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ARTICLE

Training teachers in digital competencies for formative assessment through collaborative e-rubrics

Formación de docentes en competencias digitales para la evaluación formativa mediante e-rúbricas colaborativas

Violeta Cebrián-Robles[1], Francisco José Ruíz-Rey[2] and Manuel Cebrián de la Serna[3]

Abstract: This study is based on the premise that the teaching profession is one of the professions with the greatest responsibility for educating citizens in digital competence, and as such we should focus on how to train these professionals. We carried out this research during an in-service teacher training programme in Ecuador and based it on the principle that we should train teachers in the same way as we expect them to teach their students. During the training programme, teachers acquire formative assessment skills using digital e-rubrics (teacher and peer assessment) and work in collaboration with other teams of teachers. We analysed the results of applying the same digital rubric to an oral competence exercise involving participating and course teachers, and conducted a correlational research design, obtaining a Cronbach's alpha of 0.953 from the 508 evaluations carried out with the same e-rubric. Based on the results, we present a digital rubric that has been validated to assess the oral presentation of educational projects. Moreover, we analysed the difficulties teachers had when using the rubric, as shown in the assessment of the quality of the resources. Examples of other practices and contexts for training teachers in digital rubric methods are also presented. Finally, we provide a set of web-based rubric tools as possible applications.

Keywords: In-service teacher training, Digital competencies, Formative assessment, Digital rubric, Collaborative work.

Resumen: El presente estudio parte de la premisa de que el profesorado es una de las profesiones en las que más recae la responsabilidad de la formación de la ciudadanía en competencia digital; por lo tanto, deberíamos centrar nuestra atención en cómo formar a este colectivo profesional. Siguiendo el refrán conocido de formar a los docentes como esperamos que ellos enseñen a sus estudiantes, la investigación se sitúa en un programa de formación permanente de docentes en Ecuador, donde se forma en la competencia de evaluación formativa mediante erúbricas digitales (evaluación profesor y pares) y en colaboración en equipos de docentes. Se analizan los resultados de la aplicación de la misma rúbrica digital entre los docentes participantes y el profesorado del curso a un ejercicio de competencia oral, y se realiza un diseño de investigación correlacional, obteniendo un Alfa de Cronbach 0,953 desde las 508 evaluaciones realizadas con la misma e-rúbrica. Como resultados presentamos una rúbrica digital validada para evaluar la presentación oral de proyectos educativos; a su vez, analizamos las dificultades en su aplicación entre docentes, como pudo comprobarse en la evaluación de la calidad de los recursos. Al tiempo que se presentan ejemplificaciones para otras prácticas y contextos de formación de docentes en metodologías de rúbricas digitales. Por último, se ofrece un conjunto de herramientas de rúbricas en internet como posibles aplicaciones.

Palabras clave: Formación permanente del profesorado, Competencias digitales, Evaluación formativa, Rúbrica digital, Trabajo en colaboración.

1. Introduction

Given the rapid and significant changes in society, teaching is one of the professions that requires constant updating. With this in mind, guidelines have been drawn up for the competences that teachers need to master. These are set out in guides and "reference frameworks" to be used by those of us working in initial and in-service training (Eurydice, 2019). The 'Marco de Referencia de la Competencia Digital Docente es una guía de referencia para el diagnóstico y la mejora de las competencias digitales del profesorado' (English: Digital Competence Framework for Teachers' is a reference guide for diagnosing and improving teachers' digital competences) INTEF (2023), contains five areas of competence and 21 competences, structured into six levels of competence. In this paper we will focus on three of them, namely Area 2. Communication and Collaboration, Area 3. Digital Content Creation, and Area 5. Problem Solving. We have chosen these areas for a number of reasons. Firstly, because of the speed at which digital transformation is taking place in all areas of society and work, forcing us to rethink the digital content we produce and use in education, and secondly, because of the need to address issues collectively as a team. As Hargreaves & O'Connor (2020) point out, collaboration is inextricably linked to teaching and supports the professional development of teachers. Unfortunately, the recent pandemic has meant we have had to collaborate using technological networks to deal with this situation. As a result of this collaboration, we have been able to better withstand isolation, despite the limitations experienced due to the lack of traditional forms of family-student-teacher relationships (Hargreaves & Fullan, 2020; Jordan et al., 2021). Finally, and following on from the above, given the complexity and diversity of the nature of the problems we face today, problem solving requires collaborative work, which requires expertise when working in virtual professional communities (Seashore, 2006; Gómez López & Silas Casillas, 2016; Devlin et al., 2019).

Since teachers are directly involved in the digital empowerment of the public, it is clear that we need to address the initial and in-service training of teachers in this skill. In this regard, some interesting studies based on these guidelines place this within the broader framework of the Ibero-American space (Martín-Cuadrado et al., 2022; Pérez-Sánchez et al., 2022), including the 'Capacitación de Formadores en Competencias Digitales en América Latina y Caribe' (ALC) (English: Training of Trainers in Digital Competences in Latin America and the Caribbean) within the 2030 Agenda, which has developed 172 intervention projects for the training of trainers in digital competences. The work involves an important group of leading Ibero-American academics and researchers in each of the five competence areas.

In addition to providing digital competence training, such as the ones described above, we need to develop more effective teacher training models. These need to be in line with the formats currently found in everyday life and social networks (Marcelo & Marcelo, 2021) and allow teachers to work collaboratively to address problems and carry out improvement projects in their classrooms. Networks and videoconferencing have helped us deal with the pandemic, and as a result teachers have experience of using formats such as videoconferencing and platforms that allow them to work collaboratively. However, there are still issues to be addressed in the use of these technologies, such as respecting diversity, finding solutions to intercultural problems and creating digital resources to support day-to-day teaching. As Paredes-Labra et al. (2015) point out, we should consider initial and ongoing teacher training in the use of

technology as a process of transforming teaching, and focus on topics relevant to their analysis and transformation, as well as considering the school a community where teachers work together (p.101). We believe this is the best way to face challenges, and that the pandemic has shown this to be the case.

One of the most outstanding results of the collaboration during the COVID-19 pandemic was the joint resources for learning assessment created by teachers. Criteria were agreed upon to address the competence areas previously mentioned (Areas 2, 3 and 5). Moreover, educational improvement projects promoting change were shared in order to promote the transformation mentioned above, and problems in the teaching context were addressed. These projects were shared and quality criteria were applied collectively through professional networks. In addition, the technologies were addressed through shared reflection and cooperation among all the agents of the educational community (Bolívar, 2018; Peirats et al, 2015). We include here the drafting of collaborative intervention projects designed to improve the practical aspects. These were open to peer evaluation and had a shared understanding of quality criteria.

For this shared endeavour, teachers need training in digital competences within teaching teams. They need objective assessment methods that allow for formative assessment, such as those that can be created using digital rubrics and related resources (Rodríguez Gallego, 2012; Velasco-Martínez & Hurtado, 2018; Raposo-Rivas & Cebrián-de-la-Serna, 2019; Suh, 2021; Pérez-Torregrosa et al, 2022), while at the same time considering the need to review assessments in order to align them with the learning objectives (Tractenberg, 2021). What is needed, therefore, is a training programme based on a model of shared collaboration and discussion around the quality criteria of the rubrics, where teachers work together to assess educational projects, in line with the aim of teaching teachers the way they would like them to teach their students. The idea is that teachers should become more collaborative in their practices, even more so in this post-pandemic era, where we should not go back to how it was before, but take advantage of this situation (Hargreaves & Fullan, 2020) in order to continue collaborating through professional networks and bring about a change in our practice using the technological tools we are familiar with and highlighting the importance of evaluation as a tool for learning (Turra et al., 2022).

Education centres usually have institutional platforms that host digital rubric tools. Teachers have been making increasing use of these tools, and this calls for a review of the possibilities they offer and the way they should be designed (Dawson, 2017), as well as the behaviour of students when using them to evaluate their peers as recommended in the study by Deniz & Aksu (2021). In any event, rubrics are generally considered to be effective in education according to reviews in the literature, where their scope is usually defined (Jonsson & Svingby, 2007; Cebrián de la Serna & Bergman, 2014; Dickinson & Adams, 2017; Coskett & Jackson 2018; Park et al., 2020), in both summative and formative assessment (Company et al., 2019; Masek et al., 2021). They can be used as an assessment tool for digital portfolios (García-Zabaleta et al., 2020), specific competences, and in different educational contexts, including internships (Cica-Yulia & Muktiarni, 2020), skills and transversal competences (Cubero-Ibáñez & Rodríguez-Gómez, 2018). Indeed, there are digital rubrics for the assessment of oral competences (Pérez-Torregrosa et al., 2022), or other more specific cases such as the use of the CoRubric tool used in this study for the training of pre-service teachers in science (Cebrián-Robles at al., 2021). When teachers wish to develop more sophisticated assessment practices (e.g. peer assessment, sharing the assessment

rubric with other teachers by sharing the competences or indicators to be assessed, etc.) that are not possible on these platforms, they often choose tools other than those provided by the institutions. There are several free platforms on the internet that can be used to create digital rubrics, and, by means of a link to the task module, the external digital rubric can be linked to the institutional platform. These platforms include: QuickRubric (https://www.quickrubric.com/); Rubistar (:https://goo.gl/mmPEZV); Rcampus: (https://www.rcampus.com/); Rubrimaker: (http://rubric-maker.com/); Roobrix: (http://roobrix.com/). When asked which tool to use, we recommend the one that best suits the assessment model and teaching context.

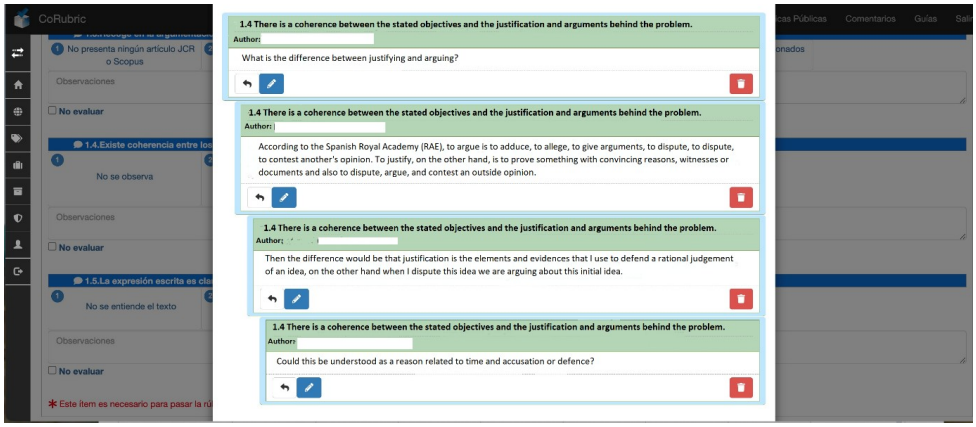

Figure 1.Example of the forum for the communicative assessment of the different elements of the rubric using CoRubric.com

In this study, we used the CoRubric tool (https://corubric. com/) because of the characteristics and functions that were created by a group of teachers and researchers as part of an R+D+i project. The tool was developed by comparing, improving and modifying it in different practice contexts and, as in the present study, in other contexts where its impact has been tested and analysed, as shown in Table 1 below. These include formative assessment (assessment of learning in external placements integrated in portfolios, team assessment, 360º assessment of laboratory work, assessment of competences in experimental sciences, argumentation rubrics, assessment of the reflective journals of work placements, etc.) and for all types of formative evaluation (peer evaluation, 360º evaluation, self-evaluation, ipsative evaluation, hetero-evaluation, etc.).

As the prefix of the name CoRubric suggests, it is an ideal platform for collaboration among teachers, as it allows them to agree on the criteria and apply them together. It also has a pop-up that can be used to add clarifications in text format through linked forums that offer an ideal way to analyse all the 23 elements created by the assessment with this rubric. This can be seen in Figure 1 which shows the forum for each of the elements of the communicative assessment, as well as for the competence, the indicator and the level of achievement. As shown in Table 1, we used the CoRubric platform together with other tools for different teaching modalities, tasks and exercises, as well as for different learning outcome purposes. This was based on different experimental research that produced resources and reports of its impact that can be found on the internet.

Table 1. References, rubric resources and areas of application of CoRubric.com

Assessment methods	Tasks	Technologies	Learning outcomes	Research, Resources, References, etc.
Hetero-evaluation Eva.Pares	MEDIUM-SIZED GROUP LABORATORIES Dilemmas in professional practices	*LMS *PLE-Portfolios *CoRubric.com * Example rubric https://cutt.ly/UywiViL	Argumentation Information search	Cebrián-Robles et al., (2018)
*Ipsative assessment *Peer review	PRACTICUM Work placement journals	*LMS *Google Drive *Trello *CoRubric.com * Example rubric https://cutt.ly/sywi3TL	Analysis Reflection Mastery of terms Applying models, etc.	Cebrián-de-la-Serna (2018)
*Hetero-evaluation *Peer review	LARGE GROUP CLASS Video annotations with tags	*Coannotation.com *CoRubric.com	*Applying concepts, models, etc. in real cases	Cebrián-de-la-Serna et al., (2015)
*360º Evaluation	LARGE GROUP CLASS Oral presentations of academic projects	*CoRubric.com *Example rubric https://cutt.ly/yt6judU	Communication and digital competences Teamwork	Serrano Angulo & Cebrián de la Serna, (2011).
*Peer reviews *Hetero-evaluation	BACHELOR'S DEGREE FINAL PROJECT AND MASTER'S DEGREE FINAL PROJECT Oral presentations	Idem above	Communication and digital competences	Raposo Rivas & Cebrián de la Serna (2019)

One of the fundamental aims of a rubric is to achieve maximum objectivity, i.e. to remove as much of the evaluator's subjectivity as possible. This can lead to a dispersion problem when teachers assess the same exercise. Even when using the same rubric, different results can be obtained for the same product or exercise. To reduce subjectivity, the criterion must be interpreted in the same way and, above all, applied in the same way to the same or different cases to be assessed. One way to train teachers in digital competencies for formative assessment with technologies is to discuss and jointly carry out an assessment exercise using the same digital rubric for the same set of tasks presented by a different group of task participants. The emphasis is on approaching communicative assessment using the explanations regarding why we use it in a given case with the help of technology, as in the case of the forums in Figure 1, where the participants of a professional learning community are in a different location. At this point, we can propose a hypothesis: the results of applying a rubric to the same exercise and group presenting different projects on the same topic do not correlate with the validation of the instrument or with the achievement of digital competence acquired by the teachers. Therefore, the aim of this research is to determine whether there is consistency or dispersion in all the elements of a rubric when applied to the same exercise by all the teachers taking an in-service course.

2. Method

The research design is correlational with an interested sample of teachers divided in two groups (37 and 33 respectively) who carried out 508 peer assessments (208 in group A and 300 in group B), including the assessment by the subject teacher on the same exercise. At the end of the course and as a proof of concept of the training received—where assessment technologies were used over six days—the cohesion of the results was analysed in the application of a rubric and in all its evidences in order to determine the level of concordance and reliability of the assessment method achieved.

The design of the rubric assesses projects presented by teachers on the application of technologies in their classrooms as examples of mastery of digital competences, as part of a training module of the Master's in Educational Technologies at the Universidad Casa Grande (Ecuador) in 2018. The last rubric used in this final exercise, among others used in the course, can be downloaded from the public rubric database of CoRubric.com at: https://acortar.link/kWL8VE. The rubric used has been greatly improved as a result of various experiences and evaluations in Ibero-American contexts, such as the one presented here. In this specific study carried out in Ecuador in September 2018, the Cronbach's alpha reliability coefficient was 0.953. An expert process based on these different experiences was used to validate the rubric presented as a final product during the academic years 2018-2020, which showed a slightly lower Cronbach's alpha reliability of 0.934 from these different Ibero-American contexts (Fernández-Medina et al., 2021).

2.1. Data analysis

After the data collection in September 2018, the confirmatory factor analysis showed that the scale has five factors, as seen in Table 2.This refutes the hypotheses and allows us to conclude that the teachers reached the same commonalities in the training carried out using the formative assessment method, in terms of the meaning of the criteria used in the scale and, most importantly, in the application of the rubric to each case.

Table 2. Confirmatory factor analysis: total variance.

Total variance explained									
	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %
1	11,487	52,215	52,215	11,784	52,215	52,215	4,372	19,871	19,871
2	2,171	9,868	62,083	2.171	9,696	62,083	4,336	19.710	39,581
3	1,657	7,534	69,617	1,657	7,534	69,617	3,505	15,930	55,511
4	1,230	5,590	75,207	1,230	5,590	75,207	3,187	14,488	69,999
5	1,151	5,233	80,440	1,151	5,233	80,440	2,297	10,441	80,440
6	,988	4,492	84,932						
7	,901	4,096	89,028						
8	,685	3,112	92,140						
9	,612	2,783	94,924						
10	,519	2,358	97,282						
11	,176	,800	98,082						
12	,166	,754	98,836						
13	,110	,501	99,337						
14	0,59	,267	99,604						
15	,056	,254	99,858						
16	,031	,140	99,999						

Total variance explained									
	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %	Total	Variance %	Accumulated %
17	,000	,001	100,00						
18	1,394E-008	6,337E-008	100,00						
19	1,000E-013	1,001E-013	100,00						
20	1,000E-013	1,000E-013	100,00						
21	1,000E-013	1,000E-013	100,00						
22	-1,000E-013	-1,001E-013	100,00						

Note: Extraction technique: principal component analysis.

When we apply a rotated component matrix, 5 internal cohesion factors are clearly observed, as can be seen in Table 3, where the rotation has converged in 7 iterations.

Table 3. Extraction technique: Principal component analysis, rotation method. Varimax with Kaiser normalisation.

	Component				
	1	2	3	4	5
1. Sufficient relevant and well-structured content is presented	,274	,418	,816	,168	,181
1.1. Quantity and relevance of information	,370	,549	,507	,012	,126
1.1.1. The information is scientifically appropriate and accurate	,370	,549	,507	,012	,126
1.2. Extent to which the message is structured	,105	,176	,871	,265	,180
1.2.1. Is able to present a structured message	,105	,176	,871	,265	,180
2. Is able to confidently present a message to an audience	,272	,715	,257	,226	,518

	Component				
	1	2	3	4	5
2.1. Oral expression	-,001	,798	,219	,095	,314
2.1.1. Speaks clearly and with good intonation at all times	-,001	,798	,219	,095	,314
2.2. Gestures and attitude towards the audience	,289	,290	,226	,170	,827
2.2.1. Is confident and relaxed in front of the audience	,289	,290	,226	,170	,827
2.3. Level of confidence in handling resources	,478	,599	,047	,282	-,087
2.3.1. Uses technological presentation aids to support his/her speech and message.	,318	,689	,185	,260	,090
3. Can adapt to the audience and establish a fluid interaction with the audience	,882	,122	,140	,218	,164
3.1. Motivates and engages the audience	,836	,056	,060	,167	,207
3.1.1. Encourages audience interest and participation.	,624	,260	,227	,128	,353
3.2. Audience management and control	,790	,121	,121	,174	,070
3.2.1. Manages question time, audience interventions and unforeseen circumstances.	,591	,356	,311	,169	,232
4. Is able to use quality technology resources and integrate them into the message	,397	,269	,244	,799	,072
4.1. Quality of technological resources	,476	,403	,271	,520	-,055
4.1.1. Develops quality technological resources	,378	,482	,373	,463	,035
4.2. Presentation formalities	,247	,060	,113	,868	,135
4.2.1. Complies with timing and other presentation requirements	,052	,118	,185	,848	,199

As can be seen below, the different elements of the rubric are grouped into factors with internal cohesion which assess specific competences of the general competence of oral communication (Table 4).

Table 4. Grouping the elements of the rubric into factors.

Factors	Ítems
Factor 1. Relationship with the audience	3. Can adapt to the audience and establish a fluid interaction with the audience. 3.1. Motivates and engages the public. 3.1.1. Encourages audience interest and participation. 3.2. Audience management and control. 3.2.1. Manages question time, audience interventions and

Factors	Ítems
	unforeseen circumstances.
Factor 2. Confidence when communicating and information transmitted.	1.1. Quantity and relevance of information. 1.1.1. The information is scientifically appropriate and accurate. 2. Is able to confidently present a message to an audience. 2.1. Oral expression. 2.1.1. Speaks clearly and with good intonation at all times. 2.3. Level of confidence in handling resources 2.3.1. Uses technological presentation aids to support his/her speech and message.
Factor 3. The relevance and structuring of the contents of the message.	1. Sufficient relevant and well-structured content is presented. 1.2. Extent to which the message is structured. 1.2.1. Is able to present a structured message.
Factor 4. Mastery of technological resources and time management of the presentation.	4. Is able to use quality technology resources and integrate them into the message. 4.1. Quality of technological resources. 4.2. Presentation formalities. 4.2.1. Adaptation to time and other exposure requirements.
Factor 5. Gestures and management of the presentation space.	2.2. Gestures and attitude towards the audience 2.2.1. Is confident and relaxed in front of the audience

There are some items where teachers are not entirely consistent in the way they assess and therefore there is still work to be done. This is the case for item 4.1.1. "Develops quality technological resources", which could be omitted because the value of the rotated matrix is lower than 0.5. In addition, the Student's t-test for independent samples can be used to analyse whether there are significant differences between the means of the two groups. Table 5 shows the means of all the items by group.

Table 5. T-test for comparison of means by group of origin.

	Group var.	N	Media	SD	Standard error of the mean
Score	A	208	87,05	16,867	1,170
	B	300	90,01	12,158	,702
1. Sufficient relevant and well-structured content is presented.	A	208	89,02	16,495	1,144
	B	300	90,00	14,869	,858
1.1. Quantity and relevance of information	A	208	87,82	22,007	1,526
	B	300	89,56	19,710	1,138
1.1.1. The information is scientifically appropriate and accurate	A	203	89,98	17,340	1,217
	B	294	91,38	15,127	,882
1.2. Extent to which the message is structured	A	208	88,94	20,736	1,438
	B	300	90,45	16,508	,953
1.2.1. Is able to present a structured message	A	205	90,24	17,840	1,246
	B	298	91,05	14,795	,857
2. Is able to confidently present a message to an audience.	A	208	90,14	15,321	1,062
	B	300	90,76	13,366	,772
2.1. Oral expression	A	208	92,79	15,587	1,081
	B	300	93,22	15,730	,908
2.1.1 Speaks clearly and with good intonation at all times.	A	208	92,79	15,587	1,081
	B	297	94,16	12,688	,736
2.2. Gestures and attitude towards the audience	A	208	87,82	20,228	1,403
	B	300	87,33	18,557	1,071
2.2.1. Is confident and relaxed in front of the audience	A	206	88,67	18,362	1,279
	B	298	87,92	17,175	,995
2.3. Level of confidence in handling of resources	A	208	59,62	44,966	3,118
	B	300	91,45	16,496	,952
2.3.1. Uses technological presentation aids to support his/her speech and message.	A	146	89,50	19,079	1,579
	B	299	91,75	15,649	,905
3. Can adapt to the audience and establish a fluid interaction with the audience.	A	208	52,16	45,096	3,127
	B	300	84,17	24,120	1,393

Table 5 (cont.). T-test for comparison of means by group of origin.

	Group var.	N	Media	SD	Standard error of the mean
3.1. Motivates and engages the audience.	A	208	51,44	45,378	3,146
	B	300	83,67	26,499	1,530
3.1.1. Encourages audience interest and participation.	A	145	84,60	23,577	1,958
	B	285	88,66	17,241	1,021
3.2. Audience management and control	A	208	31,89	45,318	3,142
	B	300	75,11	37,516	2,166
3.2.1. Manages question time, audience interventions and unforeseen circumstances.	A	92	88,41	24,922	2,598
	B	256	90,76	15,523	,970
4. Is able to use quality technological resources integrated with the message.	A	208	83,13	30,817	2,137
	B	300	91,83	15,541	,897
4.1. Quality of technological resources	A	208	59,62	45,559	3,159
	B	300	88,89	21,523	1,243
4.1.1. Develops quality technological resources	A	151	85,21	27,925	2,272
	B	293	91,01	16,746	,978
4.2. Presentation formalities	A	208	81,49	35,525	2,463
	B	300	90,00	25,863	1,493
4.2.1. Complies with timing and other presentation requirements	A	193	91,45	21,457	1,544
	B	286	94,93	15,119	,894

It can be seen that in almost 'all items', group B outperforms group A except in item 2.2. 'Gestures and attitude towards the audience'. In the confirmatory study, the bilateral significance of the Student's t-test confirms the previous statement with a value of less than 0.05, with significant mean differences in the variables of the confirmatory study: overall score of the whole rubric, confidence in the handling of resources, adaptation to the public and adaptation to the audience and, moreover, in addition to items related to the use of technological resources. Figure 2 shows all the information related to these items.

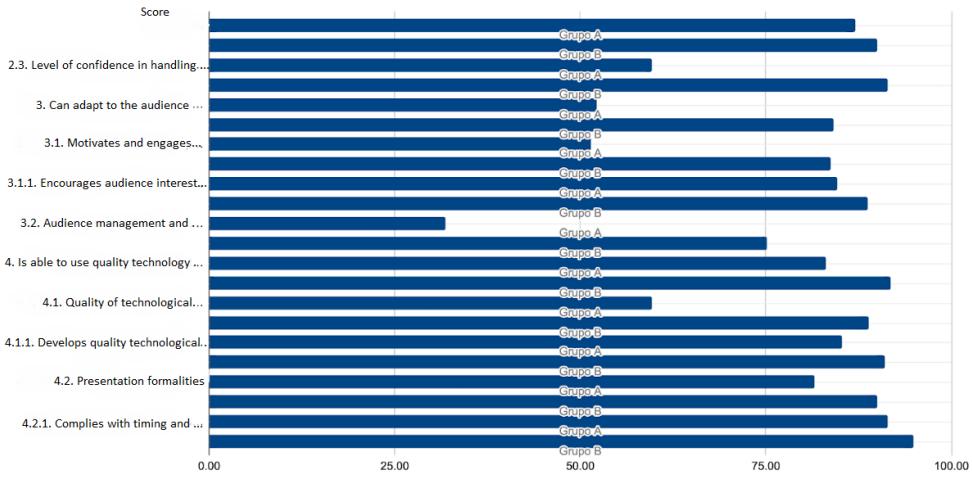

Figure 2. Figure with items and scores.

3. Conclusions

Through this collaborative assessment method with CoRubric.com and the discussion around communicative assessment in the classroom, the teachers were able to share their assessments and align themselves amongst themselves and the teacher with the various exercises in progress. This is similar to other studies (Serrano-Angulo & Cebrián-de-la-Serna, 2011) where in a peer assessment of 14 presentation teams they aligned themselves with the teacher as the presentations progressed, although in this case they were student teachers. In short, "the more the rubric is used, the better the criteria and their application are internalised". In that particular experience, the initial peer assessments were higher than those of the teacher. In the course of assessing the teams and analysing the results of the assessments, including why the teacher had applied them, the students became increasingly more aligned with the teacher's assessment. This means that the more practice they had with the same rubric, the more they internalised the criteria and their application. In contrast, in the present study, this was true for half of the assessments (here there were 7 assessments or teams compared to 14 assessments or teams in the other study), which not only matched the teacher's assessment, but also had a Cronbach's alpha coefficient of 0.953, slightly higher than the instrument itself, which had been validated by experts (Fernández-Medina et al., 2021). However, there are some themes and items, such as being “able to use quality technological resources integrated with the message" (p. 77), that need further work to achieve a more consistent view of the text and its application to different situations. As a limitation, we could mention the difficulty teachers had with the more complex training topics. However, we believe that we have been able to achieve greater cohesion and therefore internalise and train teachers in digital competency in order to share criteria and assess projects together. Thus, the research objective has been met; consistency has been achieved in all elements of a rubric when applied to the same exercise by all teachers participating in an in-service course, and therefore the null hypothesis is disproved. We can thus conclude that the work presented here is a valid general strategy for teacher training. This strategy can include, as in this case, the help of an expert, techniques in the use of spacing, as well as retrieval learning practices, which we hope will improve learning in different areas and throughout people's

working lives (Carpenter et al., 2022). Clearly, more work needs to be done on methodological procedures and techniques that make it easier for teachers to quickly read and interpret their best practices, and new emerging technologies should continue to be incorporated into assessment platforms for digital rubrics. Further studies are also needed that combine different technologies and more active and motivational techniques, such as gamification and badges with rubrics.

