Physic	Laboratories equipped with specific equipment
	Virtual	Online platforms for asynchronous communication, forums, chats, etc.

Fonte: The authors.

The answers of the interviewed teachers allow us to consider that, during the Pandemic, there is no single way in which teachers are teaching their classes, as follows: some are teaching 100% synchronous and virtual, others combine synchronous and asynchronous ways, such as Work Presentations. Nevertheless, it is verified through the interviews that different forms of knowledge sharing were found,

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in which the synchronous and asynchronous forms are always virtual, in view of the Covid 19 Pandemic. In general, these various formats are summarized in the following statements:

> *"Each teacher is doing it in a different way [...]. I keep my schedule synchronously" (Teacher 3)*
>
> *"by posting all the videos on YouTube [...], we sometimes set up meetings to ask questions", which are mandatory. (Teacher 4)*

Despite the divergent point of view, a common opinion among the interviewed is that distance learning should maintain assessments carried out in physical presence because it is difficult to assess students in a remote context. You can see this in the following opinion of one teacher about online assessment:

> *"I still haven't found a way that I consider effective to be able to assess at the end of the course if my objective was fulfilled"* (Teacher 2).

4.3 CONVERTING SYNCHRONOUS CONTENT INTO ASYNCHRONOUS CONTENT

The possibility of converting synchronous to asynchronous content was discussed in the interviews. It is noted, in general, that there is a positive belief in relation to this change. However, it is noteworthy that the characteristics of the synchronous physical presence model are still very well regarded for its benefits, such as dynamism, the possibility of seeing the students' reaction to the progress of the course, and the social interaction between them. When asked about the quality of online teaching combined with face-to-face teaching, one of the teachers stated about maintaining the quality of distance education when compared to pre-pandemic classroom teaching:

> "Without a doubt, I believe that you can maintain quality. Also, because we have been seeking to improve these contents more and more, so I think it would be rich" (Teacher 2).

In contrast, Teacher 1 states that "nothing replaces the classroom environment", citing that even if he can use online tools as support, for him, it is essential that students have on-site physical teaching for most of the course hours.

Some of these points are lost in asynchronous teaching, but it offers new opportunities for students. In a case cited in almost all interviews, it was possible to identify those teachers who consider it beneficial to have the content recorded so that students can review it later because, during synchronous

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and physically in-person classes, it is common for students to have further questions. Therefore, having this content recorded facilitates the resolution of questions that may arise.

> "In fact, even before the pandemic, I was thinking of recording the videos to make available on YouTube in case the student wants to consult the content, and the pandemic ended up forcing this", he said (Teacher 4).

It is possible to notice that, when asked about what content the teacher would be willing to put as asynchronous if it is extremely necessary, the more theoretical and initial contents of the disciplines were highlighted. This makes it easy for both parties (students and teachers) because, according to some interviewees, the extensively theoretical content can become tiresome during synchronous classes and can be presented through video classes or activities. It allows the student to study and understand in their own time. This view is expressed in the following report:

> "This part of a more theoretical nature, I believe that they, watching a video class, manage to capture the subject" (Teacher 2).

One of the interviewed teachers emphasized that the feedbacks in the master's degree were extremely positive for the classes that took place 100% in the virtual synchronous presence modality.

5 DISCUSSION AND PROPOSAL OF A FRAMEWORK TO CONVERT SYNCHRONOUS CONTEXT IN SEVERAL KNOWLEDGE SHARING MODES

For the interviewed teachers, even in the case of adopting distance learning, the assessments or part of them must continue to take place physically in person. There is, in general, a view against 100% distance learning, bringing to light the agenda that hybrid education is in line with recent perspectives about education (RAO, 2019; SILVA *et al.*, 2021), that is, the one that combines physical and virtual face-to-face approaches, synchronous and asynchronous activities, may be more appropriate. The teachers highlighted the potential that exists in the content being recorded and serving as support material for the teacher and students, mixing different forms of learning such as same-time/same-place as well as different-time/different-place in line with the literature (STRAYER, 2012; MASON *et al.* 2013).