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ARTICLE

Citizen participation and critical digital literacy of university students

Participación ciudadana y literacidad crítica digital de estudiantes universitarios

Karen López-Gil and Andrés Sandoval Sarrias

Abstract: The forms of citizen participation have been reconfigured in recent years. The presence of social networks and digital media in general have favored multiple modes of access to information, expression of ideas and social participation. A necessary reflection to think about a sustainable future requires an assessment of communicative practices in digital media and the challenges in citizen education that globalization entails. This research focused on the analysis of citizen participation practices of university students in digital media and its implications for global citizenship. A mixed investigation with a quantitative-qualitative sequence was proposed. In the first phase, a cross-sectional descriptive study was developed with 740 students from a Colombian university, to whom an electronic questionnaire was applied. In the second qualitative phase, discussion groups were held with 42 students, with the purpose of discussing the findings of the questionnaire from the perspective of the participants. It was found that the practices conducted by the students focus mostly on basic and intermediate levels of citizenship represented in the consultation of online information and expression of the ideological positions in social networks, with high limitations towards higher levels of citizenship referred to concrete actions to impact reality. It is evident that this difficulty in contributing to social changes in the world is due to the lack of education for critical global citizenship. Therefore, critical literacy for the use of digital media is proposed as a citizen educational strategy, considering that it contributes to the construction of a more hopeful vision of the future.

Keywords: Citizenship, Critical literacy, Media literacy, Participation, Higher education.

Resumen: Las formas de participación ciudadana se han reconfigurado en los últimos años. La presencia de las redes sociales y de los medios digitales en general han favorecido múltiples modos de acceso a la información, expresión de las ideas y participación social. Una reflexión necesaria para pensar un futuro sostenible exige una valoración de las prácticas comunicativas en medios digitales y los desafíos en formación ciudadana que supone la globalización. Esta investigación se centró en el análisis de las prácticas de participación ciudadana de jóvenes universitarios en medios digitales y sus implicaciones para la ciudadanía global. Se planteó una investigación mixta con una secuencia cuantitativa-cualitativa. En la primera fase se desarrolló un estudio descriptivo transversal con 740 estudiantes de una universidad colombiana, a quienes se aplicó un cuestionario electrónico. En la segunda fase, de corte cualitativo, se llevaron a cabo grupos de discusión con 42 estudiantes, con el propósito de profundizar y discutir los hallazgos del cuestionario desde la mirada de los participantes. Se encontró que las prácticas de los estudiantes se centran en su mayoría en niveles básicos e intermedios de la ciudadanía representados en la consulta de información en línea y expresión de posturas ideológicas en redes sociales, con limitaciones en niveles superiores relacionados con las acciones concretas para impactar la realidad. Se evidencia que esta dificultad para aportar a los cambios sociales se debe a la falta de una educación para la ciudadanía global crítica. Por consiguiente, se propone como estrategia de formación ciudadana la literacidad crítica para el uso de los medios digitales considerando que ello aporta a la construcción de una visión más esperanzadora del futuro.

Palabras clave: Ciudadanía, Literacidad crítica, Medios digitales, Participación, Educación Superior.

1. Introduction

When thinking about the future from the perspective of what is currently being transmitted in digital interaction online, the result appears discouraging. Believing in a future where well-being and unity overcome division and social injustice is becoming increasingly difficult. The way in which these imaginary situations are constructed has to do with phenomena such as infoxication. This phenomenon challenges people's ability to filter and interpret information (Pinto-Santos et al., 2018), including fake news that is massively reproduced due to a lack of criteria when assessing sources and data (Baptista & Gradim, 2020), a rise in radicalism about politics that make it difficult to consider multiple perspectives (Brussino, et al., 2011), and hate speech that condemns the diversity of peoples, and subjects (Izquierdo, 2019), among others. The consequences of these constructions are complex. They include an inability to articulate a desirable future and a future that is linked to real social change (Santisteban & Anguera, 2014), and a lack of alignment between positions about social problems and the actions to take to transform them.

This outlook demonstrates the need to commit to responsible citizenship that transcends short-termism and develops practices that foster participatory democracy in the digital world (Johansson, 2018). In order to achieve this, training in critical global citizenship is required (Andreotti, 2006), the ability to think of oneself as a citizen in an interconnected world (not only as a participant in a local sphere) (Nussbaum, 2002), and the integrated exercise of the four dimensions of citizenship, which are civic, political, social, and cultural (Pagès, 2019). With this, it is hoped to move beyond lower-order citizenship practices such as access and the reproduction of information in digital media, to reach higher-order citizenship levels that become established practices for social action, justice, and the construction of a more promising vision of the future.

This research aimed to analyze the citizen participation practices of young university students on digital media and the potential of critical literacy as an educational strategy to achieve transformative critical global citizenship. This involves studying not only digital media conditions to access information (Aguirre, 2014; Rámila & Martinell, 2018; Ramos Chávez, 2019) but also action and change toward a more sustainable, more inclusive, and more just world (Boni, 2011; Oxley & Morris, 2013). Three levels of participation were considered for online citizenship practices: informational interests and an evaluation of information, positioning vis-à-vis sociopolitical issues, and active participation in social transformation processes.

1.1. Critical global citizenship as a commitment to the future

An introduction to the concept of citizenship should consider its historical evolution and, above all, the challenges posed by globalization and access to information in increasingly interconnected societies. Although citizenship has Greek and Latin roots, its conceptualization and consequent crises and problems are modern. The concept acquired its meaning as a result of the French Revolution. It is founded on principles of equality, liberty, and fraternity and is linked more directly to the idea of the nation-state (Isin & Turner, 2002; Santisteban & Bravo, 2018). The consolidation of political, social, and cultural rights articulated in the twentieth century shaped the contemporary conception of citizenship that's main exponent was Thomas Marshall (1950), through whom the link between "citizenship, rights, and State" acquired its best-known and

most widespread form. Thus, we recognize three dimensions of citizenship from Marshall's studies: legal or civil citizenship, related to the rights of freedom and equality before the law; political citizenship, related to the right to vote and political participation as part of the State; and social citizenship, related to decent living conditions (Marshall, 1950; Russo, 2020).

However, citizenship as a concept linked to these ideals is in crisis as a consequence of migratory phenomena, cosmopolitanism and education (Camps, 2007; Cortina, 1997; 2021), and the challenges posed by citizen participation in the digital world that some have called "digital citizenship" (Galindo, 2009; Téllez Carvajal, 2017). Two central ideas stand out in this review. The first is that, in the general conception of contemporary citizenship, a citizen is not born but is made; that is, training is required for critical, participatory, and democratic citizenship. Second, citizenship practices are no longer limited exclusively to the political sphere, nor are they restricted to a specific territory; they now take on a global and interconnected form where world problems demand the consolidation of a global citizenship.

Global citizenship upholds the idea that any person, anywhere and regardless of his or her characteristics, has rights and duties of coexistence with other people since before being a citizen of a nation-state, he or she is a citizen of the world (Dower & Williams, 2016; Tully, 2014). In line with this, critical global citizenship is understood as the search for social justice and respect for human rights in the joint construction of universal moral principles of mutual respect and cooperation (Estellés & Romero, 2016; Santisteban, González, et al., 2020). Educating for critical global citizenship presupposes; an understanding of global processes that affect us directly or indirectly in transnational orders, a search for democratic principles that advocate freedom, the fight against inequality and social injustice, and a commitment to practical action that transcends the sphere of opinion. In other words, it is not only a matter of knowing how to critically interpret the world, but of transforming it. Therefore, critical global citizenship aims to strengthen critical reflective thinking that allows a global view of problems and a transformative, inclusive, and democratic perspective of the future as a principle of action for a sustainable future.

1.2. Critical digital literacy as a transformative principle

Critical literacy is understood as the deconstruction of texts and discourses, that considers the social, cultural, historical, and political contexts in which they are produced. It starts from the principle of linking language, meaning-making, power structures, and the distribution of labor and resources (Foley, 2017). Consequently, it cannot be understood solely as a cognitive skill or a higher-order level of understanding, since it is a critical and reflective attitude towards the information circulating in the world and a requirement for democratic citizen participation (Abiss, 2016).

Various disciplines and theoretical perspectives have contributed to the shaping of critical literacy: the critical and transformative pedagogy proposed by Freire, which focuses on the empowerment of subjects through language; the critical discourse analysis that studies how representations of reality are constructed and how to unmask ideologies; and the new literacy studies that focus on what people do with language, i.e., on its understanding as a social practice, among others (Cassany, 2021). More recently, the transformations associated with technological development have

rethought the forms of critical literacy, giving rise to critical digital literacy. For Leander et al. (2017), digital media offer particular types of relationships between subjects and discourses. The amount of information and the ease of expression "without filters" can be considered as amplifiers of social inequalities. The phenomena of misinformation and media manipulation have occurred throughout much of human history, but they are now more frequent and involve increasingly sophisticated strategies and resources (Burnett & Merchan, 2019; Kashani, 2020). This poses significant challenges for people who are committed to navigating the network with a critical rudder, according to Vargas (2015).

Understanding that language constructs and reconstructs realities, critical digital literacy has been proposed as a transformative principle in today's world (Ruiz-Bejarano, 2018; Takaki, 2021). Van Sluys et al. (2006) proposes the following as essential dimensions of critical digital literacy; questioning what is ordinary and commonplace, examining and challenging from multiple perspectives, focusing attention on relevant social problems, and bringing these analyses to specific actions aimed at social justice. Lee (2020) adds to these dimensions training to establish criteria to assess information and manage safe communicative environments where people can express and discuss their ideas. Critical literacy is also essential in digital media to identify, combat and reconstruct hate narratives (Izquierdo, 2019). All these elements are essential for the scope of critical global citizenship.

2. Method

The practices of online citizen participation constitute a complex phenomenon involving factors that can be quantified, such as how often devices are used, the interfaces and media used to access information, and share positions on issues, etc., and factors that must be understood from the perspective of the participants themselves, such as the social contexts, beliefs and individual attitudes involved in these practices. Consequently, a mixed methods approach was developed for this research. This involved a set of systematic processes (eclectic in nature), involving the collection and analysis of quantitative and qualitative data, the joint articulation of findings, and the establishment of inferences from the collected information (Creswell, 2014).

According to Hernández Sampieri et al. (2014), mixed methods allow complementarity in research, and favor a broad (quantitative) and deep (qualitative) understanding of the phenomenon. There is also greater variety and richness in the data, which allows more evidence and increases confidence that there is a more faithful approach to reality. More than just the sum of data, mixed methods seek the articulation and joint discussion of the findings and the establishment of inferences from the information collected (Tashakkori & Teddlie, 2010).

The design was sequential since each approach was used in a different phase and the second phase depended on the results of the first phase. The sequence was quantitative-qualitative, which means that quantitative data were collected and analyzed first, decisions were then made using that data, to develop the qualitative phase.

2.1. Primera fase

A non-experimental transectional design of descriptive scope was proposed that sought to characterize the online civic participation practices of young university students, without involving the manipulation of variables. For this first phase, a simple random representative sampling of first year students from a private Colombian institution was established, with 97% confidence and a margin of error of 3%, resulting in 740 participants out of 1233. University entrants were defined as participants because they belong to a generation characterized by a close link with digital technologies, as well as for being in transition toward the legal exercise of citizenship.

The 740 participants were randomly selected using the STATS "Random Number Generator" and were invited to answer an electronic questionnaire, which was the main collection instrument. The questionnaire focused on the identification of citizen participation and critical literacy practices. It included three categories: informative practices, expressive practices, and participatory practices. The items gave descriptions of each type of practices and the students had to indicate how often they carried out these actions (frequently, sometimes, never). To these items were added sociodemographic questions and general use of digital media. Categorical variables, frequency tables and graphs were mainly used for data analysis.

The instrument was designed by the study's researchers and validated by five experts (university professors with at least three years' experience in higher education, research experience and intellectual output) and based on five criteria: relationship with the objectives, clarity in writing, adjustment to the audience, internal cohesion, and extension. The experts rated all criteria with scores above 4.5. A pilot test was also conducted with 30 students from the study population, but not chosen as part of the random sampling, which allowed initial adjustments to be made in terms of item clarity, length, and frequency levels. To establish reliability, Cronbach's alpha was employed (a coefficient used to measure internal consistency or the degree to which the items of the instrument covary with each other), obtaining a result of 0.83 (high level).

2.2. Second phase

Once the main findings of the first phase were identified, a qualitative study was proposed that sought to explore the meanings constructed by the participants around their online citizen participation practices. To this end, at the end of the electronic questionnaire, we asked about their willingness to participate in the second phase of the research. The invitation was sent via e-mail to those interested and a positive response was obtained from 42 students. The sampling, therefore, was by convenience or specific purposes (McMillan, 2015).

The 42 participants were distributed in six discussion groups, with a minimum of five and a maximum of eight members, with a balance of male and female participants, as well as the disciplines to which they belonged. The purpose of these groups was to go deeper into the results of the questionnaire, based on the configuration of individual and group discourse: opinions, adhesions, oppositions, expansions, and discussions on the findings of the quantitative phase. The audio recordings were transcribed, and the qualitative content analysis technique was

applied to process them (Díaz Herrera, 2018). Three phases were established for the analysis. First, the corpus (consisting of the participants' discourse) was defined. Second, the contents were coded and categorized through a semi-inductive process, as the three categories used in the quantitative phase (informative practices, expressive practices, and participatory practices) were defined a priori and the subcategories emerged from the data. Thirdly, inferences were drawn about the findings, and the categorized data were related and contrasted with previous research and theoretical references.

2.3. Integration

To achieve methodological integration, triangulation and complementarity were defined as technical-operational strategies (Aldana, 2007), while the two phases of the research focused on the study of a single phenomenon: citizen participation practices in digital media.

Triangulation was based on the establishment of contrasts between the results; that is, the identification of similarities and differences between the data obtained through the two instruments. Complementarity made it possible to highlight the differentiated contributions of each phase of the research: a quantification phase that sought the breadth of the information, while the qualitative phase sought a deeper understanding through dialogue and the views of the participants themselves.

As a result, the data presented articulates the results of the questionnaire with the students' statements from the discussion groups, in the three central categories.

3. Results

First, the findings present a brief characterization of the participants and then provide a description of the digital practices in the categories defined for the research.

In the sociodemographic analysis, the proportion of men and women were 52% and 48%, respectively, and an average age of 18.3 years. Sixty percent of the participants were classified as having a middle socioeconomic status, 24% low and 16% high. With regards to university disciplines, 38% belonged to Engineering, 25% to Humanities and Social Sciences, 14% to Health Sciences, 14% to Administrative Sciences, and 9% to Experimental Sciences.

In terms of their use of technology and digital media, 94% of the participants indicated having at least one personal electronic device and 80% had three: smartphone, laptop, and desktop computer, with a preference for using their phone for social networking activities and searching for information.

100% of the participants indicated having an internet connection through public or private networks. The most frequently used forms of digital media were instant messaging on the WhatsApp application (91%), Instagram (89%), email (85%), Tik Tok (60%), Facebook (41%) and Twitter (38%). Below 25% were Snap Chat, own blogs, own website, Flickr, Pinterest, and other networks.

3.1. Information practices

This category refers to the uses and means available to young people to access, select, interpret, and assess information and how this affects their online citizen participation. Within these practices, we inquired about their informative interests and strategies for assessing the sources and data found in digital media.

Regarding information interests (Figure 1), the responses show a greater attention to local social issues/problems than to global ones. In particular, in item c, nearly half of the participants indicated that they frequently consulted social media about national government decisions. In items b and d, related to monitoring global issues, the majority of the participants chose the "never" option. In the focus groups, the participants established the complexities of the Colombian context as possible reasons for this difference:

> P5: "I look for issues about corruption, armed conflict, violence in the city, things that usually happen here" (male student, Administrative Sciences).
>
> P6: "In order to stop corruption, we must be very aware of what the president and the congress do... of course there is disinformation and manipulation by the media allied to political groups, just as there are more transparent alternatives to get information, you just need to look a little harder" (male student, Experimental Sciences).
>
> P31: "The environmental problems, the #MeToo movement, all the food they are importing, and yet this country is also a big food producer, the migration of Venezuelans, that affects everything, but with such serious problems here we have to focus on this" (female student, Humanities and Social Sciences).

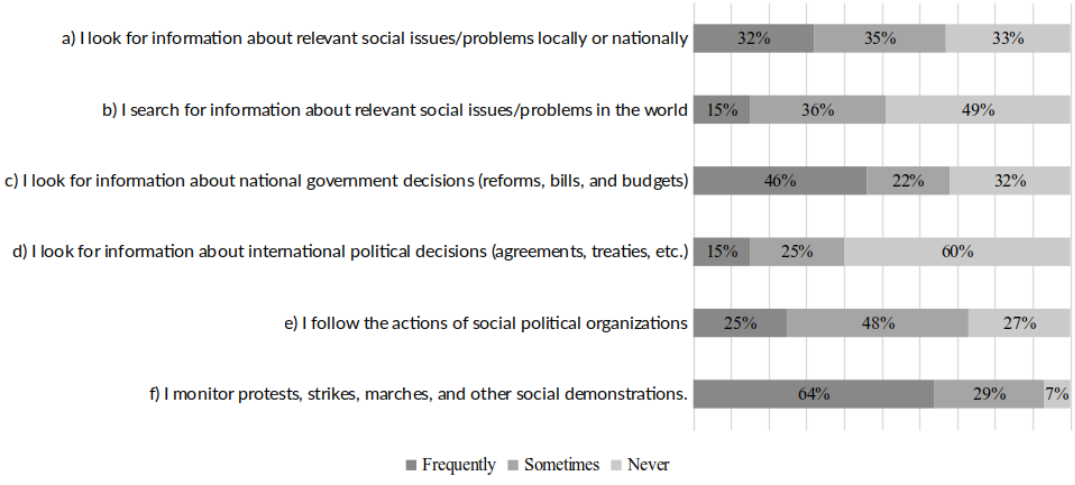

Figure 1. Information interests

These results are also related to item f, in which 64% of the students indicated that they frequently follow up on local social demonstrations:

> P21: "Protest is what appears the most because this country is so unequal that this is the only way to call attention to it" (female student, Administrative Sciences).

In the second dimension for informational practices, we inquired about the strategies used by young people to assess the information they look for in digital media. As Figure 2 shows, "frequently" was not chosen as the main option in any of the strategies. However, in item h, about considering sociopolitical information for the interpretation of texts, a medium frequency was seen. There was a relatively even distribution for the frequencies identified in items a, b, c, d, and g. In the discussion groups, some students pointed out that several of these strategies are taught in language courses in both secondary and higher education. In particular, they highlighted mechanisms such as the search for reliable sources and the historical contextualization of texts and authors.

> P9: "I look at transparency watchdogs, independent media, old news, that helps me not to believe any information sent by WhatsApp..." (female student, Humanities and Social Sciences).
>
> P16: "Normally they ask you to know who the author is, where he was from, what era he lived in, and with that you can interpret the texts better, and learn about why certain discoveries were made in science, etc." (male student, Health Sciences).

It is striking that more than half of the participants reported never focusing on identifying ideological aspects or wonder about the voices and perspectives included or excluded in the texts or use digital tools to verify the reliability of the information. In this regard, several stated that they have had problems with assessing the quality of sources and have faced disinformation phenomena such as fake news:

> P26: "...I fell for some fake news, and I felt very sorry about contributing to that. The one about the pediatrician who supposedly did not want to see a child who had been waiting for an appointment for two months. I became indignant, I shared the video of the mother explaining... And that was because I did not wait for both versions, because I did not listen to both sides, that poor doctor had to leave, because Colombia is an ignorant country in which people go out and kill before thinking" (male student, Humanities and Social Sciences).

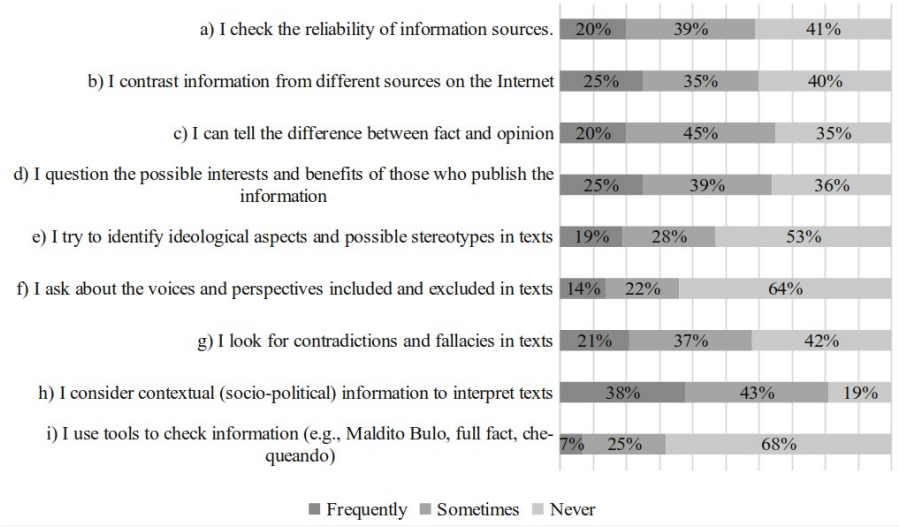

Figure 2. Assessing information.

3.2. Expressive practices

This category includes ways of interacting and expressing personal positions on relevant social issues and problems in digital media. As Figure 3 shows, expressive practices have a medium frequency, and were selected as the majority option in items a, b, c, and f (sharing and responding to publications, understanding the positions of others, and participating in political discussions).

Expressing ideas when identifying situations of injustice and sharing humorous content are the most frequent options. In the focus group, young people defended the possibility of expressing themselves on the Internet freely and without filters:

> P1: "Everyone knows that on the Internet everyone says whatever they want..." (female student, Engineering).
>
> P4: "Social networks are for expression and if others do not like what I say they can delete or block me. Freedom of expression is a right" (female student, Health Sciences).

Likewise, the dissemination and impact of humorous content about political issues stand out:

> P14: "Political memes are the best way to express resistance, because they reach people..." (male student, Administrative Sciences).

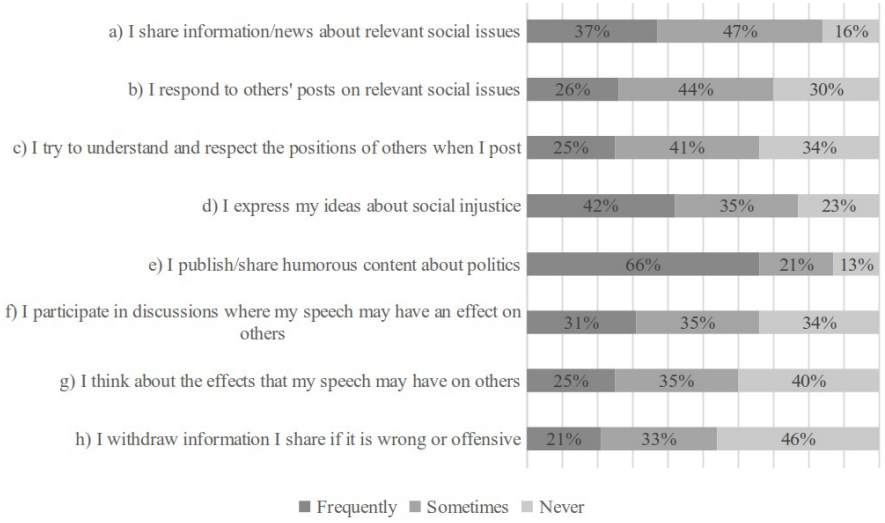

Figure 3. Expression of positioning

On the other hand, considering the effects of discourse on others and withdrawing erroneous or offensive information are reported as less frequent. Some participants attribute the low frequency of these practices to the type of audience with which they interact and to the interfaces themselves, which allow content to be removed or edited:

> P27: "Normally if I make a mistake with something, I delete it and that's it, it's not like I apologize for what happened. I think that can be done if it is a very serious case or if it affected someone" (female student, Engineering).

It is important to highlight that young people do not usually share their publications with big audiences. In a question about who the recipients of their posts are in digital media, students responded friends and family (80%), classmates (45%), broader public (39%), teachers (15%), and others (6%).

3.3. Participatory practices

This category refers to the development of online actions related to citizen participation. According to Figure 4, participation practices are not frequent. The "never" option is predominant in actions such as calling for marches, participating in groups with political or social affinities, making requests for support regarding political decisions or for the resolution of citizen problems. Making proposals to counteract hate speech is definitely the least common option.

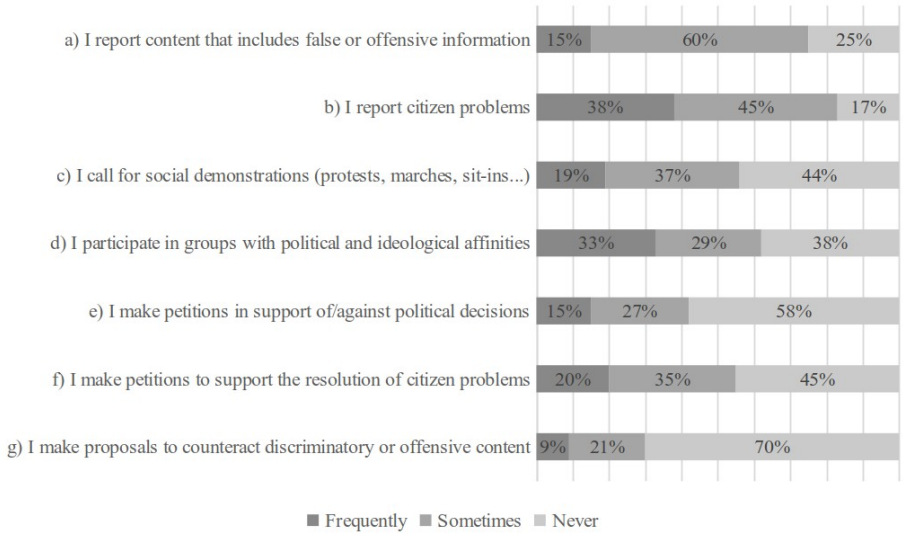

Figure 4. Participation.

Reporting activity in digital media shows an intermediate frequency both for reporting false or offensive information and for reporting citizen problems. This medium frequency is attributed to the ease of expression in digital media and to the functionality included in social network platforms (Facebook, Instagram, Twitter reporting option).

> P4: "When inappropriate content is identified, such as violence, or aggression, it is very easy to report it on any network" (female student, Humanities and Social Sciences).

In the focus group, young people also recognize the potential of digital media to carry out citizen participation actions:

> P3: "I do believe that the Internet supports participation, rallies, calls for protests, and complaints; in some way it gives people a voice, especially young people who are the ones who use social networks most" (female student, Experimental Sciences).

However, they also identify that these actions are not as frequent and are not usually reflected in "the real world" or offline:

> P19: "Yes, there are many things you can do, but many of these actions do not have repercussions, such as signatures to repeal a law... political issues are not really top of young people's agenda" (female student, Health Sciences).
>
> P22: "There is not much coherence between what happens in the networks and what happens at the polls, because it is easier to show your opinion on the Internet without leaving your home..." (female student, Humanities and Social Sciences).