Despite the possibility of adopt different modes to knowledge sharing in the educational context studied, it is important to deploy a rigorous analysis of the educational processes, and the adequate habilitation of the users of new educational frameworks based on digital technologies, due to the strategic planning of the digital literacy in this context (BLAU *et al.* 2020; LOPES *et al.* 2021; SIDDIQ *et al.*, 2017).

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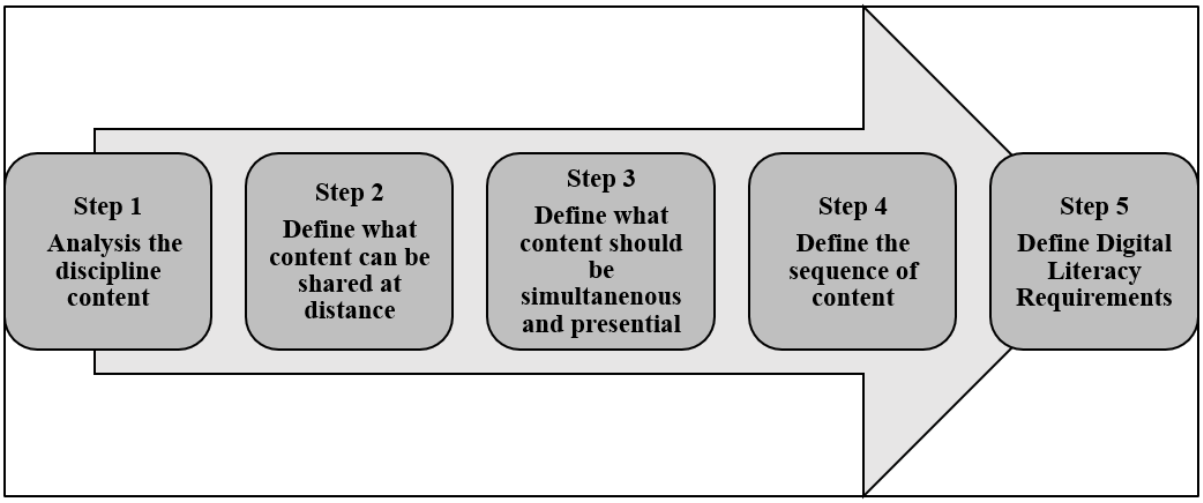
ISSN: 2176-8501

5.1 A PROTOCOL FOR CONVERTING SYNCHRONOUS IN ASYNCHRONOUS CONTENT

Although the challenges of distance learning and sharing are many, considering increasing the importance of this type of teaching, it seems valid to think of scripts that facilitate eventual changes in the forms of knowledge conversion and the required digital literacy capabilities through a strategic perspective (BLAU *et al.* 2020; LOPES *et al.* 2021; SIDDIQ *et al.*, 2017). Therefore, based on the interviews and the theoretical framework, a protocol proposal was elaborated that can contribute to the conversion of courses and disciplines that are fully face-to-face in a hybrid course and disciplines in which there is an opportunity for part of the content to be worked at a distance, in a virtual model that can be synchronous or asynchronous. It is suggested that this conversion takes place from 5 steps that can be adapted to each reality, as shown in Figure 1 and explained in the following.

Figure 1 – Protocol to transform presential content into a hybrid content



Source: The authors

Step 1 – Analyzes course content and current learning method

This step assumes that the first step to analyze the possible transformation of a learning process from a mode (e.g., same-time/same-place to another mode) requires content and method analysis. As a result, it is necessary to define of part of a course should be performed in same-time/same-place form and what may be performed through the remaining models, different-time/same-place, same-time/different-place, different-time/different-place. This analysis should consider the underpinning of pedagogical aspects of the course based on the underpinning of the hybrid learning (RAO, 2019; SILVA

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et al., 2021). To do this, consider not only the content but also how easy students can learn this content through video lessons, articles, and activities. Theoretical contents with less practical bias tended to be the best accepted by the interviewed teachers to be given remotely. Check the applicability of adopting physical in-person synchronous, in-person virtual, physical, and virtual asynchronous approaches.

Step 2 – Define how the content will be working remotely

After understanding the content that will be worked at a distance, define the best way to do what students should read and watch about the content. It is recommended to have in the material a video lesson recorded with the content, a supporting article and an evaluative activity related to the content.