4. Conclusions

This research addressed three categories of online citizen participation: a first-order category, related to the practices of accessing and assessing information; an intermediate-order category, focused on the expression of positionig; and a higher-order category, focused on the transformation of action.

Regarding the first category, it was found that young people use digital media to consult socio-political information they are interested in and focus on local or national problems rather than the global context. The apparent cause (supported by the information gathered in the focus groups), is a saturation with internal problems, for example; corruption, the history of the armed conflict in Colombia, or poverty. Although some participants are interested in issues outside their borders, such as environmental problems, gender violence or migration, the link between these global situations and local or national situations is not clear, i.e., they fail to analyze the impact of transnational phenomena in their immediate contexts.

Although practices associated with access to information are frequent, participants do not seem to be prepared to work critically with such information. This is evidenced by; the poor use of strategies to check the reliability and validity of sources and data, to identify ideological aspects, contradictions, interests, or to contemplate multiple perspectives on a topic. In relation to critical analytical skills, it has been shown in previous research that, despite having multiple resources, young people tend to place themselves at basic levels of critical literacy, particularly when addressing social issues or controversial topics (Castellví et al., 2018; Santisteban, Díez-Bedmar et al., 2020). Cassany (2012) characterizes the uncritical reader as one who focuses on identifying main ideas and single meanings in texts, without assessing the underlying intentions and ideologies.

Regarding the second category, the findings show an intermediate frequency for student's participation in expressive or communicative citizenship. This is facilitated by digital media's features and functionality and supported by ideas such as freedom of expression and the web as a sensitive and uncensored space. This reveals that young people are not only consumers but also producers of information, although this expression of positionig is usually generally restricted to private spaces, with audiences such as friends and family (Torres, 2018; 2021).

These initial findings are problematic because they demonstrate a disconnect between the types of practices. The expression of positionig appears with medium

frequency, but is not necessarily supported by conscious, reflective, and critical informational practices. This is because participants use digital media to access information but use few strategies to assess its reliability and validity. This disconnect helps to understand behavior with respect to such common phenomena as viral information, disinformation, media manipulation, and the radicalization of personal positions, etc. It should be noted that several young people identify the implications of these phenomena and employ strategies such as contrasting information sources, but this does not happen in most cases.

In relation to the third category, it was found that action-oriented participation practices in digital media are scarce. González et al. (2020), identified that young people may adopt a socially committed perspective, but that is not supported by a critical attitude or one that is mobilized to transform reality. Low participation is also frequently referred to in the literature, since digital media offer possibilities for action, but young people do not always taken advantage of them (Aguilar, 2021; Corrales, 2015; Torres, 2021). In part, this is related to the idea that online participation does not have direct repercussions in real life or offline, an aspect that is also supported in the legal conditions of digital citizenship (Aguirre, 2014). Although this finding is not ideal, the fact that participants show an interest in and sensitivity towards social and political issues, as well as the expression of ideas and the exchange of ideas with others on social networks, can be considered as building blocks for action (Maltos-Tamez et al., 2021).

This action (considered as a "higher" level of citizenship) is linked to the notion of critical global citizenship and involves mediated access to information (effective practices of consultation and contrast) and a commitment to the materialization of moral imperatives of social justice and human rights. How can the level of citizenship that is transformative be scaled up? The strategy must be to educate for citizenship, assuming the contemporary principle that a citizen is not born but is made. For this to be possible, the development of a critical digital literacy is indispensable. This literacy, as indicated, does not only refer to the ability to analyze, interpret or question the "readings" of the world, but mainly to having a reflective, insightful attitude and the commitment to move to reasoned action (Abiss, 2016; Lee, 2020). If this critical view is not achieved, the scarce understanding of global problems and their linkage with the local will remain unchanged, as will the expression of positionig without sufficient substantiation and a call to action.

In short, digital critical literacy is proposed as a strategy to achieve higher levels of citizen engagement, i.e., the formation of citizens who transform the world, based on universal ethical principles and concrete actions in their local context that have an impact on global problems. Thinking about alternatives for the future involves transcending concerns about what is happening in the world in order to be true citizens who interpret and transform it. In order to achieve this goal, a formative commitment is required at all educational levels (Tarozzi & Mallon, 2019).

Although the results of this research allow us to establish relevant conclusions and proposals in relation to the practices of citizenship and digital critical literacy, it also has some limitations that should be considered. On the one hand, the sample was restricted to first year students at a Colombian university, with access to digital media and frequent internet connection. This fact does not allow us to generalize about citizenship practices among the young population of Colombia or to estimate how

their conditions of access to information influence their understanding of reality. Similarly, the collection techniques and instruments used focused on the assessment of the frequency of practices by the students themselves, so it would be worthwhile studying the consistency between what young people indicate they do and their actual practices in digital media. Uses may include critical literacy skills, but also attitudes, representations and values attributed to online civic participation.

Finally, another limitation of the research has to do with the category of citizenship. Establishing the boundaries between the various interpretations makes it difficult to establish sufficiently broad differentiating characteristics to link it with previous research and findings on the subject. Citizenship, as a category, is dynamic; as a practice it is complex. This makes it difficult to consolidate an interpretation that is widely accepted and a generalized training strategy (Oxley & Morris, 2013). Here the focus was towards social citizenship (Pagès, 2019). Citizenship was considered key to the analysis of studies on the future because of its eminently practical and encompassing nature, which allows us to inquire into its past, analyze its present uses and, above all, establish its role in the joint construction of a shared and hopeful future.

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ARTICLE

Limits and possibilities in the techno-pedagogical virtualization process of Peruvian universities

Límites y posibilidades en el proceso de virtualización tecno-pedagógica de universidades peruanas

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Abstract: The UTEC-UNED-TECSUP University Consortium took part in the eighth edition of the Support programme for the design and implementation of strategies for continuity of the Higher Education service in public universities of the Peruvian Ministry of Education (PMESUT), devised to promote the continuity of non-classroom-based educational service in public universities. This article presents the assessment carried out in four universities, with the aim of ensuring the ongoing digitization of education in the aftermath of the pandemic. Once the diagnosis had been made, the techno-pedagogical virtualization of 138 model courses was carried out in three phases: planning; curriculum design and teaching support; and implementation of the courses in the virtual classroom. Limitations were related to existing digital divides: time constraints, personal self-regulation and limited training in pedagogical and digital competences of teachers. Individualised support and tutoring measures were sought, increasing the number of synchronous sessions to facilitate assessment. The feedback focused on information, interaction and accountability on what has been done and the improvement of the didactic act in virtual mode. In conclusion, the complexity of the process was notable, as well as the high level of demand to achieve results which, although positive, encountered several obstacles arising from the different agents and elements involved.

Keywords: Higher education, Distance education, Technological education, Tutoring, Latin America.

Resumen: El Consorcio universitario UTEC-UNED-TECSUP participó en la octava convocatoria del Programa de apoyo al diseño e implementación de estrategias para la continuidad del servicio educativo superior de las universidades públicas del Ministerio de educación peruano (PMESUT), cuyo objetivo era fomentar la continuidad del servicio educativo no presencial de las universidades públicas. Este artículo presenta el asesoramiento a cuatro universidades con el objetivo de garantizar la digitalización de la enseñanza tras la pandemia. Realizado el diagnóstico, se llevó a cabo la virtualización tecno-pedagógica de 138 cursos modelo en tres fases: planificación; diseño curricular y acompañamiento docente; e implementación de los cursos en el aula virtual. Las limitaciones se relacionaron con las brechas digitales existentes: escasez de tiempo, autorregulación personal y escasa formación en competencias pedagógicas y digitales de los docentes. Se buscaron medidas de apoyo y tutorización individualizadas, aumentando el número de sesiones sincrónicas que facilitaran la evaluación. El feedback persiguió la información, interacción y responsabilidad sobre lo realizado y la mejora del acto didáctico en modalidad virtual. Como conclusión se destaca la complejidad del proceso y el alto nivel de exigencia para la obtención de resultados que, siendo positivos atravesaron varios obstáculos provenientes de los diferentes agentes y elementos implicados.

Palabras clave: Educación superior, Educación a distancia, Educación tecnológica, Tutoría, América Latina

1. Introduction

This article reflects upon the Advisory programme for the design and implementation of strategies for continuity of the higher education service of public universities, developed in 2020-2021 in Peru to ensure the functioning, quality and relevance of the Peruvian education service with regard to non-presential adaptation within the framework of the health emergency resulting from the spread of COVID-19. This initiative was part of the 8th call for proposals of the Programme for improvement of the quality and relevance of university and technological higher education services (PMESUT). In this context, the UTEC-UNED-TECSUP Consortium carried out a 157-day assessment in 4 national universities, which is the focus of this article.

The assessment was organised in three stages: situation analysis and planning of the advisory intervention; design and development of training for the education community; evaluation, monitoring and ongoing improvement. The works by Pérez-Sánchez et al. (2022) and Martín-Cuadrado et al. (2021) both present relevant results on the assessment carried out in all three phases. On this occasion, the focus is on the final stage, namely the phase of techno-pedagogical virtualization of courses on the universities' virtual platform. Mora-Jaureguialde et al. (2022) covered unique aspects of this phase, related to the key moments: planning, curricular design, pedagogical support and finally rollout of the courses on the virtual platform.

The techno-pedagogical virtualization of courses (in Latin American contexts, the equivalent of subjects) model (model course is the concept used in the assessment to designate the subjects selected for virtualization, which served as a pilot for the rest) involved the entire university community in terms of the management and organisation of human teams and technical and technological resources. A virtual learning space was designed to map out personalised routes to respond to digital needs from their areas of residence. All this under an overall perception of virtual education as "the only way to avoid interrupting students' education in the face of the lockdowns that prevented them attending educational institutions" (Cabrera et al., 2022, p.323).

Educators from the UTEC-UNED-TECSUP Consortium assumed the role of tutors: on the one hand, by orienting and guiding teachers through their tasks; and, on the other hand, by motivating on the progress achieved, encouraging from a planned and systematic perspective. The limitations found were linked to the scarce and/or inadequate teacher training in pedagogical, methodological and technological competences, which entailed a slow pace in the progress of virtualization. One-to-one synchronous sessions were increased to strengthen techno-pedagogical concepts that led to a better understanding of e-learning. At the same time, the training scheme remained open, providing propaedeutic support in situations as required. Finally, other annexed training sessions were designed, according to the needs that arose (Pérez-Sánchez et al. 2022).

The aim of the article is to reflect on the learning achieved and the limitations encountered by the teachers involved in the creation and implementation of their model courses in virtual mode, in response to the distance teaching-learning model commissioned by the Peruvian Ministry of Education. What were the main constraints in the virtualization process of model courses in intercultural universities in Peru?

1.1. Techno-pedagogical accompaniment

Morado (2017) approaches techno-pedagogical accompaniment (TPA) from the standpoint of training, guidance and mentoring, "carried out with the teaching staff through workshops, where teachers developed the virtual environments of their courses" (p.3).

Likewise, she states that this accompaniment, "as well as the progressive and guided construction of learning environments with the use of technology, is effective and satisfactory for those involved and the knowledge lasts over time, regardless of the presence of the facilitator" (p.1).

From this perspective, the different initiatives found in the field of higher education before and during the pandemic have a relevant point in common: Teacher Guidance (Coicaud et al.; 2021; Digión and Álvarez, 2020; United Nations Children's Fund, 2021; Mora-Jaureguialde et al., 2022; Morado, 2017). Morado (2019) presents the transformation experienced by the teachers who participated in her research through a TPA process that enabled them to learn how to effectively transition to virtual learning environments. Moreover, the ECLAC-UNESCO COVID-19 report indicates that, in those environments that allow it, teacher support and training are key to the use of new technologies in education (p.11).

2. Method

The virtualization plan carried out in the four universities involved in the assessment project had the aim of creating, designing and transforming the subjects, hitherto face-to-face, into virtual courses within the Moodle platform, in order to implement teaching in distance mode, necessary after the outbreak of COVID-19. The selection of the participating courses consisted of combining general requirements set by the Peruvian Ministry of Education; those of each of the institutions on the basis of specific approaches in line with their contexts and criteria; and, finally, taking into account the Consortium's proposals.

In terms of the process structure, a complex organisation including all the university actors involved was put in place. To this end, guideline documents (standardised templates) for the end-to-end process were designed. The components and elements involved are described below: actors, selection mechanisms, working documents and defined phases.

2.1. Sample

The universities involved are National University of Quillabamba (UNIQ), the National Intercultural University of the Amazon (UNIA), National Intercultural University 'Fabiola Salazar Leguía' of Bagua (UNIFSL-B) and the National Intercultural University of the Central Jungle 'Juan Santos Atahualpa' (UNISCJSA). Initially, the Peruvian Ministry of Education proposed the virtualization of 35 courses per university, with the exception of the UNIA, which aims to achieve 50 virtualised courses. Each course would be the responsibility of a different teacher, a priori. With this premise, 155 courses were determined to be virtualized by the same number of teachers.

2.2. Criteria for selecting the courses to be virtualized

MINEDU sets the criteria for maintaining the educational service in Peru according to the type of subjects, designated face-to-face, mixed or blended and virtualized. Each university selects the subjects that made up its curricula, depending on the degree of virtuality admissible, proposed for virtualization, adapted or rescheduled. The common criteria applied for the selection were: a) the nature of the contents; b) the number of hours and/or credits; c) the necessary means (infrastructure); and d) the resources for development (pedagogical, technological and support)." (MINEDU and UNESCO-IESALC, 2021, p.9).

2.3. Consortium criteria for assessment of the courses selected

To determine whether the courses, considered a priori, were suitable for transfer to virtuality, an evaluation rubric was drawn up based on 17 objective criteria: syllabus curricular elements; modular structure; welcome; course guide; textual materials; visual materials; audio-visual materials; activities; interaction; collaborative tools; assessment; instruments; academic integrity; synchronous monitoring; asynchronous monitoring; learning sequence planning and virtual classroom. Each in turn was divided into 4 levels of execution, ranging from Excellent to Unacceptable. The resulting items (crossover between criterion and performance level) are scored from 0 to 3.

In this way, adding the score assigned to each criterion, an overall value is obtained for the course analysed. Based on the overall value, the subjects are finally identified as not at all virtualizable, 0% virtualizable (1-20 points), partially virtualizable, 25% (21-30 points), moderately virtualizable,50% (31-40 points) and 100%, fully virtualizable (41-51 points). Finally, MINEDU proposed that each university should virtualize 35 courses (one course per teacher); however, UNIA increased this figure to 50 courses. UNICSJSA upheld the ministry's proposal. UNIA and UNIFSL-B, with the 35 courses, reduced the number of responsible teachers to 33 and 15, respectively.

2.4. University criteria for selecting the courses to be virtualized

Each university proposed other criteria for consideration: (1) Courses that could not be implemented in the first cycle had to be rescheduled. (2) Balance in the academic offer of courses in the different degrees and faculties. (3) Common subjects that are taught in all the degree courses of the same Faculty or University School. (4) General courses given in the first and second cycles. (5) First and second cycle courses (Mathematics I and II) or those with the same academic coordinator. It should also be noted that selection in some cases was conditioned by the employment status of the teachers, with those appointed or tenured taking precedence over contracted or temporary teachers.

2.5. Procedure: the techno-pedagogical virtualization process

The process followed for the techno-pedagogical virtualization of the previously selected courses, in general terms, consists of three main stages:

a) Planning: the work plan is determined and schedules and issues are established and shared with the people involved (students, teachers, authorities and technical staff). In addition, teams and roles will be defined for implementation.

b) Design and support: starts with the design of the virtualization plan, according to the schedule. This phase is supported by two documents: the "Curriculum Structure Sheet" and the "Monitoring Sheet". Both allow the virtualization progress to be captured.

c) Implementation (Evaluation and Accompaniment): involves the transfer of what has been learnt and collected in the worksheets to the virtual space (Moodle platform). Thus, the course begins to take shape with a defined structure, contents, activities, spaces for interaction and evaluation system, etc.

Within these three stages, seven phases are defined which, in an integrative manner, are organised around transversal and general themes about the distance learning modality. The structure of stages and phases is set out in the methodology.

2.6. Working strategy during the virtualization process

For optimal development of the virtualization process, general considerations were defined, which were specified according to the university community and the relationship of the context in which it is located.

In this regard, the procedures or methods specified in the following standard actions are applied:

- The development of demonstrations or examples of how to incorporate the different elements that make up a virtual course. As Salazar-Estrada (2022, p.97) points out, "Demonstration allows for greater learning and understanding of certain topics".

- Clearing up doubts and queries at group and individual meetings, according to the needs of the participants (López et al., 2022).

- The practice of individual follow-up of the work done by each teacher in his or her course (Sánchez and Castro, 2022).

Likewise, and based on the 2+3 method, a weekly work methodology was used (2 hours of synchronous group support and 3 hours of asynchronous individual support). In the synchronous sessions, the core topics of virtualization are worked on, examples and demonstrations are given, doubts are resolved and participation is encouraged. Asynchronous sessions are used to resolve questions arising during rollout and are usually of an individual nature.

Communication channels are defined for the development of both synchronous and asynchronous sessions. The sessions held with teachers ranged from large groups per university to small groups depending on the degrees, faculties or professional schools. Due to the level of difficulty expressed by the teachers in the different actions of the virtualization process, it was necessary to increase the synchronous sessions, which became individual, seeking to address specific difficulties, based on "the resistance of teachers, their fears and identifying their strengths in order to build on them", which sometimes hinder the process (Morado, 2017, p.21). In the specific case of two universities, teachers did not have the skills and knowledge of the Moodle platform that was installed for virtualization at the start of the process. The teachers therefore had to be trained in the use and management of this new space.

2.7. Profiles involved in the process

Different individuals played key roles in the virtualization project.

a) Teacher/Coordinator: academic head of each course or university. Their duties include drawing up the syllabuses and didactic guides and carrying out the self-diagnosis of the course to be virtualized in its initial stage.

b) Techno-pedagogical advisors: they will work on the design of the final course proposal with the teachers. They will accompany and advise the participants in the different courses.

c) Academic coordinator of the Consortium: responsible for validation of the course design proposal before starting the development of activities and resources, so that the implementation of the Follow-up Plan is correct.

d) Technicians: forming the group of technical staff responsible for technological support. They are responsible for training the university's technical staff in all matters relating to the technical support structure.

2.8. Stages, phases, materials and resources for the virtualisation process

Stage 1: Planning

– *Phase 1: Contextualization of the monitoring plan and techno-pedagogical accompaniment (week 1).*

In this phase we present the documents that will serve as reference and support for the novice teacher to understand how to start the process of transforming their face-to-face course into a virtual course. The initial document is used by the teacher to address the change that virtuality entails, to determine the essential didactic components that will make up such courses. The types of learning materials to be used will then be considered: textual, multimedia and digital; types of activities; and tools for interaction and communication. The assessment includes types and stages, actors, techniques and instruments. All these elements are conditioned by the starting structure of each classroom course selected, the contents to be worked on, the communication strategies available and the evaluation and related tasks each teacher has to deal with. The next and final step in this preparatory phase is the definition of the curriculum structure of the e-learning course. The number and type of sessions to be held per week are specified.

With the results of the analysis of the structure of the virtual course and the assessment of the teacher's techno-pedagogical competence, the trainers assigned to the virtualization monitoring and follow-up process have sufficient information to know the needs that have arisen.

Stage 2. Design and accompaniment

– *Phase 2: Aligned curriculum design (week 2)*

In this phase, the techno-pedagogical advisor engages in the accompaniment process with the teacher through synchronous counselling and training sessions, either in groups or individually. At this point, the teacher must carry out the virtualization of the first three weeks of the course, according to the agreed timetable.

– *Phase 3. Feedback session on progress made by the teacher (week 3)*

In this third week, the first reflection session on the virtualization process of the course will be held. In the synchronous session, teachers are able to discuss progress made and difficulties encountered. Depending on the level reached, they are offered new resources, strategies, assessment tools, etc., which allow them to enrich their development process. At this point, the feedback from the trainers becomes an instrument with several objectives (Batalla-Busquets and Plana-Erta, 2014): to identify and correct errors; provide the correct answer or most appropriate solution; seek improvement of tasks or work done; provide in-depth feedback to take learning forward in the future. Teachers assimilate and transfer trainers' comments and reviews to improve the virtualization process of their courses.

– *Phase 4. Assessment of the learning process of university students (week 4)*

Evaluation of the learning process of students in virtual spaces is a fundamental issue for teachers who are starting to virtualize their courses. In order to understand how to carry out evaluation in these environments, it is necessary to assume a series of principles, which according to Cabero-Almenara and Palacios-Rodríguez (2021) are grouped as follows: (a) Learner assessment, from receiver to developer. (b) From receptive learning environments to participatory and interactive environments. (c) From product-focused to performance-focused processes. (d) Transforming a summative evaluation into an authentic one. (e) Changing the exchange produced in class into a community interchange.

– *Phase 5. Tutorial action plan (week 5)*

This aspect is a resource for monitoring student learning in the remote learning model. In the spaces and moments for tutoring, teachers should take on the role of tutors, and go deeper into subjects complementary to the syllabus, so that cross-cutting issues of particular importance can be addressed.

– *Phase 6. Feedback session on progress made by the teacher (week 6)*

During phase three, it was noted that these sessions provide moments of follow-up and sharing of progress, as well as sharing new tools with teachers.

– *Phase 7. Opening and closing sessions (week 7)*

The importance of the opening (first contact with students) and closing sessions (closing session, conclusions, reviews and farewells) will be discussed, which teachers should consider fundamental in the virtual teaching-learning process.

In relation to the start of the course, as León Naveiro (2016, p.23) points out, "the initial moments of any project are very important. … The beginning sets the path and affects the results". According to Lozano López (2016),,

> the teacher must make it clear on this first day what scenario the students are going to encounter: what are the objectives set in the Teaching Guide, the margin for compliance and/or improvisation or incorporation of new elements that may arise in the course of the subject, and the items that the teacher considers essential to estimate that the students are prepared not just to pass an exam, but also to tackle the various challenges offered by the subject. (p.39)

In the same sense, the closing sessions, which are of a conclusive, clarifying and synthesising nature, are considered very relevant. The guidelines for the assessment tests, the tasks to be completed in order to pass the subject, etc., the key points of each of the subjects for the exam are recalled (Ángel et al., 2019).

Stage 3. Implementation

This stage is characterised by the process carried out during the phases defined so far, which allows the transformation of the initial "script" (monitoring sheet) into a course already built on the Moodle platform.

The space provided on the platform for the construction of the course is configured with content, activities, resources for communication and evaluation, etc. In addition, teachers are required to achieve seventeen virtualized weeks. This involves constructing, with their elements, each of the sessions to develop the previously structured contents that will make up the totality of the agenda to be worked on.

2.9. Evaluation of the techno-pedagogical virtualization plan monitoring process

Rubrics have become a valuable tool for process evaluation and for identifying progress in virtualization. As noted by Norman-Acevedo et al. (2020), this assessment can be made concrete with rubrics to guide the course, the teaching and learning process, or any other process, through individual and group indicators. Synchronous meetings between advisors and teachers take place on a weekly basis. Complementary, asynchronous attention is offered at a higher frequency and on an individual basis, via e-mail, consultation forums and WhatsApp groups.

3. Results

Initially, a forecast was made of the courses to be virtualized in each university. MINEDU set out its requirements; each university adjusted them to their specific contexts and criteria; and finally, the Consortium made a selection proposal on the courses to be virtualized. Those selected, finally, were the result of the three decision points indicated above prompting a change between what was initially proposed and what was finally carried out. The actual and final results obtained by each university are shown in table 1.

Table 1. Actual target population by university.

UNIA		**UNIQ**		**UNIFSL-B**		**UNISCJSA**	
Courses	Associate teachers	Courses	Associate teachers	Courses	Associate teachers	Courses	Associate teachers
46	46	43	29	38	24	35	18

It can be seen that the number of courses is associated with the number of teachers responsible for them. In only one case is the number of teachers equal to the number of courses to be virtualized, as the initial aim was to involve as many teachers as possible in the virtualization process. Once the goals had been set, after the process, an assessment was made of the level of virtualization achieved by the different teachers in the assigned courses, for each of the universities, as shown below.

Table 2. Goals achieved in the course virtualization process.

University	Number of courses selected	Number of courses 100% virtualized	Number of teachers involved
UNIA	46	9 (20%)	9
UNIQ	43	12 (28%)	29
UNIFSL-B	14	12 (85,7%)	11
UNISCJSA	35	25 (71%)	18

Based on the results presented, the level of achievement of the teachers, in relation to the number of 100% virtualized courses, was very uneven, with two of the universities reaching a percentage of over 70%, while the other two did not reach 30%. The UNIA counted 37 courses not yet virtualized, although the work approach and previous design of the courses was completely carried out in the absence of the transfer of content to the university's virtual platform. UNIQ, in addition to the 12 fully virtualized courses, had 13 additional courses that were 50% virtualized. At UNIFSL-B, the two courses that failed to reach full virtualization were virtualized in 10 and 11 weeks, respectively, of the 16 teaching weeks, which represents 65% virtualization of the course. Finally, UNISCJSA, in addition to the 25 fully virtualized courses achieved, had 7 other courses with more than 8 weeks virtualized.

4. Conclusions

In line with the work of reflection described in this document, based on the process of assessment and intervention explained in previous sections and in the light of the results reported and set out in the preceding section, it is necessary to explain the reasons that led to the results finally achieved. The explanation that will provide answers about the process and results obtained, after eight months of work, comes through a series of issues for which we are seeking reasons and consequences, such as: connectivity, digital divide, teacher training, techno-pedagogical competences and so on.

First of all, and without losing sight of the initial forecast, the Consortium faced a series of obstacles and difficulties that prevented it from achieving the goals defined. All of them, obstacles and difficulties, related to the issues raised above. Implementation of the process was very demanding and demanding due to the numerous meetings, reports, reviews and monitoring of the work of those involved (university authorities, committed teachers and support trainers, etc.). Moreover, its complexity, not only for the Consortium members, but also for the teachers involved in virtualization of the selected subjects, led to moments of frustration. The teachers' lack of training in technological aspects, the impossibility of combining these tasks with their daily work, and the fact that they were not able to work on the virtualization of the selected subjects, were all made evident.

Considering that the initial project aim was to design, accompany and advise the Peruvian universities identified, with the aim of virtualizing their courses due to COVID-19 and, in view of the results presented, it seems clear that the process achieved a high percentage of success, due to the number of teachers involved in the activity and the scope of virtualization of the courses involved. With the data on the table, only 71% and 85% of 100% virtualization was achieved in two of the universities, although if we consider the data integrating the partially virtualized courses in at least 50%, we would be talking about a global reach of 84.7%, of which 42.02% corresponds to the 100% virtualized courses and 42.7% to the courses virtualized by more than half.

Despite the good data, it should be noted that those cases of lower achievement are due to a series of difficulties and drawbacks, as already indicated throughout the document, which had to be overcome during the process:

- Reluctance and opposition from the university to change its basic model documents, course structure and the inclusion of additional elements beyond its usual teaching practices.

As Corica (2020) indicates, resistance to change on the part of the educational institution and its teachers is conditioned by a sense of instability and threat to the structure of the institution; it is perceived as a test of the work being done or as a threat to their professional identity. When this perception stems from technology, resistance and rejection is greater, as teachers feel that they do not have sufficient methodological and technological knowledge to cope with these changes.

- The complex geographical situation of the institutions, teachers and students makes it difficult to have an appropriate infrastructure to meet the demands of this new

methodology. This is illustrated by statements made by heads of academic institutions highlighting the problems faced by students in remote rural regions in accessing course materials, synchronous sessions or the virtual platform per se.

Many authors have highlighted in their research (Flores and Corral, 2021; Morales, 2021; Muñoz & Lluch, 2020; Vivanco, 2020) the different difficulties and challenges that the change from face-to-face to virtual teaching entailed for teachers and students, as well as for the institutions themselves. Some of these include the dearth of technological skills, lack of space to work synchronously, insufficient network connection for easy access to materials, platform or class sessions, or feelings of isolation, anxiety and stress that have come with so many changes.

- The techno-pedagogical capacity of teachers to develop and adapt the content to their virtual course. The vast majority of teachers did not have the necessary and sufficient training to carry out this task in a totally unfamiliar virtual environment.

In this sense, Chávez (2020) highlights "the relevance of technological inclusion in training processes in the face of adverse situations and the continuous updating that today more than ever teachers must assume in their reflective practice" (p.19), exposing the need for teacher training on issues such as the inclusion and diversification of tools, to facilitate the creation of digital resources, teaching materials or graphic environments of the virtual classroom, with the intention of expanding the possible technological tools incorporated into the training process, as well as streamlining the institution's management systems of the teaching-learning process (support platforms for classroom teaching).

In addition to those already stated, the Consortium was faced with two issues beyond its control and for which it could not take any action, other than designing a support plan for permanent advice and accompaniment, as well as generating documents that would clear up any possible doubts and minimise the pressure situations arising from the lack of clarity and workload.

- Lack of time on the part of the teachers to carry out the work requested, as they had a heavy teaching load in other courses, management tasks, tutoring students, etc.

- Failure of the teachers involved to follow the guidelines set out by the Consortium. The pace demanded, at times, was too much for them.

Analysing the process overall, we understand that there are issues which, without conditioning our work in the virtualization process, deserve to be addressed in greater detail, as they are relevant aspects of the reality intervened.

There is one element for which there is no answer as to the possible impact on this study, and that is the imbalance in women's access to higher education. Perhaps the explanation lies in the fact that most of the studies involved correspond to scientific-technological and health knowledge areas. This difference was also evident in the teaching staff, where the male gender was predominant, with women making up only 33.4% (39 women as opposed to 117 in total) of the teaching staff involved in the process.

One of the most relevant elements that conditioned the virtualization process to a greater extent was the difference in the recipients' understanding of the factors involved in the virtual teaching-learning process. The methodological principles underlying the two realities were understood in different ways, mainly due to two issues. On the one hand, because of the knowledge areas of the professionals and courses involved in virtualization, since a large percentage of them belonged to the aforementioned scientific-technological and health fields; areas that are somewhat distant from the epistemological-didactic reality. And on the other, from the very conception of distance teaching-learning, understood as a mere transfer from the presential to the virtual mediated by a screen. A clear example of this issue is the experience in synchronous virtual classes, where students were forced to remain visibly behind the monitor for the duration of the class, despite the fact that the vast majority recorded the sessions for later viewing. This evinces a lack of understanding of what is meant by the e-learning process.

However, the reality closest to the authors is in line with the Global Connectivity Report (2022), which states that one of the greatest challenges for those disconnected from the network society is no longer directly related to the coverage of internet access, but rather to the acceptance and use that is made of it. The reality in which this virtualization process was working is part of the 5% of the world's population that the aforementioned report states is still physically out of reach of a mobile broadband signal (coverage gap). Furthermore, after the work carried out, it can be stated that other problems that hindered a normal development of the process included the lack of access to a device and the prohibitive costs of connection, as well as the lack of knowledge, skills or abilities to use the technology (usage gap), as already mentioned on several occasions. There are therefore many difficulties, as highlighted by different authors (Anaya et al. 2021; Chanto and Loáiciga, 2020; Flores, 2020; Flores-Cueto et al., 2020; Pinto-Santos, 2022), which can take the form of connectivity, technological resources, alternative complications and drawbacks, unequal access and the widening of the digital divide, inaccessible devices, inadequate appropriation of technology and insufficient teacher training, among others, which become a central and worrying issue.

As described in the body of this document, a way of working was developed that led to the drafting of a guide, which supported the core of the virtualization process during the seven-week period, combining synchronous and asynchronous sessions, always online. (Lavandera-Ponce et al., 2023). The pedagogical strategy chosen responded to the lack of autonomy of the teacher as a designer of teaching and learning experiences. Lack of expertise or experience in virtual contexts was blamed for the inability to perceive and/or solve problems. To overcome these shortcomings, the design of standardised templates was chosen, which was quite positive for the structure of the virtual platform for those who took on the challenge of migrating to new virtual teaching environments for the first time.

Looking ahead, there are a number of issues of concern to the educational and academic world in the aftermath of the pandemic. What has been learnt from this situation? Are we able to implement a methodology capable of challenging time and space? What kind of experiences have allowed us to move beyond a replication of the face-to-face classroom to the screen? To try to answer these questions, we rely on the latest report from the Centre for Public Policy Analysis in Higher Education (2022), presented in May under the auspices of the International University of La Rioja (Spain).

Its aim is to identify, through a prospective approach, the potential scenarios associated with the development of remote university education in Peru by 2030. To this end, both global trends and the Peruvian context have been taken into account.

Despite numerous regulatory changes, since the onset of the pandemic in Peru (face-to-face classes were suspended and adapted to distance learning, guidelines were provided for the continuity of remote educational services, face-to-face classes were authorised in laboratories and workshops at 50% capacity, changing the modality of unlicensed study programmes and giving guidelines for the return to blended and/or face-to-face learning). Ultimately, 81% of the universities consulted agree that there is a high probability that distance education will reach a higher level of consolidation in the coming years and even become a training alternative. They see this possibility as a great option that will democratise access to higher education in Peru.

The study presents four possible prospective scenarios for future distance education, in which the state plays a major role (CAPPES-UNIR, 2022). This is based on ensuring equitable access through the different educational service modalities, promoting policies related to the digital divide and connectivity on a national scale, as well as support to reverse the deficient technological infrastructure and provide due support to public universities. In addition, the document from the Office of Ibero-American States Diagnostic Report on Higher Education and Science post COVID-19 in Ibero-America. Future prospects and challenges 2022, makes a series of recommendations for implementing distance education by 2030 (Santos and Pacheco, 2022).

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ARTICLE

Digital teaching competence for inclusion and social cohesion in teaching processes: Chilean experience during COVID-19

Competencia digital docente para la inclusión y la cohesión social en los procesos de enseñanza: experiencia chilena durante el COVID-19

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Abstract: This study examined teacher digital competence training for inclusion and social cohesion in Chile during the Covid-19 confinement. The objective was to analyze how teachers are trained in ICT and how they use these tools to develop distance education processes. The methodology used was a quantitative approach through a descriptive design of a multiple-choice questionnaire. The findings indicate that ICT training occurs mainly as a spontaneous process of self-learning by the teacher and that their motivations for training in ICT respond mainly to the desire to improve their professional skills. Teachers highly value training processes to develop distance education processes around the use of technologies. The teachers who adapted their planning for the new distance education are those who carried out self-learning processes and have training in technological tools. Most teachers opted for a mixed approach in content delivery and complemented classes through video calling platforms with tools for asynchronous work. Regarding evaluation processes, teachers certainly know that clear and precise instructions are relevant in distance education.

Keywords: Digital competence, Social inclusion, Teacher training, Self-learning, Distance education.

Resumen: Este estudio examinó la formación en competencia digital docente para la inclusión y cohesión social en Chile durante el confinamiento del Covid-19. El objetivo fue analizar cómo los profesores se forman en TIC y cómo utilizan estas herramientas para desarrollar procesos educativos a distancia. La metodología utilizada fue un enfoque cuantitativo a través de un diseño descriptivo de un cuestionario de respuestas de opción múltiple. Los hallazgos indican que la formación en TIC se produce principalmente como un proceso espontáneo de autoaprendizaje por parte del profesor y que sus motivaciones para formarse en TIC responden mayoritariamente al deseo de mejorar sus competencias profesionales. Los profesores valoran altamente los procesos de capacitación para desarrollar procesos educativos a distancia en torno a la utilización de las tecnologías. Los profesores que adecuaron su planificación para el nuevo escenario de educación a distancia son aquellos que realizaron procesos de autoaprendizaje y poseen formación en herramientas tecnológicas. La mayoría de los profesores optó por un enfoque mixto en la entrega de contenidos y complementó las clases a través de plataformas de videollamadas con herramientas para el trabajo asincrónico. En cuanto a los procesos de evaluación, los profesores tienen claro que las instrucciones claras y precisas son un elemento relevante en la educación a distancia.

Palabras clave: Competencia digital, Inclusión social, Formación docente, Autoaprendizaje, Educación a distancia.

1. Introduction

The relevance of adequate training in digital competence for the inclusion and social cohesion of educational professionals acquired special meaning during the confinement period, as a result of the COVID-19 pandemic, due to the teaching of distance classes through, fundamentally, digital tools. It was an opportunity to assess to what extent teachers' digital competence was or was not adequate. Forero-Arango et al. (2022) note that weaknesses of ICT-supported teaching included technical difficulties and loss of face-to-face interaction. Lack of access to computers, low internet speed and quality, and technical challenges related to software for virtual learning platforms decreased the quality and efficiency of learning (Park & Awan, 2022). The socio-family context also played an important role (González, 2021). It is necessary to review to what extent the training in digital teacher competence is sufficient to sustain an adequate implementation of teaching strategies in a particularly challenging context such as the confinement during the COVID-19 pandemic (López-Martín, 2022).

This research reviews the work carried out by 125 teachers in Magallanes, Chile, regarding the deployment of teaching strategies implemented in distance classes during the confinement period. For this, training in information and communication technologies (ICT), understood as teaching digital competence, and the possible relationships between that training and the strategies themselves will be valued.

1.1. Digital competence in the global context

Digital competence is a topic that has gained importance in the world. One of the main challenges is linked to social digitalization, a broad phenomenon that includes, on the one hand, different sectors of the population and, on the other, different rhythms and needs of digitalization. In this context, one of the issues that has gained more strength is the phenomenon linked to citizen digital competence. The study on the importance of digital skills in large Spanish companies shows the need for better training of workers in these skills (Infante et al., 2016). The European Commission stated that digital competence must be assumed as the ability to use digital technologies safely, responsibly, and critically, whether to access information, learning, participation in society, or work (European Commission et al., 2022). However, digital competence is not only relevant in the European context, but efforts must be at a global level. Several reports, such as the one developed in 2020 by the World Economic Forum on the future of jobs, realize the importance of addressing it as a key skill for the near future (Zahidi, 2020). The World Bank (World Bank, 2019) highlights that digital competence is essential for success in today's labor market.

From education, multiple organizations highlight the role of digital competence. The United Nations Educational, Scientific and Cultural Organization [UNESCO] (2019) highlighted that digital competence is essential for education and lifelong learning, and European Schoolnet (2019) notes that it refers not only to the ability to use technology but also to reflect critically on its the impact on society. From this perspective, the initiative of the Universidad Nacional de Educación a Distancia (UNED) (2020) stands out, whose distance education approach has promoted the development of citizens' digital competences, offering students the opportunity to acquire flexible and accessible in technical-digital skills. The DigComp, as a reference

framework of the European Union, describes the digital skills needed for citizens to participate actively in the digital society; in education, it focuses on the development of digital skills in teachers to use these technologies effectively in teaching (European Commission et al., 2022). Moreover, CODE.org (2023) highlights teaching programming and digital skills to children and young people worldwide. Consequently, digital competence, being essential for success in the labor market, education, and daily life, is a major challenge for various actors around the world. Continuity is expected in the development of initiatives and good practices to promote and improve digital competence on the world stage. This addresses not only technical skills but also critical and reflective capacity on the use of technology in society. Betancur & García-Valcárcel (2022) show the need to implement teacher training plans focused on practice and methodological renewal, using agile and flexible formats adjusted to the particular conditions of the teaching teams.

1.2. Addressing digital competition in Latin America

Governments and non-governmental institutions in Latin America are promoting the development of digitalization in citizens, because of technological, economic, cultural, structural, geographical, educational, and other reasons; All of them are accelerated by the digital transformation Latin America is experiencing. The report prepared by Burdín (2022) for the Organización Internacional del Trabajo [OIT], concludes the need to strengthen these skills to improve employability and productivity in our region and provides a series of recommendations to improve education and training in digital skills. The Banco Interamericano del Desarrollo [BID] (Dalio et al., 2023) highlights the need to strengthen digital skills to stimulate economic growth and especially innovation in the region. Cabero-Almenara and Valencia (2019) conclude that there is a substantial advance in the incorporation of ICT in Latin American countries. However, the lack of policies in the implementation, monitoring, and evaluation of these initiatives is evident, which makes it necessary to establish progressive levels of incorporation of the programs.

1.3. Chile and the development of digital competence among citizens

Both the public and private sectors have promoted the development of digital competence in Chile. Some of the initiatives are the Plan Tecnologías para una Educación de Calidad, of the Government of Chile, which since 2007 sought to increase the technological equipment of schools and ensure their pedagogical use (Toro, 2010); the organization MetaRed Chile (n.d.) that seeks to identify teachers' digital skills; the project "Fortaleciendo las competencias digitales de docentes" led by UNESCO (2023) and the Ministry of Education of Chile, which aims to strengthen Chilean teachers in the face of the challenges of digital transformation in education and society; the "Red de Docencia Digital AP", proposed by the Alianza del Pacífico (Educarchile, n.d.) and implemented by Fundación Chile, which was created to generate capacities for pedagogical use in digital technological tools in response to educational needs exacerbated by the Covid-19 pandemic; the effort of the Fundación "Conecta Mayor"(n.d.) from the Pontificia Universidad Católica de Chile to provide senior citizens with technology that facilitates their integration into the digital world.

According to the study "Brechas en el uso de internet: desigualdad digital" by the Fundación País Digital (León & Meza, 2020), 80% of Chileans have access the Internet. 86.4% use it to obtain information in search engines; 47.2% to purchase goods

and services; 30.3% for educational activities and 34.4% for online procedures. Silva & Lázaro-Cantabrana (2020) propose a series of recommendations to promote the development of digital citizenship that are summarized in propertraining in digital skills during formal education and with projection throughout life, with innovative practices that promote the collaborative use of technology. There is a need to improve connectivity in schools, along with curriculum reforms and other initiatives to introduce ICTs, and to develop applications and online content aimed at groups with low connectivity, such as older adults, people with disabilities and speakers of indigenous languages. Finally, invest in professional development through connectivity subsidies focused on low-income households with school-age children, who attend the school system.

Chile is committed to strengthening the development of digital skills in the education sector, assuming the gaps evidenced in the education crisis caused by Covid-19. The Ministerio de Educación (2023) developed the "Política de Reactivación Educativa Integral" in 2022. Its objective was "promote a comprehensive and strategic response to the educational and socio-emotional well-being needs that have emerged in educational communities during the pandemic" (p.2), with a budget of more than 120 million dollars. This program faces, among others, the challenges of digital transformation aiming at "promoting technological resources, connectivity and the development of digital skills in educational communities, based on the strengthening of learning, pedagogical innovation and the continuity of educational processes" (p.21). As regards the Digital Transformation strategy, its main actions are linked to the provision of free internet access to national subsidized schools, including those areas without internet access; improve the current ICT infrastructure, implementing internet networks for students and teachers in all their lessons; 7th-grade students will receive personal computers equipped with educational software and data plans to guarantee ICT access; providing schools with Technology Kits for digital transformation (computers, audiovisual equipment, mobile devices, printers, among others) to optimize learning experiences.

1.4. Digital teaching competence

Perdomo et al., (2020) show that digital teaching competence refers to the ability of educators to effectively use digital technologies in the teaching process-learning to improve the quality of education and enhance student learning. The scientific literature provides an understanding of the challenges and opportunities faced by teachers when using information and communication technologies (ICT) in teaching processes, and considering what they experienced during the Covid-19 pandemic, it is indisputable that the use of technology played a fundamental role in giving continuity to the teaching-learning process of children and young people. However, a more comprehensive view of the process is required, for a proper plan regarding the incorporation of ICT in the educational context, which involves the training or development of digital teaching competences. Koehler & Mishra (2009) propose that, for integrating technology in education, each teacher must be trained in technological, pedagogical, and content knowledge. The same is proposed in the report "Education at a Glance" of the Organización para la Cooperación y Desarrollo Económico [OECD] (2019), where it is emphasized that digital teaching competence is crucial to develop in students, capabilities that allow them to enter the digital world and to develop the necessary skills in the 21st century. Rossi & Barajas (2018) show that the process of acquiring digital competence is complex, and teachers have difficulties in information

management, the didactic use of ICTs, the assessment of digital activity, and collaboration in virtual environments. Training needs to be more coherent and adapted to their needs, giving priority to collaborative work as a mechanism for acquiring digital competence.

1.5. Digital teaching competence from educational centers

Educational centers are fundamental in digital teacher skills training, through support and resources to improve teachers' skills in the use of digital technologies in teaching. Many educational centers generate professional development programs in digital teacher competence, offering workshops, trainings and resources to help educators acquire the necessary skills for teaching with information and communication technologies (ICT). The Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) in Spain, together with school organizations, has been working for quite some time, a digitally competent education around three areas: Digital competence of students, teachers, and educational centers. The latter aims to align itself with international proposals such as the European DigCompOrg framework, which seeks to develop guidelines for schools to become digitally competent educational organizations (Ministerio de Educación y Formación Profesional, 2020).

Training in digital teaching skills should not be limited to adopting technological tools but should also address broader and deeper aspects of digital pedagogy. Teachers need to develop skills to design effective digital learning environments, adapt new and better pedagogical strategies, promote the active and meaningful participation of students, and evaluate learning in new environments, that can be digital.

This research aims to describe the characteristics of training in digital teacher competence and its possible relationship with the deployment of teaching strategies implemented in distance classes during the period of confinement during Covid-19; and explore links between such training and appropriate educational practice. In addition, it is hoped to find connections between variables that can explain how the training in digital teacher skills helped or did not shape educational practice in the emergency context.

2. Method

The methodology adopted was a descriptive quantitative approach based on using a questionnaire asking teachers about various issues that, in the case of the work presented, have to do with the ICT training of the teachers who participated and the strategies implemented for online lessons during the confinement.

2.1. Design

Participants

The questionnaire was answered by 125 educators who conducted classes in the First and Second Cycle of Primary Education (1st, 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th grades), in public schools of the Commune of Punta Arenas, Magallanes, Chile. On a universe of 475 teachers, a non-probabilistic and casual sampling was made of teachers who, due

to the confinement during Covid-19, had to take online lessons and apply their digital teaching skills. Table 1 provides information regarding study participants.

Table 1. The participants * in the study.

Age	1º		2º		3º		4º		5º		6º		7º		8º		Total	
	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
20-30 years					14	01											14	01
31-40 years	38	04							06	03	04	04					48	11
41-50 years							22	05									22	05
51-60 years			14	01									01	02			15	03
61 years and over															02	04	02	04
																	125	

W=Women M=Men

2.2. Instrument

For data recording, a questionnaire was developed whose content came from different sources. On the one hand, part of a bibliographic review has been presented in the theoretical assumptions of this work. Reference was also made to the bibliographic review of online education in Galindo et al. (2020), which sets out didactic recommendations for adaptation to non-face-to-face education in emergencies. Likewise, the validated questionnaire on teaching and learning in online education, developed by Herrera, was consulted et al. (2022). As a result of this first elaboration phase of the questionnaire, the large dimensions on which the questionnaire items would be formulated were defined. These dimensions are as follows: the first concerned demographic data of the participating teachers; the second concerned data on ICT training; the third concerned the conditions of pedagogical practice carried out during confinement by Covid-19; the fourth, related to the teachers' perception of the students' experience during the classes; the fifth, linked to the assessment and projection of the educational experience at a distance implemented ; and the sixth, on teaching strategies implemented in online classes. From all these, only the second and sixth are used in this article. In the results section, you can contrast some of the items used in the second and sixth dimensions.

As Meneses (2016) recommends, this first questionnaire model was submitted to the review of three experts on the use of ICT resources in teaching practices (one of them from the country of origin of the study) seeking to validate the relevance of the dimensions and items included in relation to the object of research. An evaluation guideline (1 to 3) was prepared, with criteria of Understanding (understood), Pertinence (it is pertinent), and Discrimination (generates a diversity of responses). Additionally, space was provided for comments (e.g., alternative wording). As a result of the opinion of the experts, the instrument had some minor adjustments (Table 2), for example, verb times, lexicon, details of some indicators such as autonomous learning,

mode of teaching, digital tool grouping, virtual platforms, and some relationships between statements and indicators.

Tabla 2. Procedure of elaboration the instrument.

Phase I: **Theoretical construct validation**	**Objective**	**Process**	**Result**
I. To define theoretical construct. II. To determine dimensions according to the construct.	To define the theoretical construct regarding teaching and learning in emergency remote education. To determine dimensions according to the theoretical construct. To define each of the six dimensions that constitute the questionnaire.	To review theoretical bibliography. To define construct. To elaborate dimensions according to the construct. To define dimensions.	1. Demographic Data 3. Conditions of the pedagogical practice performed during confinement due to the Covid-19 pandemic 4. Perception of the experience of students during classes in confinement due to the Covid-19 pandemic 5. Assessment and projection of the distance learning experience implemented in confinement due to the Covid-19 pandemic *Dimensions used for the study* 2. Characterization of ICT training. 6. Teaching strategies implemented in distance classes during confinement.
Phase II: Triangulation of experts	**Objective**	**Process**	**Result**
I. Experts´ review on the use of ICT resources in teaching practices.	To validate the relevance of dimensions and items included in relation to the object of research.	Assessment guideline (1 to 3), with criteria of Understanding (understood). Relevance (relevant). Discrimination (generates a diversity of responses).	Adjustments related to: verb times, lexicon, details of some indicators such as autonomous learning, mode of teaching, digital tool grouping, virtual platforms, and some relationships between statements and indicators .
Phase III: Pilot study	**Objective**	**Process**	**Result**
I. Pilot study.	To review the questionnaire to incorporate all the observations made by a group of subjects who shared the characteristics of the actual subjects.	Verification involving 30 teachers with characteristics similar to the final participants, who were excluded from the actual application.	Adequacy to questions and statements. Correctness of item position or order of presentation.

A pilot study was subsequently conducted, involving 30 teachers with characteristics similar to the final participants, who were excluded from the final application, in order to revise the questionnaire to incorporate all the observations made by a set of subjects with similar characteristics to that of the actual participants. The instrument again underwent minor changes (table 2), related to the adequacy of some questions and statements, the correction of the item positions or presentation order. Therefore, the instrument´s internal consistency was guaranteed through the validation of the theoretical construct, expert triangulation, and pilot study.

2.3. Data collection and processing

Data collection took place during the second half of 2022. Participants were formally emailed to their institutional accounts with the necessary information to enable them to respond to the instrument through an online and self-administered electronic form. At the same time, to strengthen the data collection process, meetings were held with the authorities responsible for educational establishments to present the objectives of the study, which, in turn, sent the information to the respective directors of the public schools in Punta Arenas, Magallanes, Chile. With the answers, a database was built to implement statistical procedures using SPSS software, version 25.

3. Results

The presentation of the results is divided into two sections: the first analyzes the variable ICT training, understood as training in digital teaching competence, and the second, the relationship between this ICT training and the teaching strategies implemented in a non-face-to face mode during the period of the confinement. Multiple-choice questions were analyzed based on one and multiple-response preferences for the 125 cases.

3.1. Characteristics of ICT training, understood as training in digital teacher competence.

ICT training received for teaching.

The results show that self-learning is the option indicated by the largest number of teachers (71.2%) (Figure 1).

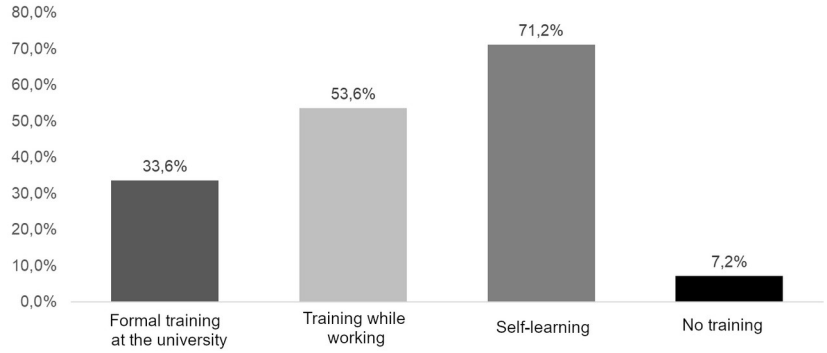

Figure 1. ICT training received for teaching according to response (multiple choice).

A detailed analysis of the responses shows that 52.8% indicated only one type of training received or none, and 48.2% had received more than one of the training proposed (Figure 2). In the case of self-learning, reported by 71.2% of teachers, the distribution was as follows: 28.8% received only this form of training; 8.8% added to this self-training ICT received during its initial stage; 17.8% had ICT self-training and ICT training at the professional exercise stage; and 16% were trained at the initial stage, in their professional exercise development and self-training (Figure 2).

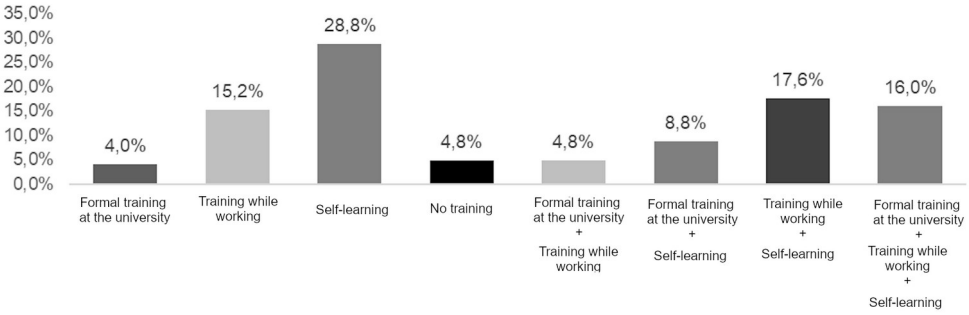

Figure 2. ICT training received for teaching according to case (teacher).

Approach to ICT training received

When asking regarding the focus of ICT training in education, the question with five possible answers found that 84.9% of teachers indicated that the type of ICT training received corresponds to the knowledge of technological tools to be used in lessons; 61.3% of technological tools in general; and 47.1% of tools for management tasks (Figure 3).

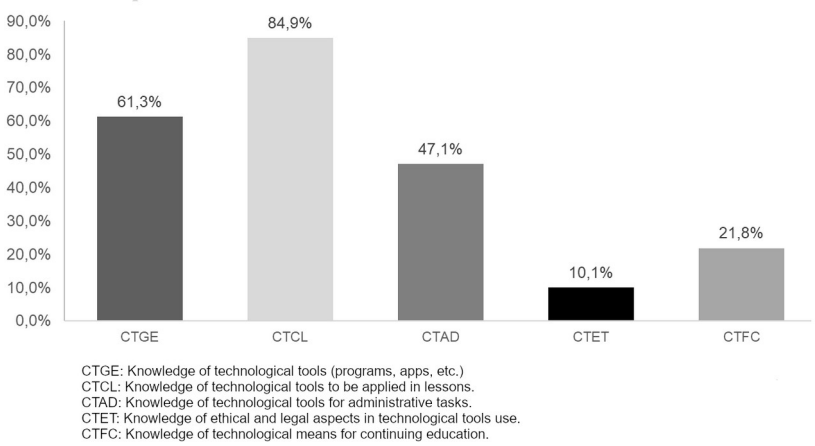

Figure 3. Type of ICT training received according to response (multiple choice).

The preference analysis shows that 17.6% indicate that the type of ICT training received corresponds to the knowledge of technological tools to be used in lessons; another 17.6% add to their training the general technological knowledge, followed by 12.8%, 10,4%, 7.2% and 4.8% which add preferences to the type of ICT training received

with respect to general technological knowledge, technology for administrative use, technology on ethical aspects, and technology for their continuing training, respectively; and other lower values (Figure 4).