Step 3 – Define what content will be working in the physical presence

It must be understood which parts of the content are essential to be given through face-to-face and collective communication, such as tests, work presentations and group dynamics.

Step 4 – Define the sequence of the content

In this step, it is necessary to define the sequence of activities combing the different forms of knowledge sharing (synchronous-physic, synchronous-virtual, asynchronous-physic, and asynchronous virtual), including the application of tests.

Step 5. Define the requirements of digital literacy

Finally, after the initial design of the new forms of performing a course, it is necessary to define the digital literacy requirements for teachers and students.

In fact, the not consideration of this aspect in the new course configuration can bring educational problems that can negatively interfere with the course quality (GUZMÁN-SIMÓN *et al.* 2017). As such, it is necessary firstly define what technologies will be employed in each form of learning (TANG *et al.* 2016), under the adequate design of learning activities and training requirements of teachers and students in the use of digital technologies (AL-EMRAN; TEO, 2019; AL-ARAIBI, 2019; AL-FRAIHAT *et al.*, 2020; MERIEM, 2019). In this context, it is necessary also to design assessment instruments (SIDDIQ *et al.*, 2017) with the purpose of guaranteeing minimal proficiency of these actors necessary to assure the learning process in new forms of the configuration of the educational processes.

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Finally, in the design of new forms of learning processes, through the different configurations of space-time dimensions, it is necessary to consider aspects such as motivation AL-FRAIHAT *et al.*, 2020; TIBA & CONDY, 2021; DUNN & KENNEDY, 2019 and self-regulating behaviour (NERONI, 2019). To cope with this dimension of the human being with new forms of learning processes, it is also necessary to create supplementary activities with the purpose of forming a culture for education and also support persons that face difficulty in adaptation to the new forms of learning.

6 CONCLUDING REMARKS

This article investigates forms of knowledge sharing used in an education setting and introduces a method to the analysis of the knowledge sharing process based on four possible configurations of knowledge sharing (same-time same-place, same-time different-place, different-time same-place, different-time different-place) under the perspective of digital literacy (PRIOR *et al.*, 2016; SPANTE *et al.*, 2018). This article is embedded from a scientific view of educational processes based on the process of formation of knowledge and the role of interaction of actors of educational processes, students and teachers, through the lens of space and time dimensions. Through the four configurations of the knowledge sharing through space-time, same-time same-place, same-time different- place, different-time same-place, different-time different-place (GRUDIN, 1984; ELLIS & GIBBS, 1991), this article highlights the importance of evaluating the current educational process, in their majority based on the same-time/same-place form, through a critical lens about how they can be improved and even transformed in other forms, without any prejudice. Additionally, to the correct changing of these process is necessary to be aware of the concept of digital literacy, as a important reference to the initial educational of the actors of new educational environments to be able to learning in them.

This article presents two contributions to the current literature. Firstly, through the lens of the four forms of knowledge shared existent in the literature, it is proposed a simple method of analysis the current educational activities with the purpose of reframing them in different forms, with tend a promote the hybrid learning processes. The second contribution is to bring attention that the profusion of contemporary forms of learning, consolidated in distance learning, requires the development of a strategic perspective of digital literacy, according to the recent studies in this direction (BLAU *et al.* 2020; LOPES *et al.* 2021; SIDDIQ *et al.*, 2017). This article assumes that even though it is important to think about new forms of learning through the extensive use of digital technologies, the success of these new efforts depends on the adequate attention to the digital literacy capabilities of the main actors of the

ISSN: 2176-8501

educational processes, the students and teachers, and assure the efficiency of these processes (PRIOR *et al.* 2016; TANG *et al.* 2016).

As a recommendation for future studies, the framework introduced in this article can be refined with the purpose of maintaining a detailed analysis of each digital technology is best to each modality of course, and each modality of the learning process, under the four configurations of time-space, same-time different-place, different-time same-place, different-time different-place. And consequently, under the theoretical lens of digital literacy, this method should prescribe a general strategy for digital literacy for each educational context and the forms of preparation and assessment of its students and teachers.

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