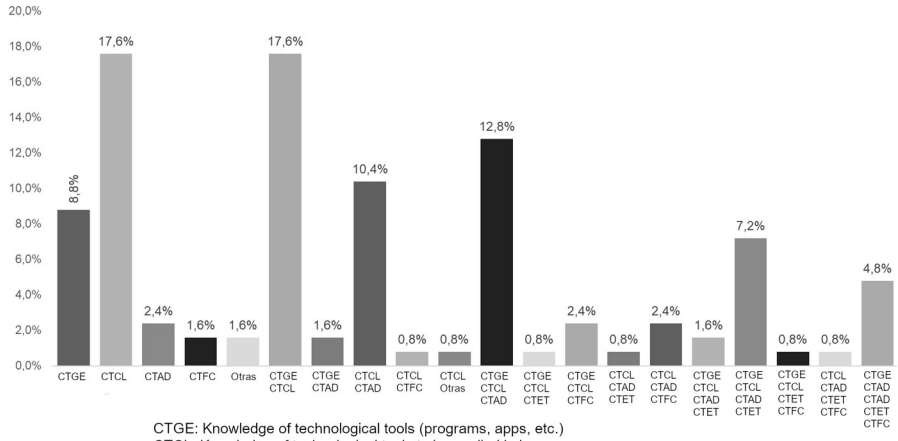

Figure 4. Type of ICT training received by case (teacher).

Motivation for ICT training received

The question on motivation for ICT training, with five possible answers, shows that 71,2% of respondents indicated that their motivation for ICT training was mainly due to their desire to improve their professional skills to teach their lessons (Figure 5).

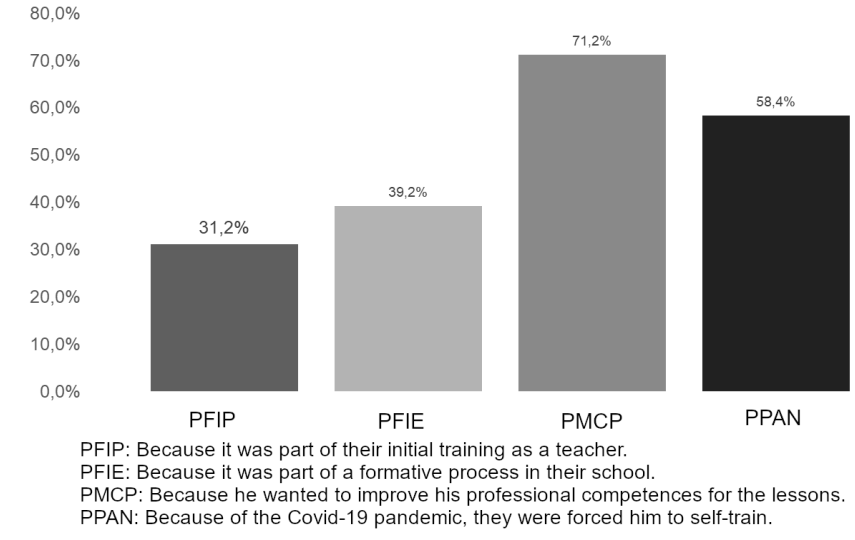

Figure 5. Motivation for ICT training (multiple choice).

When analyzing each preference, the highest percentages show that 16.0% had as motivation for ICT training to improve their professional skills to face classes; 14.4%,

effect of the pandemic; 11.2%, part of the training process in their educational institution, and 8.8%, part of their initial teacher training (Figure 6).

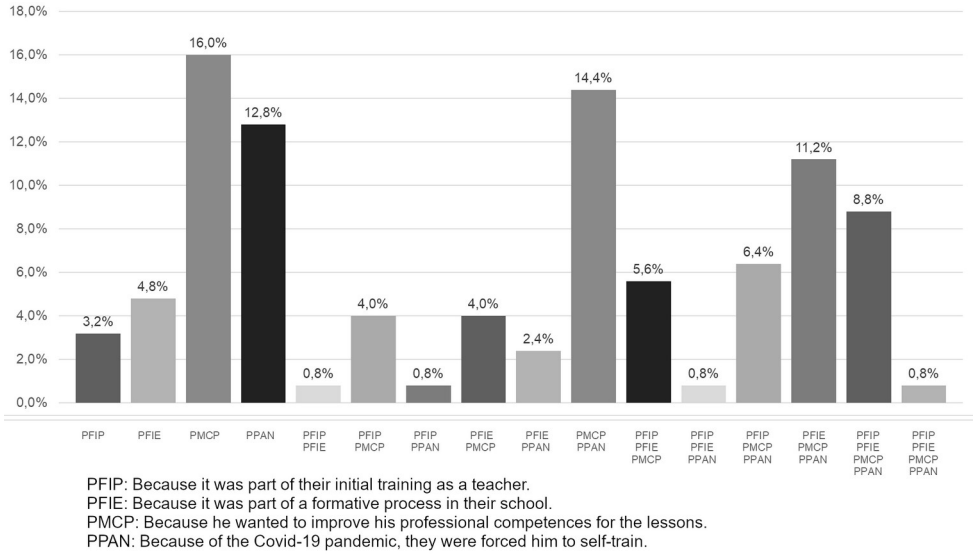

Figure 6. Motivation for ICT training (only preference).

Assessment of ICT training received in the educational institution

In relation to the assessment of ICT training given by schools during the confinement, 49.6% believe that it received adequate training to develop distance learning processes around the use of technologies. 28.8% maintain that they received training from their schools, but it was not adequate and, therefore, they had to learned through other means; 16.8% say they did not receive any training and that they were trained properly through different alternatives, and 4.8% said they did not receive any training and their self-learning did not meet their expectations (Figure 7).

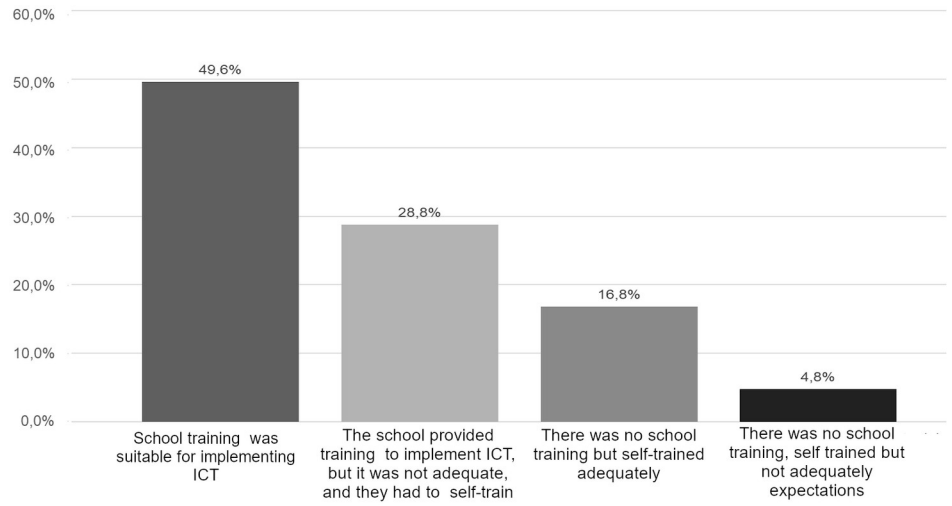

Figure 7. Assessment of ICT training (only preference).

3.2. Relationship between ICT training and the teaching strategies implemented during non-face-to-fce confinement.

Concerning the variables "ICT training received" and "Technical-pedagogical guidelines to support the process of lesson planning in emergency contexts", 72.4% report having been trained in ICT as a spontaneous process of self-learning; 54.5% do so in the professional teaching exercise (training courses); 32.5% for initial teacher training (subjects); and 6.5% did not receive training. After reviewing the guidelines received, 45.5% declared that they adapted the initial planning to curricular prioritization; 51.2% said they adapted it to curricular prioritization for a new scenario of distance education. 2.4% did not receive guidance for this process, and 0.8% maintained their planning.

Table 3. Distribución de porcentajes de respuestas sobre formación TIC en relación con las orientaciones recibidas.

			Formación TIC recibida				
			Formal training at the university	Training while working	Self-learning	No training	**Total**
Technical-pedagogical guidelines to support your classroom planning process in emergencies	Kept their planning.	(f)	0	0	0	1	1
		%	0,0%	0,0%	0,0%	0,8%	0,8%
	Adapted initial planning to curricular prioritization.	(f)	17	31	40	3	56
		%	13,8%	25,2%	32,5%	2,4%	45,5%
	Adapted initial planning considering curricular prioritization for online lessons.	(f)	23	34	47	3	63
		%	18,7%	27,6%	38,2%	2,4%	51,2%
	Did not receive technical and pedagogical guidance.	(f)	0	2	2	1	3
		%	0,0%	1,6%	1,6%	0,8%	2,4%
Total*		(f)	40	67	89	8	123
		%	32,5%	54,5%	72,4%	6,5%	100%

*Percentages and totals are based on (teacher) cases.

From these results, it appears that most respondents received ICT training in professional teaching or as a spontaneous process of self-learning, suggesting the importance of continuous training and self-training for skills development in this area. It is also noted that the majority chose to adapt the initial planning to curricular prioritization and adapt it to a new scenario of distance education, being those self-taught the ones who achieved this process the best (38.2%).

Table 4. Distribution of percentages of responses on type of ICT training in relation to guidance received.

			Types of ICT formation received					
			Knowledge of technological tools (programs, apps, etc.)	Knowledge of technological tools to be applied in lessons	Knowledge of technological tools for administrative tasks	Knowledge of ethical and legal aspects in technological tools use	Knowledge of technological means for continuing education	**Total**
Technical-pedagogical guidelines to support your classroom planning process in emergencies	Kept their planning.	(f)	0	0	0	0	0	0
		%	0%	0%	0%	0%	0%	0%
	Adapted initial planning to curricular prioritization.	(f)	29	45	22	1	6	54
		%	24,6%	38,1%	18,6%	0,8%	5,1%	45,8%
	Adapted initial planning considering curricular prioritization for online lessons.	(f)	43	54	30	10	19	61
		%	36,4%	45,8%	25,4%	8,5%	16,1%	51,7%
	Did not receive technical and pedagogical guidance	(f)	0	2	3	1	1	3
		%	0,0%	1,7%	2,5%	0,8%	0,8%	2,5%
Total*		(f)	72	101	55	12	26	118
		%	61,0%	85,6%	46,6%	10,2%	22,0%	100,0%

* Percentages and totals are based on (teacher) cases.

As for the variables "Type of ICT training received" and "Technical-pedagogical guidelines to support lesson planning in emergency contexts", 86.6% received training in the knowledge of technological tools to be applied in their lessons; 61% in technological tools (programs, apps, etc.); 46.6% in digital tools for administrative tasks; 22% in technological means for continuous training, and 10.2% in ethical and legal aspects in the use of these tools. When reviewing the second variable, and regarding those who adapt the initial planning considering the curricular prioritization for a new scenario of distance education, it is noted that those teachers who had training in technological tools are the ones who best achieved this process (48.8%).

Table 5. Distribution of percentages of responses on reasons for ICT training in relation to guidance received.

			Reasons for ICT formation				
			Because it was part of their initial training as a teacher.	Because it was part of a training process in their school.	Because he wanted to improve his professional compe-tences for the lessons	Because of the Covid-19 pandemic, they were forced to self-train.	**Total**
Technical-pedagogical guidelines to support your classroom planning process in remote emergency context	Kept their planning.	(f)	0	0	0	0	0
		%	0	0	0	0	0
	Adapted initial planning to curricular prioritization.	(f)	11	21	39	35	55
		%	9,2%	17,5%	32,5%	29,2%	45,8%
	Adapted initial planning considering curricular prioritization for online lessons.	(f)	27	28	47	36	62
		%	22,5%	23,3%	39,2%	30,0%	51,7%
	Did not receive technical and pedagogical guidance	(f)	0	0	3	2	3
		%	0,0%	0,0%	2,5%	1,7%	2,5%
Total*		(f)	38	49	89	73	120
		%	31,7%	40,8%	74,2%	60,8%	100,0%

*Percentages and totals are based on (teacher) cases.

Regarding the variables "Reasons for training in ICT" and "Technical-pedagogical guidelines to support the lesson planning in emergency context," 74.2% of respondents were trained because they wanted to improve their professional skills for their lessons, 60.8% due to the pandemic; 40.8% due to the usual training process in their school, 31.7% as part of their initial teacher training. When reviewing the second variable, and regarding those who adapted the initial planning considering the curricular prioritization for a new scenario of distance education, it is noted that those teachers who wanted to improve their professional skills for the classes best achieved this process (39.2%). In summary, the results show that the majority of respondents sought training in ICT to improve their professional skills for classes, and most received guidance to adapt their initial planning to curricular prioritization and the new scenario of distance education. Teachers are ready to train and adapt to new circumstances to deliver quality education in emergencies such as the pandemic.

Table 6. Distribution of percentages of responses on the type of ICT training in relation to content delivery.

			Tipos de formación TIC recibida					
			Knowledge of technological tools (programs, apps, etc.)	Knowledge of technological tools to be applied in lessons	Knowledge of technological tools for administrative tasks	Knowledge of ethical and legal aspects in technological tools use	Knowledge of technological means for continuing education	**Total**
Content delivery	Only through online lessons (Meet, Zoom, Microsoft teams, and others).	(f)	16	21	9	5	6	22
		%	13,6%	17,8%	7,6%	4,2%	5,1%	18,6%
	Only with platform activities (Classroom, Moodle, Edmodo, and others).	(f)	7	8	7	1	3	12
		%	5,9%	6,8%	5,9%	0,8%	2,5%	10,2%
	Through online lessons and with complementary activities in platforms.	(f)	49	72	39	6	17	84
		%	41,5%	61,0%	33,1%	5,1%	14,4%	71,2%
	Total*	(f)	72	101	55	12	26	118
		%	61,0%	85,6%	46,6%	10,2%	22,0%	100,0%

*Percentages and totals are based on (teacher) cases.

In the analysis of the variables "Type ICT training received" and "Content delivery," most respondents received training in the technological tools knowledge of for their lessons and administrative tasks. From these, 85.6% had training on technological tools to be used in their lessons. The review of the variable "content delivery", shows that 71.2% developed the training through online classes and complementary activities on platforms, being this mixed approach the most used for content delivery. Within this percentage, 61% report having received technological knowledge training for their lessonstools to be applied in classes. These data suggest that there is a variety of technology training received and used by teachers in their practice; that mixed approaches to content delivery were the most commonly used; and that the type of training is not linked to how they deliver their content. From the above, we learn that more attention should be paid to teacher ICT training in ethical and legal aspects of technology.

Table 7. Distribution of percentages of responses on the reasons for ICT training in relation to content delivery.

			Motivos para la formación TIC				
			Because it was part of their initial training as a teacher.	Because it was part of a training process in their school.	Because he wanted to improve his professio-nal compe-tences for the lessons	Because of the Covid-19 pandemic, they were forced to self-train.	**Total**
Content delivery	Only through online lessons (Meet, Zoom, Microsoft teams, and others).	(f)	9	10	16	14	23
		%	7,5%	8,3%	13,3%	11,7%	19,2%
	Only with platform activities (Classroom, Moodle, Edmodo, and others).	(f)	4	6	10	5	11
		%	3,3%	5,0%	8,3%	4,2%	9,2%
	Through online lessons and with complementary activities in platforms.	(f)	25	33	63	54	86
		%	20,8%	27,5%	52,5%	45,0%	71,7%
	Total*	(f)	38	49	89	73	120
		%	31,7%	40,8%	74,2%	60,8%	100,0%

*Percentages and totals are based on (teacher) cases.

Data from the variables "reasons for ICT training" and "content delivery" show that the main motivation for ICT training was to improve professional skills for lessons (74.2%); the pandemic context (60.8%); it was part of the training process in their educational institution (48.8%); it was part of their initial teacher training (31.7%). The analysis of the variable "content delivery," evidences that 71.7% report having developed training through online classes and complementary activities on platforms. It is interesting to note that the pandemic was a significant reason for ICT training for many respondents, as well as improving their professional skills and adapting to the circumstances and demands of the current educational environment. In this sense, the mixed approach is the most used for the delivery of content, and faced with this challenge, 52.5% of teachers who used this strategy sought to improve their professional skills for their lessons. In general, these data show a high participation of teachers in technology-related training processes, mainly due to the pandemic context, which demonstrates the importance of technology in the current educational field and the need for continuous training in the development of teachers´ digital skills.

Table 8. Distribution of percentages of ICT training responses in relation to the evaluation

			ICT formation received				
			Formal training at the university	Training while working	Self-learning	No training	**Total**
Considerations for planning the evaluation process.	Gave clear and precise instructions.	(f)	35	59	83	7	110
		%	28,2%	47,6%	66,9%	5,6%	88,7%
	Delivered feedback timely.	(f)	32	55	71	5	97
		%	25,8%	44,4%	57,3%	4,0%	78,2%
	Gave priority to the implementation of evaluations.	(f)	26	41	53	5	71
		%	21,0%	33,1%	42,7%	4,0%	57,3%
	Shared the rubrics in advance.	(f)	22	39	51	3	68
		%	17,7%	31,5%	41,1%	2,4%	54,8%
	Offered feedback to partial deliveries of the assignments	(f)	21	38	58	8	76
		%	16,9%	30,6%	46,8%	6,5%	61,3%
Total*		(f)	41	67	89	9	124
		%	33,1%	54,0%	71,8%	7,3%	100,0%

*Percentages and totals are based on (teacher) cases.

With regard to the variables "ICT training received" and "Considerations for planning the evaluation process," it is observed that the former corresponds to a of self-learning process (71.8%), professional teaching (54%), initial teacher training (33%) and 7.3% received no training. Regarding the second variable, 89% report having given their students clear and precise instructions, and 78.2% timely feedback. Among these results, 57.3% have privileged implementation evaluations, and 54.8% have shared headings in advance. Additionally, 61.3% reported that teachers offered feedback to partial deliveries of the assignments. Consequently, all the considerations for planning the evaluation process made by teachers are explained by a process of self-learning, and within this group, 66.9% consider clear and precise instructions, crucial in distance education.

As for the variables "Centre ICT training" and "Considerations for planning the evaluation process," the data show that 50% of teachers received adequate training to develop online learning with the use of technologies. 29% received training, but it was not adequate, so they had to train on their own; 16.9% did not receive training, which they sought voluntarily and was suitable for developing distance learning processes. Regarding the second variable, it is noted that most respondents considered that these were largely met. 88.7% indicated that the instructions were clear and precise. From this group, 44.4% received adequate training to develop technological distance learning processes in their respective schools. Note that those teachers who did not receive training had fewer considerations in planning the evaluation process than the rest.

Table 9. Distribution of percentages of center-based ICT training responses in relation to the evaluation.

			ICT training conducted at the centre during the pandemic				
			Received adequate training to develop online learning with the use of technologies.	Received training, but it was not adequate, so they had to train on their own	Did not receive training, which they sought voluntarily and was suitable for developing distance learning processes	Did not receive training, which they sought voluntarily and was unsuitable for developing distance learning processes	**Total**
Considerations for planning the evaluation process.	Gave clear and precise instructions.	(f)	55	34	17	4	110
		%	44,4%	27,4%	13,7%	3,2%	88,7%
	Delivered feedback timely.	(f)	49	32	12	4	97
		%	39,5%	25,8%	9,7%	3,2%	78,2%
	Gave priority to the implementation of evaluations.	(f)	38	22	8	3	71
		%	30,6%	17,7%	6,5%	2,4%	57,3%
	Shared the rubrics in advance.	(f)	33	23	9	3	68
	Offered feedback to partial	%	26,6%	18,5%	7,3%	2,4%	54,8%
	Deliveries of the assignments	(f)	30	27	16	3	76
		%	24,2%	21,8%	12,9%	2,4%	61,3%
Total*		(f)	62	36	21	5	124
		%	50,0%	29,0%	16,9%	4,0%	100,0%

*Percentages and totals are based on (teacher) cases.

4. Conclusions

Training in digital teacher competence has become crucial to promote inclusion and social cohesion in the educational field since it enables teachers to develop skills and knowledge to diversify their practice in the classroom. This process allows the development of skills to adapt more effectively to the dizzying changes that technology causes, and with it, to improve their educational practice, not only from the educational but also from the social and cultural contexts. The UNESCO (2022) states the need for a new social contract for education that allows students and teachers to think differently about learning and relations, for which training in digital teacher competence is crucial. At present, the importance of this training is undeniable, understood as a concrete tool to develop the skills necessary to teach and promote the responsible use of ICT in the classroom. Jiménez-Hernández et al. (2021) compiled different models used as training guides to facilitate the development of these skills and analyzed their characteristics, purposes, and dimensions, to support the importance of digital teacher competence training.

In the main findings of the present study, it is observed that the training in digital teacher competence occurs mainly as a of self-learning process, focusing on the knowledge of technological tools to be used in lessons; and that the motivations for training in ICT, respond mostly to the desire to improve their teaching skills. Mateus et al. (2022) conclude that the development of media competence in school students improves with the training they receive in the area, which largely involves teacher training in this area.

Another relevant finding is the high-value teachers give to training offered by their schools itself to develop distance educational processes around the use of technologies. Notwithstanding the above, and despite the existence of reference frameworks for the development of digital competences, it is necessary to review their scope to adjust to the real experience of teachers. Then it is essential to generate training processes in specific digital skills, based on the reality of the schools agreeing with aspects revised and confirmed by Portillo-Berasaluce (2022).

With regard to ICT training and the teaching strategies implemented during the non-classroom period, some teachers adapted their initial planning to online lessons. Those teachers carried out self-learning training on technological tools, motivated by improving their teaching skills The incorporation of projects or new methodologies in teaching processes does not guarantee success in terms of students' academic performance, therefore and as Marcano et al. (2017) indicate, it is crucial to strengthen digital competence work in the teacher training programs, and in continuing education.

Regarding the delivery of content, most teachers opted for a mixed approach (online classes and complementary activities on platforms), and in this group, most of them had training and knowledge of technological tools to be applied in lessons. In relation to the reasons for ICT training, most teachers wanted to improve their professional skills, resulting in a comprehensive approach, using video calling platforms, and asynchronous work. This approach and role of the teacher reinforces the idea of combining methodologies and conceives the student as the protagonist and

the teacher, as a guiding figure who actively participates in the construction of learning (Trujillo et al., 2016)

Finally, from the training in ICT and in relation to the evaluation processes, teachers at the time of planning them considered that clear and precise instructions are an important element in online education. In this, the school played an important role in providing adequate training. However, it is necessary to note the need to carry out formative evaluation processes, especially in an online context, where it is highly appropriate to design instruments to collect truthful information, on which timely actions will be taken in order to generate feedback, in accordance with the different findings found in the training process, accompanied by a pedagogical reflection on teaching practice (Sánchez et al. 2022)

In conclusion and with reference to the implications, limitations, and prospective of future studies, it is necessary to promote training in digital teacher competence., This training should be offered by the schools as a complement to the self-learning processes. The promotion of mixed approaches in the delivery of content, combining online classes, complementary activities in educational platforms, and adequate training for the evaluation process should be a strategic axis This research focused on the Chilean experience during the confinement during the Covid-19 pandemic and may not be generalizable to other contexts; as well as results that are based on teachers' perceptions and experiences may not fully reflect reality. However, digital teacher competence training research can improve social inclusion and cohesion in other contexts, not just in the education sector. At the same time, assessing the long-term impact of the digital teacher competence training programs offered by schools, teachers' motivations to train in ICT, and their influence on educational practice are opportunities for further research.

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ARTICLE

Digital technology and University leisure: Exploring learner access, use and attitudes

Tecnología digital y ocio universitario: Explorando el acceso, uso y actitud de los estudiantes

Estefanía de los Dolores Gil-García[1], Pedro Francisco Alemán-Ramos[2] and Juan Carlos Martín-Quintana[3]

Abstract: Digital leisure has become a useful and motivating didactic tool for student learning, which also contributes to the acquisition of digital skills. The aim of this study is to analyse the access and use of digital technology by university students at the Universidad de San Carlos de Guatemala (USAC), as well as their attitudes towards digital leisure. This study is framed within the quantitative paradigm, with a non-experimental, cross-sectional, descriptive, exploratory, and correlational design. A total of 203 university students (47.5% male; 52.5% female) from USAC between the ages of 17 and 49 (M=23.33; SD=5.55) participated in the study. The results indicate that the most accessed digital devices and services by university students are smartphones (91.8%) and laptops (80.3%). Additionally, 96% of the students have profiles on social networks. Specifically, younger students (17-20 years) are the ones who have the highest usage of digital technology for leisure purposes and show greater enjoyment of these digital activities. This data shows how university students, particularly newly admitted ones, are highly familiar with digital technology and possess a positive attitude towards digital leisure. Thus, teachers can make use of this openness towards technology and include it as a learning tool in the classroom to then promote digital competences and so create a motivating and effective learning environment.

Keywords: Digital competence, Digital technology, Access, Use, Digital leisure.

Resumen: El ocio digital se ha convertido en una herramienta didáctica útil y motivadora para el aprendizaje de los estudiantes, que además contribuye a la adquisición de competencias digitales. El objetivo de este estudio consiste en analizar el acceso y uso de la tecnología digital por parte de los universitarios de la Universidad de San Carlos de Guatemala (USAC), así como su actitud hacia el ocio digital. Este estudio se enmarca en el paradigma cuantitativo, con un diseño no experimental de carácter transversal, descriptivo, exploratorio y correlacional. En él participaron 203 universitarios (47.5% hombres; 52.5% mujeres) de la USAC entre los 17 y 49 años (M=23.33; DT=5.55). Los resultados indican que los dispositivos y servicios digitales a los que más acceden los universitarios son el smartphone (91.8%) y el ordenador portátil (80.3%). Asimismo, el 96% posee perfiles en redes sociales. Específicamente, los estudiantes más jóvenes (17-20 años) son quienes usan en mayor medida la tecnología digital para actividades de ocio digital informan de un mayor agrado por la realización de este tipo de actividades. Estos datos reflejan cómo el alumnado universitario, fundamentalmente de nuevo ingreso, está familiarizado con la tecnología digital, mostrando una actitud positiva hacia el ocio digital. Esto podría ser aprovechado por los docentes para propiciar la inclusión de esta herramienta por los docentes para promover la inclusión de esta herramienta en el aula a fin de promover las competencias digitales y crear un ambiente de aprendizaje motivador y efectivo.

Palabras clave: Competencia digital, Tecnología digital, Acceso, Uso, Ocio digital.

1. Introduction

Information and Communication Technologies (ICTs) are present in all spheres of life. Therefore, accessing and knowing how to use digital devices and services is a prerequisite to participate and develop in this network society (Ragnedda & Muschert, 2013). However, in the Guatemalan context, despite the increasing number of Internet users in recent years, they continue to register the lowest penetration rates of this service in comparison to other Central American countries. In fact, at the beginning of 2022, 35% of the Guatemalan population did not have access to this service (Hootsuite & We Are Social, 2022). This phenomenon can be attributed to factors such as the digital divide (Ragnedda, 2017; Van Dijk, 2020).

According to data from the latest report published by the International Telecommunication Union (ITU, 2022), young people between 15 and 24 years of age are those who make greater use of digital technology mainly for digital leisure activities (playing online games, interacting on social networks, listening to music on digital platforms, watching videos) due to the new features and opportunities provided by this type of activity (Bryce, 2001; Nimrod & Adoni, 2013). This has contributed to the fact that current university students, a generation known as digital natives, possess certain traits, as a consequence of their early relationship with digital technology (Prensky, 2001). In contrast, recent research, carried out by Sánchez-Caballé et al. (2020) argues that young people are not a homogeneous group, and so having been born after the year 2000 is not associated with a greater acquisition of digital skills in this age group. Considering that digital competence englobes knowledge, skills, abilities, values and attitudes for the safe and responsible use of digital devices in contexts such as education (European Commission, 2019), authors such Morduchowizc (2018) state that most students reach university with a rather unequal degree of digital literacy. This author observed that, although the students have a high level of technological skills associated with leisure activities, they present certain difficulties when it comes to handling ICTs for educational purposes.

Since digital competences are not skills that can be developed separately but encompass a set of abilities that are applied in various areas and dimensions of knowledge, it is crucial that all students acquire them for their comprehensive training in an increasingly digitalised society (European Commission, 2019). In this context, higher education institutions are acquiring a key role in digital literacy education and training (Calatayud et al., 2018).

Although it has traditionally been assumed that the use of ICTs for leisure activities decreases the time dedicated to educational activities, current studies show that this type of activity can become a resource for learning, socialization, and the creation of social capital. Specifically, it has been shown that digital leisure promotes the development of cognitive strategies and skills such as information search and organization, problem solving and decision making. It also stimulates socialization by acting as an instrument for the transmission of values and behavioural patterns. Furthermore, it contributes to fostering digital competences (Gutiérrez et al., 2013).

In accordance with the above, Correa (2016) argues that the greater the use of digital technology by students for digital leisure activities, the greater the perception of digital competences, feeling of autonomy and digital self-efficacy. For this reason,

nowadays, far from understanding digital leisure as a simple entertainment activity, a growing number of teachers are expressing interest in incorporating this type of activity as a didactic tool in their classrooms. As digital leisure not only allows for more playful and accessible learning, but also increases students' motivation (Santana & García, 2018) and their level of digital competences, this paper aims to analyse the access and use of digital technology by university students at the University of San Carlos de Guatemala (USAC), as well as their attitudes towards digital leisure. In this way, teachers, after knowing the attitudes towards digital leisure by the students, will be able to establish more effective strategies for the inclusion of these type of tools in their lessons.

2. Method

This study is conducted within the quantitative paradigm, with a non-experimental, cross-sectional, descriptive, exploratory, and correlational design.

2.1. Participants

A non-probabilistic sampling was carried out, conditioned by the number of people who responded voluntarily and anonymously to the questionnaire. A total of 203 university students (47.5% men; 52.5% women) from USAC between the ages of 17 and 49 years (M=23.33; SD=5.55) participated in the study. 53% indicated that they were only studying, while 47% were studying and working simultaneously. Finally, 90.1% said they were single, had no dependent children (89.7%) and were living with their mother, father with or without siblings (heteroparental family) (55.7%) (Table 1).

2.2. Instrument

A self-reported questionnaire (via pencil and paper) structured in three parts was developed. First, sociodemographic data was collected from the participants. Then, to study access to digital technology, a list of nine devices and four digital services was created for them to indicate whether they had access to each of them. Next, to examine what they use digital technology for, a Scale called "Uses of Digital Devices and Services" of ten items was created ad hoc, based on the list of the activities that people do most on the Internet according to the National Institute of Statistics (INE, 2022). Participants had to rate the frequency with which they perform each of the proposed activities using a Likert-type Scale from 1 (not at all) to 5 (very much). Finally, with the intention of finding out the attitudes towards digital leisure, the "Leisure Attitude Scale-Short Version (LAS-SV)" of eighteen items elaborated by Teixeira & Freire (2013) was translated and adapted to Spanish. Participants had to reflect the degree of agreement from 1 (strongly disagree) to 5 (strongly agree), in each of the items that make up the Scale, which evaluates the cognitive, affective, and behavioural components of attitudes.

Table 1. Sociodemographic characteristics of the participants.

Variables		n	%
Sex			
	Male	94	47.5
	Female	104	52.5
Age			
	17-20 years	81	39.9
	21-25 years	61	30
	>25 years	61	30
Family structure			
	Heteroparental family	112	55.2
	Homoparental family	4	2
	Single-parent family	55	27.4
	Extended family	14	7
	Emancipated	15	7.5
	Reconstituted family	1	.5
Marital status			
	Married	18	8.9
	Single	183	90.1
	Separated	2	1
Number of children			
	1	14	66.7
	2	6	28.6
	3 or more	1	4.8
Academic-employment status			
	Study only	107	52.7
	Study and work	95	46.8

2.3. Procedure

To achieve the sample, the School of History of the USAC collaborated in disseminating the objective of the study and encouraging both its own students and the rest of the student population belonging to other faculties to participate. Participants took approximately 8 minutes to complete the questionnaire.

2.4. Data analysis

First, we checked whether the data met the assumptions of normality (Kolmogorov-Smirnov), homoscedasticity (Levene's test), skewness and kurtosis indices. Since these assumptions were met, it was decided to apply parametric tests. Secondly, knowing that the Chi-Square test for the association of nominal categorical variables can be used to validate or provide additional context to the observed frequencies, this statistical procedure was performed to determine whether there are significant differences in terms of access to digital devices and services, according to gender, age and academic-employment status of university students. Third, after developing the Scale of “Use of Digital Devices and Services" and, after translating and adapting the

Scale of Teixeira & Freire (2013) into Spanish, following the guidelines of the International Test Commission (Hernández et al., 2020), we proceeded to validate both instruments by means of an exploratory and confirmatory factor analysis (Asparouhov & Muthen, 2009). Specifically, to analyse model fit and determine if the model is correct, the following indices were reported: RMSEA ≤.08; CFI ≥.90 and SRMR ≤.08 (Kline, 2015). To determine the number of factors, attention was paid to the number of these with at least three significant items (CI=95%) in the expected factor and which, in addition, were interpretable at a theoretical level. To assess the internal consistency of the Scales, McDonald's omega was used instead of the usual Cronbach's alpha, since the latter requires that the factor weight be equal for all items (Yang & Green, 2010) and that the data be continuous (Elosua & Zumbo, 2008). Descriptive statistics and the correlation between the different factors were also calculated. To test for significant differences between the factors that make up each of the Scales, a repeated measures analysis was performed, considering the effect size through the partial eta squared. Likewise, the t-test procedure for related samples was carried out to check if there are two-to-two differences between the factors that make up the Scales.

Next, mean contrasts (ANOVA) were performed to test for significant differences according to the criteria variables. Additionally, post-hoc tests were performed by Tukey's procedure when there were more than two subgroups to analyse between which groups the differences were occurring. Then, the relationship between the use of digital devices and services and the attitudes towards digital leisure was carried out by means of a correlation study using Pearson's linear correlation coefficient r. The level of significance of the correlation coefficient was calculated using the Pearson's linear correlation coefficient. The significance level with which we worked was ≤0.05. The effect size used was Cohen's d (1988). SPSS V.23, Mplus 6.11 (Muthén & Muthén, 1998-2010) and Microsoft Excel were used to perform the analyses described above.

3. Results

3.1. Access to digital technology

The most accessed digital devices and services are smartphones (91.8%) and laptops (80.3%). The majority of students have email (96.1%) and social network profiles (96%). In addition, 83.7% claimed to have Wi-Fi at home. In contrast, they have access to activity bracelets (7.4%) and smartwatch (8.9%) to a lower extent and only 8.9% mentioned having a digital certificate (Table 2).

Chi-Square tests were used to determine whether there are significant differences in terms of the digital devices and services most frequently accessed by university students (smartphone, laptop, e-mail, social network profiles and access to Wi-Fi at home), according to their sex, age, and academic-employment status. These tests revealed significant differences in terms of having or not having a profile on social networks according to age (Table 3) and having Wi-Fi at home according to this same variable (Table 4) and the academic-employment status of the university students (Table 5). In contrast, no differences were found according to sex. No differences were found in any of the criteria variables evaluated in relation to the possession of a smartphone, laptop, or e-mail.

Table 2. List of digital devices and services they have access to.

		Yes (%)
Digital devices	Smartphone	91.1
	Laptop	80.3
	Computer	80.3
	Smart TV	62.6
	Tablet	39.9
	Mp3 o mp4 player	28.7
	Electronic book	13.8
	Smartwatch	8.9
	Activity bracelet	7.4
Servicios digitales	Correo Electrónico	96.1
	Perfil en redes sociales (Facebook, twitter, Instagram, …)	96
	WiFi en casa	83.7
	Firma electrónica o certificado digital	8.9

Table 3. Distribution according to the availability of a profile in social networks with respect to age.

	Yes	No
17-20 years	41.8	0
21-25 years	30.4	12.5
>25 years	27.8	87.5
Total	100	100

Note. $\chi^{2(2,202)}$=13.227,p=.001***, with a mean effect size (d=.53)

Tabla 4. Distribution according to the possession of Wi-Fi from home with respect to age.

	Yes	No
17-20 years	40.8	33.3
21-25 years	32.5	18.2
>25 years	26.6	48.5
Total	100	100

Note. $\chi^{2(2,202)}$=6.646,p=.036*, with a small effect size (d=.37)

Table 5. Distribution according to the possession of Wi-Fi from home with respect to the academic-employment status.

	Yes	No
Study only	56	36.4
Study and work	44	63.6
Total	100	100

Note. $\chi^{2(1,201)}$=4.246,p=.039*, with a small effect size (d=.29)

3.2. Uses of digital technology

To decide the factor structure of the Scale of "Uses of Digital Devices and Services", several analyses were carried out with solutions from 1 to 10 factors. The factor structure in which adequate adjustment indexes were obtained was the factor structure made up of two factors. This Scale initially had 11 items. After the exploratory and confirmatory factor analysis, it was reduced to 10 clearly interpretable items, where the factor weights in their respective dimensions ranged between .216 and .739 (Table 6). In addition, the model is considered to have good fit indices (RMSEA=.07; CFI=.93; SRMR=.052), high overall reliability (α=.81). For each of the factors it explores instrumental use, collected in 5 items (α=.64) and leisure use, collected in 5 items (α=.70).

Table 6. Exploratory and confirmatory factor analysis of the Scale of "Uses of Digital Devices and Services".

Factors	Items	F1	F2
F1: Instrumental use	Online shopping for events, products or services	**0.427**	0.23
	Preparing a trip through the Internet (viewing destinations, hotel features, online diaries, user reviews or ratings, ...)	**0.48**	0.067
	Preparing meals or watching recipes from video tutorials or web pages	**0.623**	0.007
	Consult and discuss news, information or books (from websites, ebooks, ...)	**0.336**	0.316
	Watching and performing craft activities (videotutorials, web pages, ...)	**0.708**	-0.186
F2: Leisure use	Playing video games	0.056	**0.216**
	Surfing the Internet (searching for information in general)	0.135	**0.728**
	Listening to music (on electronic media or over the internet)	-0.005	**0.65**
	Watching video or digital TV (connected to the internet such as Youtube or Netflix)	0.062	**0.538**
	Use of social networks and communication services (whatsapp groups, facebook, ...)	-0.058	**0.739**

As shown in Table 6, it was found that university students make an eminently instrumental and leisure use of digital technology.

First, the repeated measures analysis showed that there are significant differences between the factors that make up the Scale ($F_{(1,\ 201)}$= 467.985[b]; p=.000; n^2=.700) with a high effect size. This was also evidenced by the t-tests for related samples ($t_{(201)}$= -21.633; p=.000). In addition, it is worth mentioning that there is a low positive correlation between the Scale factors (r_{xy}=.357[***]) with a high effect size (d= 1.69).

Secondly, after knowing the factorial structure of the Scale, the descriptive values (central tendency and distribution) of its component variables were calculated (Table 7).

Table 7. Average of the factors of the Scale of "Uses of Digital Devices and Services".

Factor	n	M	SD	Skewness	Kurtosis
Instrumental use	202	2.53	.85	.332	-.425
Leisure use	203	3.88	.74	-1.235	2.927

Thirdly, this study aimed to explore the extent to which there are significant differences between the factors found and the criteria variables. The results of the ANOVAs reveal that there are significant differences in all the criteria variables analysed.

Regarding the sex of the participants, women, unlike men, report making greater instrumental use of digital technology ($F_{(1,195)}$=6.858; p=.010**) with a mean effect size (.37) (Table 8).

Table 8. ANOVA of the factors of the Scale of "Uses of Digital Devices and Services" according to sex.

Factor	Female		Male		F (gl)	p-valor	d Cohen
	M (n)	DT	M (n)	DT			
Instrumental use	2.70 (103)	.82	2.39 (94)	.85	6.858 (1,195)	.010**	.37
Leisure use	3.86 (104)	.69	3.95 (94)	.76	.710 (1,196)	.40	-

Note. ***p ≤ .001; **p≤ .01; *p ≤ .05

Concerning age, the post-hoc tests show that, students older than 25 years use digital technology to a lesser extent for leisure activities, with respect to younger students ($\bar{x}_{(>25\ years)}$=3.54; $\bar{x}_{(17\text{-}20\ years)}$=4.07; p=.000***) with a high effect size (d=-.71.); ($\bar{x}_{(>25\ years)}$=3.54; $\bar{x}_{(21\text{-}25\ years)}$=3.95; p=.005**) with a medium effect size (d=-.54) (Table 9).

Table 9. ANOVA of the factors of the Scale of "Uses of Digital Devices and Services" according to age.

Factor	17-20 years		21-25 years		>25 years		F (gl)	p-valor	d Cohen
	M (n)	SD	M (n)	SD	M (n)	SD			
Instrumental use	2.52 (81)	.79	2.63 (61)	.90	2.45 (60)	.87	.686 (2,199)	.50	-
Leisure use	4.07 (81)	.62	3.95 (61)	.66	3.54 (.85)	61	10.032 (2,200)	.000***	.71

Note. ***p ≤ .001; **p≤ .01; *p ≤ .05

Finally, in relation to the academic-employment status, those who are only studying, as opposed to those who study and work simultaneously, report making more leisure use of digital technology ($F_{(1,200)}$=7.801; p=.006**) with a small effect size (.39) (Table 10).

Table 10. ANOVA of the factors of the Scale of "Uses of Digital Devices and Services" according to academic-employment status.

Factor	Study online		Study and work		F(gl)	p-valor	d Cohen
	M (n)	SD	M (n)	SD			
Instrumental use	2.52 (107)	.84	2.55 (94)	.86	.053 (1,199)	.819	-
Leisure use	4.01 (107)	.68	3.72 (95)	.77	7.801 (1,200)	.006	.39

Nota. ***p ≤ .001; **p≤ .01; *p ≤ .05

3.3. Attitudes towards digital leisure

To translate and adapt Teixeira and Freire's (2013) "Leisure Attitude Scale-Short Version (LAS-SV)" into Spanish, the back-translation strategy (Hambleton & Patsula, 1998) was used. In addition, and with the intention of adjusting it to the research objective, a team of experts decided to include the term "digital leisure" (Table 11). The resulting Scale was called "Digital Leisure Attitude" (Table 12).

Table 11.Translation and adaptation process of the "Leisure Attitude Scale-Short Version (LAS-SV)" (Teixeira & Freire, 2013)

Original items	Translation and adaptation into Spanish
1. Engaging in Leisure activities is a wise use of time	1. Participar en actividades de ocio digital es hacer un uso sabio del tiempo
2. Leisure activities are beneficial to individuals and society	2. Las actividades de ocio digital son beneficiosas para los individuos y la sociedad
3. Leisure activities contribute to one's health	3. Las actividades de ocio digital contribuyen a la salud
4. Leisure activities increase one's happiness	4. Las actividades de ocio digital aumentan la felicidad
5. Leisure activities help to renew one's energy	5. Las actividades de ocio digital ayudan a renovar la energía
6. Leisure activities help individuals to relax	6. Las actividades de ocio digital ayudan a las personas a relajarse
7. My leisure activities give me pleasure	7. Mis actividades de ocio digital me dan placer
8. I feel that leisure is good for me	8. Siento que el ocio digital es bueno para mí
9. I like to take my time while I am engaged in leisure activities	9. Me gusta tomarme mi tiempo mientras me dedico a actividades de ocio digital
10. I like to take my time while I am engaged in leisure activities	10. Mis actividades de ocio digital son originales
11. I feel that the time I spend on leisure is not wasted	11. Siento que el tiempo que dedico al ocio digital no se pierde
12. I like my leisure activities	12. Me gustan mis actividades de ocio digital
13. I spend considerable time and effort to be more competent in my leisure activities	13. Paso mucho tiempo y esfuerzo para ser más competente en mis actividades de ocio digital
14. I would attend a seminar or a class to be able to do leisure activities better	14. Asistiría a un seminario o clase para poder hacer mejor las actividades de ocio digital

Original items	Translation and adaptation into Spanish
15. I support the idea of increasing my free time to engage in leisure activities	15. Apoyo la idea de aumentar mi tiempo libre para participar en actividades de ocio digital
16. I engage in leisure activities even when I am busy	16. Participo en actividades de ocio digital incluso cuando estoy ocupado
17. I would spend time in education and preparation for leisure activities	17. Pasaría tiempo en educación y preparación para actividades de ocio digital
18. I give my leisure high priority among other activities	18. Doy prioridad al ocio digital entre otras actividades

To decide the factorial structure, several analyses were carried out with solutions from 1 to 10 factors. The factorial structure in which adequate adjustment indexes were obtained was the one formed by three factors. This Scale initially had 18 items. After the exploratory and confirmatory factor analysis, it was reduced to 16 clearly interpretable items, where the factor weights in their respective dimensions ranged between .386 and .988 (Table 12). Furthermore, the model is considered to present good fit indices (RMSEA=.08; CFI=.96; SRMR=.036), and high overall reliability (α=.95). It also indicates the same for each of the factors explored, such as cognitive component, collected in 3 items (α=.71); affective component, collected in 7 items (α=.92) and behavioural component, collected in 6 items (α=.83).

Table 12. Exploratory and confirmatory factor analysis of the "Digital Leisure Attitude Scale".

Factors	Items	F1	F2	F3
F1: Cognitive component	Engaging in digital leisure activities is a wise use of time	**0.772**	0.018	-0.009
	Digital leisure activities are beneficial to individuals and to society	**0.783**	0.118	0.018
	Digital leisure activities contribute to health	**0.485**	0.3	0.065
F2: Affective component	Digital leisure activities increase happiness	0.023	**0.808**	-0.126
	Digital leisure activities help to renew energy	0.189	**0.428**	0.081
	Digital leisure activities help people to relax	-0.045	**0.988**	-0.275
	My digital leisure activities give me pleasure.	0.023	**0.84**	-0.152
	I feel that digital leisure is good for me.	0.155	**0.732**	-0.012
	I like to take my time while I am engaged in digital leisure activities	0.027	**0.883**	-0.12
	I like my digital leisure activities	-0.323	**0.884**	0.052

Factors	Items	F1	F2	F3
F3: Behavioural component	I spend a lot of time and effort to become more proficient in my digital leisure activities.	0.007	0.329	**0.386**
	I would attend a seminar or class in order to be able to do digital leisure activities better	0.037	-0.179	**0.715**
	I support the idea of increasing my free time to participate in digital leisure activities	0.08	0.019	**0.694**
	I participate in digital leisure activities even when I am busy	-0.289	0.013	**0.82**
	I would spend time in education and preparation for digital leisure activities	-0.009	-0.204	**0.899**
	I prioritize digital leisure among other activities	-0.047	0.003	**0.56**

As shown in Table 12, the cognitive component refers to the person's general beliefs about digital leisure, including the relationship of leisure with other concepts such as health. The affective component reflects the person's feelings towards his or her own digital leisure, as well as the level of liking or disliking of leisure activities. And finally, the behavioural component includes the person's level of participation in leisure activities and the predisposition to broaden their training in this type of activity.

The repeated measures analysis showed that there are significant differences between the factors that make up the Scale ($F_{(2,195)}$= 24.316[b]; p=.000; n^2=.800) with a high effect size. However, according to the t-test procedure for related samples, there are significant differences between the affective and cognitive component ($t_{(199)}$= -4.867; p=.000) between the first and behavioural component ($t_{(196)}$= 6.494; p=.000), but not between the latter and cognitive component. In addition, it is worth mentioning that there is a highly positive correlation between the affective and cognitive component (r_{xy}=.571[***]) with a small effect size (d=.32).

After determining the factorial structure of the Scale, the descriptive values (central tendency and distribution) of its component variables were calculated (Table 13).

Table 13. Mean of the factors of the "Digital Leisure Attitude Scale".

Factor	n	M	SD	Skewness	Kurtosis
Cognitive component	200	2.87	.96	-.132	-.435
Affective component	200	3.16	.86	-.570	-.186
Behavioural component	197	2.78	.82	-.250	-.124

The results of the ANOVAs reveal that there are significant differences according to the age of the participants, but no differences were found by sex and academic-employment status. Specifically, according to the post-hoc tests, the younger the age,

the higher the attitudes towards the affective component of digital leisure ($\bar{X}_{(17\text{-}20\ years)}$=3.31; $\bar{X}_{(>25\ years)}$=2.94; p=.030*) with a mean effect size (d=.43) (Table 14).

Table 14. ANOVA of the factors of the "Digital Leisure Attitude Scale" according to age.

Factor	17-20 years		21-25 years		>25 years		F (gl)	p-valor	d Cohen
	M(n)	SD	M(n)	SD	M(n)	SD			
Cognitive component	2.92 (79)	.93	2.89 (61)	.92	2.77 (60)	1.04	.443 (2,197)	.643	-
Affective component	3.31 (79)	.72	3.18 (61)	.90	2.94 (60)	.96	3.299 (2,197)	.039*	.43
Behavioural component	2.91 (78)	.71	2.80 (60)	.78	2.61 (59)	.96	2.260 (2,194)	.107	-

Note. ***p ≤ .001; **p≤ .01; *p ≤ .05

3.4. Relationship between the uses of digital technology and attitudes towards digital leisure

Table 15 shows how the factors of the Scale of "Uses of Digital Devices and Services" correlate positively with all the dimensions of the Digital Leisure Attitude Scale. Specifically, it is evident that, making both instrumental and leisure use of digital technology, contributes, mainly, to increase the affective component of digital leisure (r_{xy}=.378***) with a high effect size (d=.90) and (r_{xy}=.302***) with a high effect size (d=.74) respectively. However, making a playful use promotes the cognitive component to a greater extent (r_{xy}=.302***) with a high effect size (d=1.41), while making an instrumental increase the behavioural component (r_{xy}=.195**) with a small effect size (d=.30).

Table 15. Correlations between the factors that make up the Scale of "Uses of Digital Devices and Services" and the "Digital Leisure Attitude Scale".

Factors	n	M	SD	1	2	3	4	5
1.Instrumental use	202	2.53	.85	-				
2. Leisure use	203	3.88	.74	.357***	-			
3. Cognitive component	200	2.87	.96	.190**	.302***	-		
4. Afective component	200	3.16	.86	.212**	.378***	.571***	-	
5. Behavioural Component	197	2.78	.82	.195**	.182**	.453***	.537***	-

Note. ***p ≤ .001; **p≤ .01; *p ≤ .05

4. Conclusion

This paper analysed the access and use of digital technology, as well as the attitudes towards digital leisure by university students at USAC.

First, according to our findings, most university students access the Internet from home, as suggested by the ITU (2022). Likewise, 96% indicated having at least one account on some social network. In this regard, it should be noted that, in Guatemala, the use of social networks has become very popular in recent years. As proof of this, in 2022, there were 9.55 million social network users, equivalent to 51.9% of the total population (Hootsuite & We Are Social, 2022).

According to Papademetriou et al. (2022), social networks have been used mainly for leisure purposes. However, since the COVID-19 pandemic, the educational use of these digital platforms increased. This may be because, during the lockdown, universities were forced to transform traditional teaching methodologies to ensure quality distance education and hence incorporating social networks as a learning tool. Cartagena (2016) and Valentín et al. (2013) state that the integration of social networks in the classroom helps the teacher to establish alternative teaching strategies, thus contributing to the creation of an effective learning environment. Moreover, it is a means to motivate students and arouse their interest. To add to this, current studies highlight the important role of social networks in promoting students' digital competences (Martínez-Sala & Alemany-Martínez, 2022; Spanhol et al., 2020).

As Tejedor et al. (2019) point out, students learn to use digital technology in informal contexts, a fact that conditions both the use of ICTs and the development of digital competences among the youth. Thus, many of them have learned how to make use of digital technology for specific activities, such as digital leisure activities, but they do not know how to make a broader use of this tool to benefit from all the advantages and opportunities it offers in all contexts of life and, especially, within the educational one. As it is documented that the digital sphere also involves some risks which learners may encounter, higher education institutions face the challenge of educating students in the critical consumption of technology (Lozano & Fernandez, 2019). Henceforth, the gradual inclusion of digital devices and services in the classroom is being augmented so learners can work on their digital competences required in today´s society. Likewise, it should be considered how these can help educational boards achieve objectives, challenges, and strengthen educational projects.

Secondly, it should be noted that, although the digital divide in terms of access seems to be decreasing, there are still differential patterns of ICTs use with respect to the sex and age of the students, as other studies have shown (Hargittai, 2002; van Dijk, 2020). On the one hand, it was observed that girls make a greater instrumental use of digital technology than boys.

According to INE (2022), boys use ICTs mainly for digital leisure activities, while girls show a greater interest in using digital tools for training and educational purposes. However, our data contradicts previous studies that showed an equal use of digital technology for educational purposes between men and women (Rubio & Escofet, 2013).

Vergés (2012) argues that the use made of digital technology has an impact on the acquisition of digital skills. Specifically, for this author, it is not only the more utilitarian motivations that develop advanced digital skills, but also the motivations for pleasure associated with digital leisure which favour digital self-inclusion. Along these lines, Gómez et al. (2012), considering the predisposition shown by students to use digital technology for digital leisure purposes, encourages teachers to incorporate the use of video games or social networks in their classrooms for the promotion of digital skills. On the other hand, it was observed that older students have the least usage of ICTs for leisure. This may be because this population profile presents a low level of digital competences, conditioning the activities they perform on the Internet (Smahel et al., 2020).

Third, as suggested by Botero-Gómez et al. (2022), people are coming to value the potential of digital leisure and becoming aware of its multiple benefits, and so it is expected that the use of digital devices and services for this purpose will increase. Therefore, parting from the basis that attitudes determine the predisposition of a person to perform a certain task or activity, it was decided to determine the attitudes of university students towards digital leisure. This will allow professionals of higher education institutions to understand the benefits these activities entail for their students, in order to propose solid strategies promoting the use of digital leisure in the teaching and learning processes. For this purpose, it was decided to translate and adapt to Spanish the short version proposed by Teixeira & Freire (2013), of the original Leisure Attitude Scale created by Ragheb & Beard (1982), due to its optimal psychometric conditions.

According to our findings, university students have a positive attitude towards digital leisure. In this regard, it is relevant to highlight that the item with the highest factor loadings corresponding to the behavioural component is "would spend time in education and preparation for digital leisure activities". Becerra & Martín (2015) have found that most students consider that the use of digital technology in the university setting is limited, especially when compared to the ways in which they can use these digital tools in their free time. Therefore, teachers are required to start questioning the merely instrumental use of ICTs to promote new forms of digital literacy by digital leisure as a didactic tool.

In conclusion, the present study has some limitations, such as the size of the sample and the fact that the study was carried out at only one university. As digital competence is fundamental in the academic development of university students, it is equally essential for university teachers to acquire digital competences and skills to incorporate ICTs in the classroom, promoting digital leisure and encouraging students to learn (Calatayud et al., 2018). Recent studies have shown that the factors that most influence a teacher's incorporation of digital leisure in their professional practice are their own technological characteristics such as, for example, their degree of digital literacy or their training in educational technology. The access or type of personal use they make of ICTs, as well as their attitudes towards digital leisure also determines how and if they include digital leisure in their lessons. (Badia et al., 2015). Therefore, we encourage future studies to investigate teachers' access, use and attitudes towards digital leisure, to compare the results with those of the university students themselves.

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ARTICLE

Participatory evaluation and digital tools in humanitarian aid settings

Evaluación participativa y herramientas digitales en escenarios de ayuda humanitaria

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Abstract: Information gathering may obviously be a complex process during a humanitarian crisis for both relief workers and its victims. Faced with the inherent difficulties, digital tools have much to contribute to the different phases of participatory evaluation. This article presents partial results of the Erasmus+ project, KA2- Cooperation for innovation and the exchange of good practices (InovHumbRE Projects). The main aim has been to analyse data on the participatory evaluation methods used by the different institutions/agencies involved in a project and within the context of crisis situations. A mixed type of study was selected using a descriptive and interpretative approach of a non-generalisable nature based on an analysis of quantitative and qualitative data provided by the staff of non-governmental organisations working in crisis situations in Spain. The cohort was comprised of 14 respondents from sundry social agencies and organisations. A questionnaire was used with 26 items that followed an open-ended and closed response format. The results show that the use and development of technology can favour social interventions and participatory evaluations in certain projects or crisis situations.

Keywords: Social work, Participatory evaluation, ICT, Humanitarian aid, Social organitations.

Resumen: En situaciones de crisis humanitaria, la recopilación de información puede ser compleja, tanto para el personal del proyecto como para los beneficiarios. Frente a todas estas dificultades, el Trabajo Social Digital tiene mucho que aportar a las distintas fases de la evaluación participativa. En el presente artículo se presentan resultados parciales del proyecto Erasmus+, KA2- Cooperation for innovation and the exchange of good practices (InovHumbRE Projects). El objetivo principal de este trabajo fue analizar información sobre qué métodos de evaluación participativa se utilizan desde las distintas instituciones/entidades que participaron en el proyecto y en el contexto de las situaciones de emergencia. Se optó por un estudio de tipo mixto desde un enfoque descriptivo e interpretativo de tipo no generalizable y basado en el análisis de datos cuantitativos y cualitativos de profesionales de entidades sin ánimo de lucro que trabajan en situaciones de emergencia en España. El número de participantes fue de 13 informantes de diferentes organizaciones y entidades sociales. Se utilizó un cuestionario que contó con un total de 30 ítems que siguieron un formato de respuesta abierta y cerrada Los resultados evidencian que el uso y desarrollo de la tecnología, desde el enfoque del Trabajo Social Digital, puede favorecer las intervenciones sociales y las evaluaciones participativas en determinados proyectos o situaciones de crisis.

Palabras clave: Trabajo social, Evaluación participativa, TIC, Ayuda humanitaria, Entidades sociales.

1. Introducción

The community of experts (e.g., Abrisketa and Pérez de Armiño, 2000; Humanitarian Coalition, no date; Montes del Castillo and Montes Martínez, 2020; Rouleau and Redwood-Campbell, 2009) agree on defining humanitarian aid as the material or logistical assistance provided for humanitarian purposes in response to crisis situations, such as those caused by natural or manmade disasters (e.g., wars, armed conflicts, and persecution). They also indicate that this aid serves the following purposes: save lives, alleviate suffering, and uphold human dignity, which are wholly consistent with the goals of social work, as «an academic discipline that promotes social change and development, social cohesion, and the empowerment and liberation of people.» (IFSW, no date, paragraph 1).

The triggering of a humanitarian crisis requires the immediate intervention of relief workers and, besides their actual hands-on presence, psychosocial support and mentoring for the victims is vital in these circumstances, whereby their task becomes crucial for myriad reasons. Ábalo, (2011, p. 138) reports that «the social worker's task is critical in building social capital for the sustainable relief of the disaster and its management». In turn, Castillo de Mesa and López Peláez (2019) contend that these workers in social emergencies have a strategic task to perform in keeping with the one mentioned by Ábalo and also as the ones responsible for the social services provided for the users of existing resources.

Social or relief workers are responsible for finding and managing these resources once they have assessed the population's needs; they activate networks of communication and solidarity; set the targets for their interventions; guarantee action and coordination measures involving the different organisations and institutions, and foster social promotion and people's resilience. In addition, they take charge of providing mechanisms that favour development, understanding that, within the context of the disaster, the aforesaid resilience is not only individual as it also extends to the entire population affected, therefore becoming collective. Their role is also significant in the development of programmes for the prevention of catastrophes and their recovery, designing scenarios and planning means and measures to tackle humanitarian crises. Furthermore, from the perspective of human rights, they champion human dignity, engagement, transparency, the fair use of resources, and accountability, whilst also ensuring that governments observe their duty to protect people's rights during a catastrophe (Barney, 2020).

Despite the only recent appearance of e-Social Work, its radius of action is increasing, An environment of digital infrastructures and social media that connects individuals all over the world enables them to reach places that were hitherto difficult or practically impossible to reach (García-Castilla et al., 2018).

López Peláez and Marcuello Servós (2018) find that these technologies are altering the nature and performance of social intervention because «the range of digital procedures and devices has opened a broader dimension in matters of research, therapies, administration and management in a way that has a mainstream impact on Social Work and on social intervention as a whole, as well as on traditional settings, reconfiguring areas of specialisation» (p. 28), one of which is undoubtedly humanitarian aid.

Indeed, and related to this ambit, the European Parliamentary Research Service (2019) has studied the significance of technological developments, especially digital ones, when preventing and reducing human suffering during social emergencies, and it finds that they may act as facilitators for addressing the joint challenges that are faced in the aid process, furthermore allowing for the active involvement of different players in assessing their impact. Moreover, it sees them as «a way forward to better address the needs of those affected by humanitarian disaster, and to address the challenges faced in humanitarian assistance» (European Parliamentary Research Service, 2019, p. 10).

If, due to its very nature, e-Social Work uses these technological innovations, when we refer to humanitarian aid it may exploit them to their full potential in the different stages of the intervention, including the evaluation of past interventions, in consonance with the pledge to transparency and the due and proper management of resources, as features that every social project should have (Páez et al., 2020).

Although evaluation processes involve different models and approaches, since the beginning of the 1990s, a growing number of international organisations and non-governmental organisations (NGOs) have recognised the need to undertake more participatory processes to garner a more thorough understanding of the issues at stake, by incorporating the perspective of the stakeholders involved. The latter, what's more, may provide pertinent feedback for the design and management of projects (Roche, 1999), playing an active role that especially helps to empower the beneficiaries, as in the case of the methodological strategy of participatory evaluation.

We are reminded of the phrase used by Madsen (2007) and McLaughlin (2009): users are «experts by experience», with social work providing them with a context in which they can resolve their problems, in cooperation with social workers (Kustec, 2020). It is here that the diagnosis acquires a particular importance, namely, the recipients' promotion and empowerment through the use of participatory methods (Melero and Fleitas, 2015; Trull-Oliva et al., 2022).

Nevertheless, it is not always easy to conduct a participatory evaluation of humanitarian aid on the ground. As reported by the Organisation for Economic Cooperation and Development (OECD) in 1999, the nature of social emergencies renders it necessary to consider that the evaluation criteria in these kinds of situations are not the same as the ones commonly applied in other types of projects (e.g., in development). Kaiser (2002) stresses that one of the difficulties facing evaluators is that host countries often reject participatory approaches, adding that it should be noted that «beneficiary populations cannot be trusted to answer honestly for fear of losing assistance, that methodological know-how is missing, that no baseline data exists against which to measure change and that the obstacles represented by logistical constraints are too great to overcome for the sake of beneficiary involvement in evaluation processes». (p. 15).

The Good Enough Guide (Oxfam, 2007) stresses that the gathering of information in social emergencies may be difficult and dangerous, for both relief staff and the beneficiaries. Furthermore, it cannot be ignored that there are power relationships (Falkenburg, 2021) and that the beneficiaries' involvement may be difficult to arrange due to factors such as the organisation of communities, level of education, and local politics, for example (PROLOG, 2007).

Faced with all these difficulties, according to Rotondo (2001) e-Social Work has a lot to contribute to the different stages of a participatory evaluation (preparatory measures, design of the plan, knowledge building, and the use and disclosure of results), supporting and extending the interventions of in situ social work. For example, the monitoring of social media (Twitter, Facebook, Instagram, etc.) may lead to the creation of working parties, reveal power relationships, and provide the latest data on the situation in general. It may also shed light on behaviour, and users' needs and demands that they themselves have expressed, which help to define the prior measures required for undertaking the process of participatory evaluation and enable the plan to be drawn up, reducing the risks for all those involved. Likewise, regarding the final stage of the process (use and disclosure of the results), they permit the results to be disseminated and may be used for assessing the interventions' impact, as proposed by Castillo de Mesa and López Peláez (2019).

While social media allow users to interact and orchestrate networks of communication and solidarity (Castillo de Mesa and López Peláez, 2019), digital social workers also have access to collaborative working platforms and videoconferencing, which allow for the real-time organisation of workshops whenever these cannot be held face-to-face, catering for dialogue and group knowledge building, leading to consensuses and agreement upon commitments, as the steps that lie at the heart of participatory evaluation.

In sum, this article presents the partial results of the project Erasmus+, KA2-Cooperation for innovation and the exchange of good practices (InovHumbRE Projects). This research's overriding goal was to analyse data on the participatory evaluation methods used by the various institutions/agencies involved in the project and within the context of crisis situations. In addition, it pursued the following aims: 1) assess those measures of participatory evaluation that have been undertaken by the different agencies involved in the study; 2) identify the main strengths and weaknesses of the evaluations that agencies have undertaken thus far; 3) detect those participatory evaluation measures that the agencies have applied in response to crisis situations; and 4) investigate those digital tools that agencies use to conduct online evaluations.

2. Method

The decision was made to use a blended study involving a descriptive and interpretative approach of a non-generalisable nature based on an analysis of quantitative and qualitative data provided by staff employed by a series of agencies.

2.1. Participants

Purposive sampling was used based on an analysis of the main NGOs that operate in emergency situations in Spain. The Magtel Foundation arranged the recruitment of the participants, making use also of the ease and feasibility of access to the sample units. For increasing the response rate, the participants were asked to distribute the questionnaire to their peers in a snowball process that would increase participation. The following criteria were applied for selecting participants: be a manager or member of staff of reference NGOs within the field of social services in Spain involved in crisis situations.

The final sample consisted of 14 respondents from different social agencies and organisations. The data for each one of them referred to the agencies in which they work are shown in the results section.

2.2. Instrument

A questionnaire was used that consisted of 26 items with an open-ended and closed answer format. The instrument was applied asynchronously by emailing an access link (Bryman, 2012). Its design was based on the following three criteria (Flick, 2018): focus on the study's pertinent issues, on the research purpose, and on the process for understanding the research purpose.

This involved a brief introduction to the research and followed a funnel logic in the questionnaire's development, beginning with general questions and then narrowing them down to more specific matters for engaging the participants and focusing their attention on each one of the research topics. This meant that the items were distributed into the instrument's four main sections:

1) Sociodemographic data on the participating agencies and the participatory evaluation they conduct. (8 items: 1-8)
2) Use of participatory evaluation by the agencies. (7 items: 9-15)
3) Participatory evaluation in the response to crisis situations. (11 items: 16-26)
4) Participatory evaluation and online digital tools (4 items: 27-30)

2.3. Procedure

The questionnaire on participatory evaluation in crisis situations was administered using the Google Workspace Forms application in June and July 2021. Before sending the link, a review was conducted by several colleagues in the research process as per the criterion of intersubjective verifiability specific to such processes (Pérez, 1994). The use of this instrument proved to be flexible, and reduced the cost of the research in terms of resources and distribution times. Furthermore, this arrangement minimised the social desirability of the informants' responses as the researchers were not directly involved or present during the narration of the testimonies (Fricker and Schonlau, 2002). Finally, the questionnaire was administered after seeking the participants' consent once they had been informed of the study purpose, in keeping with the Declaration of Helsinki's ethical principles.

2.4. Data analysis

The content of the respondents' testimonies was systematically processed using the database that was automatically generated in Google Sheets. The quantitative data were analysed through descriptive statistics, percentages, and frequencies. In turn, the qualitative data were treated according to the content of the respondents' answers and by systematically processing the statements made in the open-ended questions. The structuring and organisation of the information in the free answers involved the creation of a simple category system that followed a process of open coding the units of information provided into different categories (Denzin and Lincoln, 2011; Kuckartz and Rädiker, 2019; Strauss and Corbin, 2002).

3. Results

3.1. Participating agencies and the participatory evaluation they conduct

The questionnaire was answered by 14 representatives at 13 agencies, all of which were Non-Governmental Organisations (NGOs), as follows: Red Cross, CODENAF, Open Arms, AIRE NGO, Asociación de Apoyo al Pueblo Sirio – Association in Support of the Syrian People (AAPS), the Spanish branch of Childhood without Borders, Asociación Diversidades, Prolibertas Foundation (two representatives), DIACONIA, the Spanish branch of Chemists without Borders, Paz y Bien Association, Plan Internacional España, and the Sevilla Acoge Foundation. 71.4% (N = 10) of the study's respondents reported conducting participatory evaluations, while the remaining 28.6% (N = 4) said they did not.

Type of participatory evaluation conducted by each agency

The qualitative data on the different kinds of participatory evaluations these NGOs conduct correspond to the following categories (Table 1).

Table 1. Type of participatory evaluation conducted by each agency.

Internal evaluations	Final evaluations on plans, programmes and projects focusing on staff's own performance. (9 testimonies)	«Internal or external evaluations (largely involving local universities).»
		«General evaluation of projects undertaken.»
		«Interim and final evaluation of subsidies/external and internal cooperation projects in development and humanitarian aid, real-time review and post-distribution monitoring.»
		«Evaluation of plans involving strategy, equality, quality, and human resources.»
	Interim participatory evaluations for monitoring and resolving issues and/or reaching agreements (3 testimonies).	«Interim and final evaluation of subsidies/external and internal cooperation projects in development and humanitarian aid, real-time review and post-distribution monitoring.»
	Evaluations of training courses (2 testimonies).	«Evaluation of training courses».
External evaluations	External evaluations on satisfaction with the attention received conducted by (3 testimonies).	«We have conducted an evaluation with beneficiaries using a final questionnaire on the satisfaction of refugees.»
		«Internal or external evaluations (largely involving local universities).»

Participatory evaluations: internal capacity and subcontracting

As regards the question on the agencies' internal capacity for conducting participatory evaluation. 85.7% (N = 12) of the participants stated they had enough internal capacity for conducting participatory evaluations, as opposed to 14.3% (N = 2) that considered they did not.

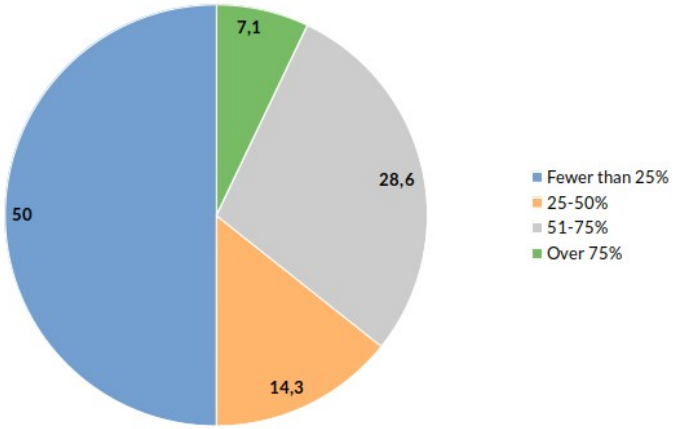

Figure 1. Agency staff involved in or responsible for the evaluations.

Training requirements for participatory evaluation

Regarding the training in the field of participatory evaluation that the participants considered they required to improve such processes, 12 open-ended responses were received that were classified into three groups (Table 2).

Tabla 2. Demandas en la formación sobre la evaluación participativa.

Quantitative and qualitative impact indicators of final and procedural evaluations by the different agents involved in the survey	(4 testimonies) «Training in impact evaluation»; «Learn how to adapt the indicators to focus on real needs.»
Evaluation methods and techniques	(6 testimonies). «evaluation techniques». «methods for Managing for Development Results (MfDR)», «Training in evaluation applied to international cooperation», «methodology for evaluating a community and participatory approach.»
Designing an evaluation plan	(2 testimonies). «Learning about the methods most suited to each moment at the organisation or to each process», «Definition of standard forms or protocols for evaluating the same indicators.»

3.2. Agencies' use of participatory evaluation

The participatory evaluation methods used

85.7% (N=12) of the respondents report that their agencies used participatory evaluation as a method as opposed to 14.3% (N = 2) that did not. These methods have been used in different contexts such as training and employment or within a community or educational setting in social intervention projects. Nevertheless, they have also been used at different stages of the evaluation process, as illustrated by the following testimony:

> (…) major projects, building schools, workshops for women, etc. Some tools involve stakeholder participation in all the stages of the evaluation process, from making the decision to evaluate through to the final assessment of the results. Existing local resources and knowledge provide the platform for launching the IFEE[1] process. The evaluation is embedded within the learning cycle as the means for achieving more participatory development. (Participant 11, item 9)

From another perspective, participatory evaluation has been used in «questionnaires with open-ended answers and discussion groups, where the main method applied involves semi-structured interviews.» (Participant 3, Item 9). This is also the case in satisfaction surveys involving both hired staff and beneficiaries, as revealed by the following testimony:

> (…) We have conducted a self-assessment among employees and then undertaken a joint evaluation with the project's coordinators. The aim is to verify whether employees and coordinators have the same perception of the results obtained. It is taken as an analysis of the synchrony, subjectivity or different viewpoints of the those of us involved in the projects. This would involve, on the one hand, self-assessment, internal evaluation and joint evaluation. On the other hand, the questionnaires administered to refugees involve an evaluation of the programme and their satisfaction. The purpose of this analysis is to understand the programme's difficulties and its successes. (Participant 7, Item 9).

The results show how a participatory evaluation has been applied in the launch of processes for identifying, implementing, and monitoring projects through such techniques as observation and group dynamics involving semi-structured dialogues with key respondents; dialogue techniques with children focusing on ludic/recreational activities, drawings, etc.; questionnaires, and discussion groups for drawing up plans on strategy, quality, and equality, for example.

Main challenges involved in conducting participatory evaluations

The respondents addressed the different challenges that need to be considered regarding participatory evaluations. One of the main ones involved boosting the participation of those involved in the intervention, as well as that of local players. A further challenge mentioned by the participants involves the complexity of undertaking a participatory evaluation in wartime settings. There are also challenges related to the actual design of the evaluation's tools, methodology, and techniques:

[1] Spanish acronym for the method of «Identificación, Formulación, Ejecución y Evaluación» [identification, Drafting, implementation and Evaluation]

> «Adapting the methodology and techniques to suit each context, above all in humanitarian crisis/emergency situations, that the tools correspond to the culture and idiosyncrasies of the interventions, considering the differences between men and women, girls and boys, the lack of access to communities for reasons of safety and COVID-19, the lack of funds for training the staff conducting the evaluation and of teams headed by women. Besides the following: the chaos of humanitarian emergencies, the lack of reference data, high staff turnover, humanitarian crises in remote areas with damaged infrastructure, pressure of time on the affected population and the fact people may not have enough time to take part in an evaluation, overly ambitious terms of reference and limited resources, and the absence of clearly defined responsibilities among stakeholders.» (Participant 1, Item 10)

Consideration should also be taken of the lack or restriction of resources for conducting these evaluations.

Main lessons learned in conducting participatory evaluations in your area of work

Among the learning and strengths of the participatory evaluation for their area of work is the possibility of gathering different perceptions of the people involved, which results in a better understanding of the environment, in an adjustment of expectations and in a possible improvement of the intervention. As these testimonies show:

> The richness in the points of view when approaching the evaluation is the most interesting thing, the greater the participation of actors belonging to different fields of action, the greater the effectiveness of the product achieved in the evaluation.

The main learning is the enormous difference between the expectations of the technical staff and the expectations of the participants, with the consequent divergence not so much in the general assessment as in the aspects that are considered relevant.

In turn, "having to explain to the participants the reasons for the need and advantages of carrying out these evaluations" can lead to the idea that in participatory evaluation it is important that all parties are convinced of its usefulness" and that "a permanent evaluation is necessary, that we cannot act in isolation with the actors of our activities in general. That there is more than one institution to collaborate with, that there is always room for improvement (...)".

Using participatory evaluation methods in other parts of the project cycle

The majority of survey participants stated that their organisations did use participatory evaluation methods in other parts of the project cycle - 7 (53.8%) compared to 6 (46.2%). Participants stated that "we always advocate for process evaluations, whereby we set up a priori evaluations at different points in the intervention so that the final evaluation has the greatest possible impact. Each moment of the project and its evaluation involves a level of meetings with the actors involved, which as a general rule tend to be focused on the before and after of the action. This means that if we find incidents or deviations, we have time to redirect the intervention and ultimately achieve the projected results and objectives". Likewise, they also opt for other methods such as "Participant observation during the identification phase" or "focus groups for

the design of campaigns (within the implementation), committees for the development of activities, etc.". Also, "working groups have been carried out for the analysis of the projects that we considered to be a priority and suitable for presentation or implementation." Likewise,

> In several projects, feedback has been collected from participants to set the direction and pace of the groups, as well as their rules of operation, at the beginning of certain training actions that do not depend on a formal programme or that can be developed with different strategies.

In any case, the aim is to try to measure the long-term impact of the project, and for this purpose it also resorts to "working on standardised evaluation models by areas of work, but leaving room to measure unique project indicators".

3.3. Participatory evaluation in the response to emergency situations

Differences in conducting these evaluations compared to those involving ordinary programmes

71.4% (N = 10) of the sample did not report any differences in the participatory evaluations regarding the response to emergency situations compared to ordinary programmes. The remaining 28.6% (N = 4) justified their answer by signalling the difference in the application of operating criteria between the two types of intervention, as reflected in the following testimony: «Other criteria are prioritised in an emergency (efficacy, efficiency, and accessibility) over and above sustainability or the transfer of capabilities.»(Participant U)

Adjustment of the methods for evaluating humanitarian projects

The participants were asked whether the participatory evaluation method suited the reality of the humanitarian projects undertaken; 63.6% (N = 9) said they did while 36.4% (N = 5) said they did not. One of the main reasons given was the importance of adapting to the evaluation parameters for the humanitarian intervention in hazardous contexts:

> Humanitarian aid is provided quickly and it is often the case that no further work is done in the area. It is very hard to measure the long-term impact because people still need long-term humanitarian aid under the same conditions, which means you continue to provide them with humanitarian or emergency aid several months or even years later, depending on whether they are refugees, or by contrast in the event of natural disasters when people generally resettle in other areas. The evaluation therefore enables you to measure, for example, the number of people cared for, the number of new people in the project, the number of people with a basic food supply, the number of people vaccinated, the number of people with access to medication, the number of treatments provided with basic medication, the number of treatments for each kind of chronic illness, frequent diseases amongst the target population, and the budget per person for medical care, health, and food. The figure will always be the same, but if you extend the time the care is provided for these people you only measure the same thing. There is no improvement in quality of life as they remain in the camp with no chance of improvement. Another differentiating aspect and which can indeed be evaluated is when there is a transition from emergency to development,

> which means you can then measure other aspects regarding an improvement in quality of life. (Participant 13, Item 11)

Types of participatory techniques, methods, and tools used when evaluating programmes involving humanitarian aid/the resettling of refugees

The participants were asked about the type of participatory techniques, methods, and tools used when programmes involving humanitarian aid/the resettling of refugees. The following presents the respondents' answers:

Table 3. Types of participatory techniques, methods and tools used when evaluating programmes involving humanitarian aid/the resettling of refugees.

Types of participatory techniques, methods, and tools	N	%
Rural participatory evaluation	3	21.4
Investigation-action	4	28.6
Mainstream community treks	0	0
Focus group discussions	9	64.3
Analysis of the daily use of time	3	21.4
Score, classification for initiating dialogue	2	14.3
Analysis of the main change	2	14.3
Mapping results	7	50
Others	6	42.9

Testimonies on the different methods of participatory evaluation

The participants were asked whether the methods of participatory evaluation provide different results to non-participatory ones. Twelve participants answered, of whom 83.3% (N = 10) said they did, while only 16.7% (N = 2) said they did not.

Among the participatory methods they have used and which they have found useful, "All those that allow a change in the observer's point of view: focus groups, experience diaries, etc." stand out. For example, "action research, as well as group discussions and debates are more in line with the type of social intervention in which we work in the organisation", or "focus groups because they allow relevant qualitative assessments that shed light on the quantitative results and on the processes to achieve them, as well as on the difficulties experienced subjectively".

However, it appears that "the beneficiary survey is a straightforward method in this area". Although "participatory rural appraisal, focus group discussions, and change analyses also offer significant results." However, reflection and shared dialogue with the affected population are "feedback mechanisms and joint assessments with other actors through coordination mechanisms."

Furthermore, the use of participatory evaluation offers added value in "shared knowledge, insights based on own experiences that sharpen interventions with the collective." It brings diversity of perspectives by "complementing the institutional vision with first-person experience, ownership of the results achieved, etc." It also "adds an essential element of active listening to the participants and gives them a leading role in assessing the results, improving or correcting the projects". All of this offers the

possibility of gathering ideas from different actors about the reality at the moment when a project evaluation is being carried out. Some of these ideas "are not initially contemplated and give support to the programmes" and allow the perspective, needs, vulnerabilities and capacities of different people, groups and organisations to be taken into account in order to use resources more efficiently and maximise the impact of the intervention.

3.4. Participatory evaluation and online digital tools for social work and intervention in emergency situations

Out of the 13 participants that answered this question, 84.6% (N = 11) affirmed that their agencies had sometimes used digital tools in social work in emergency situations, compared to 15.4% (N=2) that claimed they had not. Out of the 11 participants that said they did use digital tools, we identified different moments and usages, as shown in Table 4

Table 4. Use of digital tools for social work in emergency situations.

For the intervention	«Because of the pandemic we have suffered, tools of this nature have become essential arms for intervening, and without them there would have been a collapse in social interventions».
	«In all the projects, above all for workshops and meetings with the target populations. For direct contact and receiving their message in person.»
	«Zoom connections and similar with beneficiaries.»
For communicating between staff and agencies	«Because of the pandemic we have suffered, tools of this nature have become essential arms for intervening, and without them there would have been a collapse in social interventions».
	«In all the projects, above all for workshops and meetings with the target populations. For direct contact and receiving their message in person.»
	«Zoom connections and similar with beneficiaries.
For training	«Plataforma e-learning».
	«Durante la crisis del Covid-19, para replantear la estrategia y metodología formativa de un proyecto de inversión y producción en el medio rural andino.»
	«Para charlas de formación de equipos, encuestas, comunicación colaborativa inmediata, puesta en común de actividades y solución de problemática.»«e-learning platform».
	«During the Covid-19 crisis for reformulating strategy and the training methodology for an investment and production project in the Andean countryside.»
	«For team briefing talks, surveys, immediate peer communication, for sharing activities and troubleshooting.»
For assessment	«Monitoring and evaluations due to the COVID-19 restrictions and lock-down.»

On the other hand, the participants responded on the assessment of the use of conventional digital tools for participatory evaluation carried out by NGDOs. In this respect, the entities scored this item from 1 to 5, with 1 being not at all and 5 being totally. None of the organisations gave a score of 5. The rest rated the degree of use as follows: not at all (2; 15.4%), a little (1; 7.7%), quite a lot (4; 30.8%), a lot (6; 46.2%). The results show that the majority of the organisations use these digital tools between quite a lot and a lot.

Among the most commonly used tools are: Whatsapp (N=9, 33%), Zoom (N=8, 31.3%), Skype (N=2, 5.4%); WeChat (N=2.7%); LINE (N=1, 2.7%), Facebook Messenger (N=1, 2.7%); Teams (N=1, 2.7%); Adobe connect (1, 2.7%), Drive (forms) (N=1; 2.7%); Google form (N=1, 2.7%), Meet (Google) (N=1, 2.7%), among others. These results show that the most used tools were Whatsapp for mobile and desktop messaging; Zoom for online meetings and video calls, Skype for video calls.

4. Conclusions

This article's main aim has been to analyse data on the methods of participatory evaluation used by sundry institutions/agents involved in a project in emergency situations. At the same time, the aim was 1) to evaluate the participatory evaluation actions undertaken by the different agencies participating in the study; 2) to identify the main strengths and weaknesses of the evaluations the agencies have conducted; 3) detect those participatory evaluation measures the agencies have adopted in response to emergency situations, and 4) investigate the digital tools agencies use to conduct online evaluations.

Recent decades have witnessed a significant increase in the importance given to processes of social and community participation, and in the discourse of both international organisations and national governments, given their potential contribution to social development and the consolidation of democratic systems (Cardozo, 2008), with community participation being directly related to collective decision-making and the community's own empowerment. These aspects are the hallmarks of participatory evaluation. This methodology constitutes a change in perspective in the way of evaluating programmes (Soler et al., 2014). The results obtained are consistent with that tendency, as they reveal that this method has been adopted by most of the agencies surveyed. Among the lessons learnt, and as the strong points of participatory evaluation, the testimonies highlight the possibility of gathering the different perceptions of the people involved, thereby improving our understanding of the context, adjusting expectations, and potentially enhancing the evaluation. What's more, and as posited by Suárez-Balcazar and Harper (2004), participatory evaluation stands as a process of individual and collective learning that benefits both users and the social workers themselves.

The participants affirmed that use is always made of procedural participatory evaluations, with the establishment a priori of evaluations at different moments of the intervention to ensure the final evaluation has the greatest possible impact. Each moment in the project and its evaluation involves a series of meetings with stakeholders that generally tend to focus on the before and after of the action. This means, as scholars such as Haefner and Gutiérrez (2019) contend, that if any issues or shortcomings are found, there is enough time to realign the intervention and

ultimately achieve the planned outcomes and targets. This calls for such techniques as participant observation during the identification stage or focus groups for the design of campaigns (as part of the undertakings), and steering committees for activities, among others.

This analysis has shown that participatory evaluation is a method that is highly beneficial to interventions in crisis situations. Nevertheless, it is not without its drawbacks, many of which are linked to the interventions' idiosyncrasies in humanitarian aid settings. Many of the difficulties and challenges facing the implementation of participatory evaluation in adverse settings require adapting the method and techniques to the cultural diversity of each context and to its idiosyncrasies.

These drawbacks and difficulties involve the chaos prevailing in humanitarian emergencies, the lack of reference data, a high staff turnover, a humanitarian crisis in remote areas and damaged infrastructure, the pressure of time on the victims and the fact that people may have little time to take part in an evaluation or are frightened to do so. These difficulties may be largely mitigated by ICTs, as revealed by the vast majority of participants that affirmed that their agencies had sometimes used digital tools in interventions involving emergency situations, which they value positively.

These tools provide the possibility of communicating despite the distance or physical isolation thanks to videoconferencing apps such as Zoom or Meet; the flexibility and facility of reducing costs in terms of resources and distribution times, and the minimisation of the social desirability of the respondents' answers, as there is no direct, face-to-face intervention, enabled by such tools as Google Form; and the possibility of jointly drafting documents using collaboration software resources such as Google Drive, are some of the examples presented in this study.

The use and development of technology in the Knowledge Society may favour social interventions and participatory evaluations in certain projects and situations with the aim of making people's lives easier. This renders it important for the development of e-social work to continue advancing as another indicator in the pursuit of wellbeing and the advancement of cities, as well as in areas with few resources. We cannot conclude without flagging the importance of acquiring digital skills and the know-how that social workers need to have as hands-on professionals (García-Castilla et al., 2017), which will help them in their interventions with social agencies and in situations of emergency.

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ARTICLE

Digital competencies for teachers and continuing education: A proposal from the qualitative paradigm

Competencias digitales docentes y formación continua: una propuesta desde el paradigma cualitativo

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Abstract: The changes and transformations experienced in today's world have led to daily use of digital technologies shaping new ways of living and working, and the educational field has been no exception. Given the need to digitally enable teachers to improve their pedagogical practice in the society of the 21st century, this study sought to define the indicators that can serve as a basis for designing a model of continuous training in digital competencies for teachers using a qualitative research approach. A rigorous content analysis of institutional materials, semi-structured interview reports and focus group reports was carried out, with their triangulation leading to the design guidelines. The results indicate that the role of digital technologies in the educational process analyzed is meager; the participating teachers state that a continuous training strategy is required to meet their specific needs, and that the emerging digital competencies should focus on the creation of content and the implementation of the hybrid modality. Although these findings are not generalizable, as they do not relate to a specific environment, the analysis process is replicable and can be used in other environments. It is concluded that it is essential to have a continuous training model that makes use of a technology adaptable to the particular needs of the contexts in which it is to be implemented.

Keywords: Digital literacy, Inservice teacher education, Qualitative research, Teaching models, Teacher education programs.

Resumen: Los cambios y transformaciones que se viven en el mundo actual han llevado a un uso cotidiano de las tecnologías digitales conformando nuevas formas de vida y trabajo; el campo educativo no ha sido la excepción. Ante la necesidad de habilitar digitalmente a los maestros para mejorar su práctica pedagógica en la sociedad del siglo XXI, en este estudio se buscó definir los indicadores que pueden servir de base para diseñar un modelo de formación continua en competencias digitales docentes desde el enfoque de la investigación cualitativa. Se realizó un análisis riguroso de contenido de materiales institucionales, informes de entrevistas semiestructuradas y reportes de grupos de discusión, cuya triangulación llevó a concretar las guías para el diseño. Los resultados indican que el rol de las tecnologías digitales en el proceso educativo analizado es exiguo; los docentes participantes refieren que se requiere una estrategia de formación continua que atienda sus necesidades concretas; y, que las competencias digitales emergentes deben enfocarse en la creación de contenido y la implementación de la modalidad híbrida. Aunque éstos no son generalizables, por haberse realizado en un entorno específico, el proceso del análisis es replicable y puede emplearse en otros ambientes. Se concluye que es primordial tener un modelo de formación continua que haga uso de una tecnología adaptable a las necesidades particulares de los contextos en los que se desea implementar.

Palabras clave: Alfabetización digital, Formación de profesores en servicio, Investigación cualitativa, Modelos de enseñanza, Programas de formación docente.

1. Introduction

Currently, digital technologies are permeating everyday life, configuring new ways of living and working (@prende.mx, 2020). The educational field has been reached and has been forced to evolve (Contenidos MéxicoX, 2020a), but there are still many educational agents who lack adequate training in the use and application of information, communication, knowledge and digital learning technologies (ICKDLT) as technopedagogical tools within teaching and learning processes (Acuña-Gamboa, 2022), so it is imperative to articulate their integration into the classroom and ensure the quality of service offered by educational systems (Martínez-Garcés and Garcés-Fuenmayor, 2020).

In Mexico, studies on ICT in general basic education are scarce (Centeno-Caamal et al., 2022; Olivares et al., 2016) and, despite the fact that the educational use of digital technologies in this sector dates back to 1983 (Cruz and Ferra, 2019; Nieto et al., 2015), training has not kept pace with the advances introduced since then, nor has it been structured to cover the entire teaching population, leading to the existence of unequal technological training profiles, as well as different requirements and scenarios for their adoption due to the diverse exercising of knowledge and practices that respond to the existing educational diversity in classrooms (Acuña-Gamboa et al., 2023; Cabero et al., 2015; Valencia et al., 2016).

This situation became evident during the educational emergency produced by the Covid-19 pandemic, forcing the incorporation of ICKDLT and provoking hasty learning, without direction or formal planning, leading teachers to use their particular available resources, and make creative and innovative adaptations according to their needs, leading to scattered results (Comisión Nacional para la Mejora Continua de la Educación [Mejoredu], 2020; Casillas and Ramírez, 2021).

However, despite the fact that this singular circumstance prompted such integration, it is fair to say that this topic is nothing but a continuous training issue that has been studied with much interest for about two decades and may lose its importance if it continues to be associated with it, as is currently happening in many institutions that, faced with the return of face-to-face , have reduced or eliminated ICKDLT from their educational practices instead of consolidating its use, leaving aside the urgency of digital training for teachers (Carbonell et al., 2021).

Studies on digital competencies and their application to teaching have increased (Barbazán et al., 2021; Cabero et al., 2020; Casillas et al., 2014; Diaz, 2021; Domingo-Coscollola et al., 2019; Pech and Prieto, 2016; Perdomo et al., 2020; Rodríguez-Alayo and Cabell-Rosales, 2021; Torres et al., 2022) and several are handled in light of the Covid experience (Cárdenas-Contreras, 2022; Jiménez and Sánchez, 2022; Martínez-Garcés and Garcés-Fuenmayor, 2020), thereby continuing to demonstrate the urgency of achieving the digital empowerment of teachers to respond to the educational demands of today's world and to reduce the gap that prevents them from exercising and teaching digital citizenship (Casillas et al., 2014; Juvera, 2022; Pech and Prieto, 2016).

To respond to this need, it is important to consider the digital competency frameworks that have been created to guide the ICT training of teachers so that it

transcends their teaching practice (Cabero-Almenara et al., 2020; García-Valcárcel, 2016; INTEF, 2017; Jiménez-Hernández et al., 2021; Valencia et al., 2016). Although each one varies in relation to the target audience, place of action and scope, they coincide in recognizing the interdependence between the technological, pedagogical and disciplinary, and group the digital knowledge that teachers must develop in different dimensions: technological, informational, pedagogical, communicative, educational management and research, among others. Likewise, those derived from the remote and distance work experienced as a result of the pandemic and its aftermath should be incorporated, as well as those produced by recent technological advances applicable to education (Barbazán et al., 2021; Casillas and Ramírez, 2021; Cejas and Navío, 2018; INTEF, 2022; Pozos, 2016; Rangel, 2015).

Since several reports highlight the importance of developing relevant institutional proposals to train educators with the intention of achieving a digital transformation that helps to successfully manage the vicissitudes of teaching (Rambay and De la Cruz, 2021; Viñoles-Cosentino et al., 2022), this paper will describe the analytical process that was carried out to obtain the indicators that will guide the proposal for the design of a model of continuous training in digital teacher competencies for basic education teachers in a particular context.

It is organized in four sections, which cover the following aspects: I) Methodology, where the context and methodological design followed to collect and examine the information are presented; II) Results, which shows what was found during the analysis; III) Discussion, where the findings are interpreted and contrasted with previous works; IV) Conclusions, where the resulting indicators and the possibilities for further research that can be derived from this analysis are expressed.

2. Method

What is presented in this article is part of a broader research work carried out under the qualitative-quantitative approach, with a descriptive-exploratory cut (Hernández et al., 2014). In this opportunity, we present the results of the qualitative analysis that helped to identify the necessary assumptions for the design of a model of continuous training in digital teacher competencies (Hernández et al., 2020). To collect, analyze and interpret the data, several strategies were used from the qualitative paradigm (see Table 1) and, given the nature of the inquiry, a sample size was defined based on contextual needs (Hernández et al., 2014). Likewise, we proceeded by means of relevant technological tools that helped us to implement, remotely, the techniques and instruments considered in the study (Arias, 2020).

From a population of 68 basic education teachers of the Adventist Educational System of Campeche (AESC), located in southeastern Mexico, a nonprobabilistic purposive sample of 20 elements was compiled, based on an open invitation, including teachers who consented to participate, by voluntary disposition and availability of time. The documents included in the study were selected for their essentiality in the AESC educational process. Demographic variables were not considered relevant in this analysis.

In the first part, the importance and role of ICT in the AESC educational process was investigated by examining the Educational Model of the Southeast Mexican Union

and the strategic plans of each of the institutions, as well as the didactic plans and video recordings of some classes. The data to be observed and recorded were defined, delimiting the unit of analysis to words, sentences or paragraphs.

Table 1. Data collection and analysis strategies

Aim	Sample	Technique	Instrument and Category	Tool	Interpretive Procedure
1) To investigate the importance and role of ICT in the AESC educational process.	20 didactic plans 20 video lessons AESC's guiding documents: educational model, institutional plans of the 3 colleges	Documentary	Category coding Hierarchy tab Category: Role of ICKDLT in the educational process	Google Drive	Document analysis
2) To assess the need for a continuous training strategy for the development of teachers' digital competencies and consider the characteristics required for its implementation.	20 teachers	Semi-structured interview	Interview guide Categories: - Need for a strategy for continuing education in digital teacher competencies - Characterization of the continuous training required	Zoom	Comparative analysis

Aim	Sample	Technique	Instrument and Category	Tool	Interpretive Procedure
3) To explore the digital teaching competencies that AESC basic education teachers put into practice during their teaching and which ones need to be developed or improved.	20 teachers	Focus groups	SOWT Development, integration and reelaboration of digital content, INTEF Framework individual and group version Category: Use of digital teaching competencies	Zoom Google Forms Google Docs	Element matrix analysis

The category was defined as "Role of ICKDLT in the educational process," and the concepts that were chosen because of their relationship with the research objective were: Digital competencies, ICT competencies, ICT use, Digital skills, Digital tools, ICT tools, Digital teaching, Teaching with ICT, Digital educational resources and Digital learning objects. Then, a "Category Coding Hierarchy Card" was elaborated where the terms were established as search codes and delimited through definitions that made it possible to clearly recognize when to use them. A search was also done for words that could be thematically and contextually related to the pre-established terms (skill[s], digital[s], technology[s]; technological[s]; tool[s]; resource[s] and competence[s]). The document analysis technique (Ñaupas et al., 2018) was implemented and the statistical packages ATLAS.ti, version 9 and MS Excel 2019 were used to manipulate the texts and concentrate the data (Rapley, 2014). Through hermeneutics, the ideas expressed in the materials were extracted to ponder the meaning of the words, themes or phrases related to the predefined codes in order to draw conclusions about them.

In the second part, we explored the need for a continuous training strategy in teachers' digital competencies and the desirable characteristics for its implementation. Semi-structured interviews were conducted with a representative sample of teachers, belonging to the different basic education levels of AESC: three preschool, six lower primary, four upper primary and seven secondary. A guide was used to help direct it towards the established purpose. The meetings were conducted through the Zoom platform, with the conversations being recorded so that they could be examined in the ATLAS.ti version 9 software and the information concentrated in MS Excel 2019. The data obtained were examined by means of analysis by comparison (Barrera, 2009) with the purpose of contrasting the participants' responses and making conclusive inferences about the statements made.

In the third and final part, the digital teaching competencies that the participating teachers put into practice during their teaching and those that required acquiring or improving were examined, basing the activity on what was detected in the diagnostic phase, where it was found that competency area 3 "Creation of digital

content" of the INTEF 2017 framework obtained a mean of 3.75, with the others obtaining a mean above 4 (Centeno-Caamal, 2021). This was done through the four groups in the sample and the discussion was organized by means of a Topic Guide in order to coordinate the participations and achieve the objective of the meeting.

This phase consisted of three parts: (a) Resolution of an online questionnaire, which was called "SOWT Development, integration and reelaboration of digital content," based on the INTEF 2017 Common Framework of Digital Teaching Competence for a preliminary individual exercise of choice of items, in order to contextualize teachers in the digital competencies covered by dimension 3 of this framework, punctuating those related to the design, adaptation or modification of teaching resources; this consisted of marking, for each item, 1) if they had this competency [S]; 2) if they needed to reinforce it [O]; 3) if they needed to learn it [W]; or 4) if they considered it out of their reach [T]; and, subsequently, obtaining their strengths, opportunities, weaknesses and threats (SOWT) of the digital competencies they indicated. (b) Completion of an adaptation of the previous questionnaire in the collaborative tool Google Documents for group discussion. (c) Analysis by matrix of elements (Barrera, 2009) of the reports of each group, in MS Word 2019 and MS Excel 2019, to specify a list of topics to be considered in the intervention proposal.

To conclude, an exploration based on methodological triangulation (García et al., 2016; Feria et al., 2019; Forni and De Grande, 2020) was carried out to interpret the results of the contextual analysis and generate the indicators that will serve as the basis for the design of the model of continuing education in digital teacher competencies. This is specified in the Discussion section.

3. Results

As a result of the analysis carried out, the results obtained in each of the categories explored are presented below.

3.1. Role of ICKDLT in AESC's educational process

After examining the information contained both in the didactic texts and in the institutional documents, focusing the search on the terms, phrases, paragraphs, concepts and codes defined within this category, it was found that, compared to the word with the most mentions in the whole corpus of titles analyzed (students, 309), the codes that could be related to the assessment of the importance and role of ICKDLT in the educational process of AESC add up to only 127 mentions, which constitutes only 41.1% (see Table 2).

3.2. The need for a continuous training strategy in digital teacher competencies

With regard to the information obtained from the semi-structured interviews, after conducting a comparative analysis in order to contrast the data obtained from the participants and make interpretations of what they said, it was found that it is important to establish a training strategy to help develop teachers' digital skills. The participants stated that it should be official or formal, that there should be a plan or methodology to pursue the same objectives or goals and that it should have a continuous or permanent character to follow up. They also revealed that it would be

beneficial to have their own training scheme because it would give system workers the opportunity to improve professionally, which would lead them to lead in this area and improve academically; it would also help them to know where they are heading, to be competitive and to improve educational quality; in short, according to the interviewees, they would be at the forefront, would have support and would be open to reflection on the potential of using ICKDLT.

Table 2. Comparison of vocabulary and code mentions in the analyzed documents.

Most frequently used terms in teaching and guiding documents		Mentions of category coding hierarchy terms	
students	309	ICT teaching	33
God	212	ICT use	25
development	202	ICT Competences	22
minutes	196	Digital competences	12
life	179	Digital tools	12
activities	162	Digital teaching	10
education	152	Digital skills	7
learn	140	ICT tools	3
subject	131	Digital learning objects	3
service	124	Digital educational resources	0
		Total	127

3.3. Characteristics of the required continuing education strategy

With regard to the desirable features of the training strategy, it was found that the most convenient modality would be one that allows interaction; questions and offers accompaniment, support and feedback; handles participation forums and provides a clear presence of the trainer and humanizes. If it is at a distance that combines theory with practice and adapts to the level, it does not matter if it is extended. Those who collaborated also mentioned that it should have synchronous and asynchronous parts and may not necessarily be face-to-face but online or virtual. They also said that they expect it to have content adapted or designed for the environment in which they work, balancing the academic with the spiritual, allowing them to manage their personal pace, time and deliveries; and above all, that it should not be left to personal initiative, but should be institutional, that is, a formally established program that helps to implement digital tools for student learning.

Among the factors that, in their opinion, would favor participation in continuing education programs are: an accessible schedule, topics that interest them, that their multiple responsibilities are contemplated, that it is flexible, that it has a platform with free access, that it is scheduled in time. In addition, it should be attractive, useful, practical, innovative, dynamic and motivating, and simple but profound. Additional

factors include: that the availability and willingness of the participants is considered, that the effort is recognized, that there are incentives, stimuli and, as far as possible, that there is economic support, that they produce authentic learning, are self-managed and, preferably, are taught by specialists, taking into account the different levels of technological training and seeking to improve knowledge in pedagogical aspects.

3.4. Use of digital teaching competences

Finally, an analysis was carried out through a matrix of elements of the results of the SOWT questionnaire Development, integration and reelaboration of digital content obtained in the different groups (Preschool, Lower Primary, Upper Primary and Secondary), which coincided with the implementation of remote or distance learning because of the Covid-19 pandemic, which directly influenced the activity. The most relevant digital competencies for each teacher were chosen, then ordered according to the priority assigned, and it was agreed to establish the following interpretation, as part of the training needs: 1) I search and find tutorials on the network on how to use applications for the creation of digital educational content. 2) I know the PLE (Personal Learning Environment) concept and I use it for learning when editing digital content; I represent it in a detailed, orderly way and I apply it in my teaching practice. 3) I store resources or files that I have selected for my students in an organized way in my devices and in the cloud. 4) I have a channel or personal space in online services or applications where I publish throughout the course text files, videos, presentations and/or recordings of audio and video programs in which the students have been involved. 5) I encourage students to create digital educational material involving the design and editing of texts, presentations, videos and audios, helping them to create their own PLE. 6) I edit texts and presentations in an advanced way in my teaching practice and I bear in mind that they are attractive to my students.

Additionally, the participants pointed out that, in order to continue to adequately address the educational situation generated by the pandemic, they needed to develop skills for virtual or hybrid teaching and were concerned about having to implement this modality without having worked in this way before; they recognized that they lacked the tools to speed up learning activities, capture the students' attention, promote collaborative work, simultaneously visualize the resources used and form virtual groups. They said they were unaware of some relevant technological aspects, such as: searching and downloading of specific programs, verification of reliable sites, attention to specific technical issues, identification of minimum characteristics of an appropriate piece of equipment or device, acquisition of equipment compatible with, and adequate for, their needs, techniques for copying or downloading information, maintenance, Internet connectivity, use of Antivirus and security in downloads. All these represent digital knowledge that a teacher of the twenty-first century must have.

4. Conclusion-Discussion

In this work, a qualitative analysis has been carried out to define the indicators that will serve for the design of a model of continuous training in digital competencies for teachers of basic education of the AESC, which corresponds to a proposal that, when put into practice, would lead to strengthening the digital citizenship of those who have to procure it in their students. Each category analyzed represents different contextual

aspects that led to discovering the indicators for the intended design (see Figure 1), since it is from this trench that we can respond to the demands of today's society, seeking a comprehensive training that includes digital competencies (@prende.mx, 2020; Contenidos MéxicoX, 2020b).

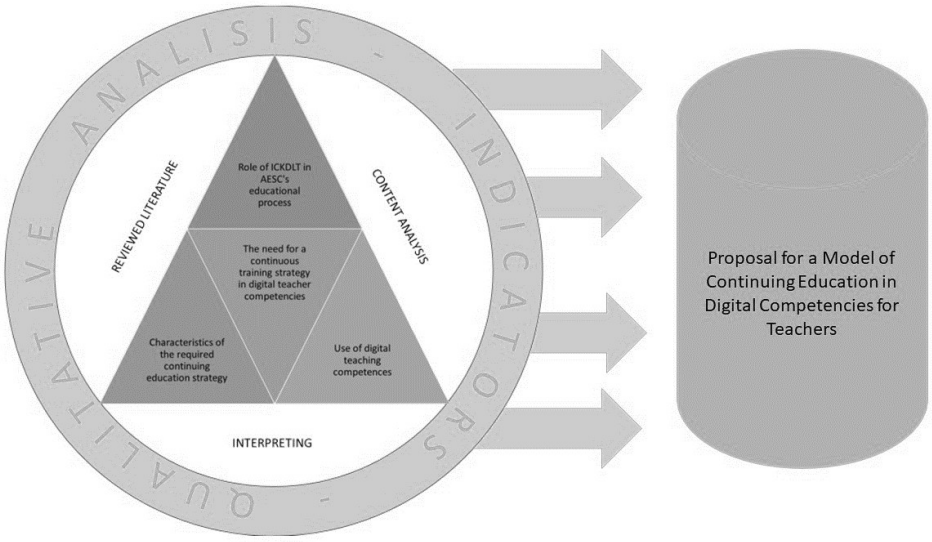

Figure 1. Qualitative analysis process to define the base indicators for the design of a Model of Continuing Education in Digital Competences for Teachers.

Thus, the conclusions and the discussion that lead to the identification of the indicators derived from the analysis carried out in the categories are presented below:

1) In the guiding and didactic documents, the main guides of the AESC educational service, the mentions of the predefined codes related to the role of ICTs in the formative process, compared to those of the word that was most evoked in the corpus of texts analyzed, are relatively few, constituting only 41.1%, which reveals the low importance and role of ICTs in the context studied. This differs from the findings of Jiménez et al. (2016), Flores et al. (2021), Mendo (2021) and Zambrano et al. (2021), who discovered that the use of new technologies in the educational field is highly relevant and topical. The first indicator proposed, therefore, increasing the importance and role of ICTs in education.

2) When examining the participants' perceptions about the need for a continuous training strategy for the development of teachers' digital competencies, it was found that they believe it is needed and that it would have a positive impact on their practice, which reinforces what is revealed in the literature reviewed (Acuña-Gamboa et al., 2023; Arellano, 2021; Delgado et al., 2022; Segura et al., 2022), and is congruent with the findings of Morales et al. (2015), who assert that the attitude of educational actors regarding ICT integration in instructional processes is positive because they consider it important to do so due to the possibilities they offer. Thus, the second indicator is obtained, which corresponds to the recognition of the usefulness of ICT training.

3) In the information obtained from the interviews on the particular characteristics they consider such a strategy should have, it was found that it should be adapted to the use of ICKDLT in pedagogical work and include the development of knowledge related to applications, platforms and tools that support the learning process; it should also contain interactive, dynamic, interesting, attractive and eye-catching activities that are properly integrated into didactic strategies and enrich the current educational models. In line with Gargallo (2018), Valbuena et al. (2021) and Véliz and Gutiérrez (2021), it can be said that it must provide coherence between the technological and the educational to achieve better results (Centeno-Caamal et al., 2022), establishing a congruent process that links the technical and pedagogical with the training needs of those who will participate in it. Therefore, the third indicator is coherence with educational work (versatile, integrating and enriching).

4) Among the modalities that the participants find most useful are those that allow close interaction with the trainer, offering practical application contents, especially in the AESC field. If possible, it should be synchronous, although it can also be carried out asynchronously; it should be formal, flexible and self-managed, but, although it allows self-regulation of learning, it should be possible to receive accompaniment and timely feedback, when necessary, since this encourages enhanced learning (Cruz et al., 2019). Here we can add what was suggested by Lalangui et al. (2017), who stated that teacher training, as a continuous process, "must start from the contextualization and systemic approach of the actions that are projected, the collaborative learning of the participants and the multidimensionality of the actions that are executed" (p. 30). In this way, a coherent development of the teacher can be achieved, because the strategy would be based on the problems expressed and the needs that have been diagnosed (Rivero and Soria-Valencia, 2021; Sibaja, 2021; Vera et al., 2021).

   Therefore, it can be inferred that the strategy should have the design of a digital learning environment (García and Pérez, 2015). Thus, it will be sought to design a continuous training model based on virtual learning environments with an andragogical approach because they promote autonomous learning and imply a critical appropriation of knowledge (Maliza et al., 2021; Rodríguez and Barragán, 2017), attending to the peculiar learning needs of teachers as professional adults (Collazos and Molina, 2018), and likewise because they are an open opportunity for training as they offer a teaching model based on flexibility, effectiveness, appropriateness and rigour, which considers the particular situation of the user (Blanco and Anta, 2016), as well as an option of adaptability to the existing differences in the digital transformation of organizations (Campuzano et al., 2021). It follows, therefore, as a fourth indicator that a virtual environment adapted to the context is built (semi-open, andragogic and ubiquitous).

5) In the discussion groups, it was found that the digital competencies that need to be developed or improved are those corresponding to the development of digital content (INTEF, 2017); in addition, the need to implement the hybrid modality was revealed. This phase helped to define the content of the training paths of the strategy to be implemented. Thus, it is believed that continuous teacher training will be a key factor in the

educational integration of ICT and a school challenge in this digital era (Aparicio et al., 2021; Escudero et al., 2018; Valbuena et al., 2021). Thus, the last indicator is about having a formative path according to the needs of the participants.

In conclusion, the results of this study led to the establishment of indicators that provided the guideline for the preliminary outline of a Model for Continuing Education in Digital Competencies for Teachers (see Figure 2), which can serve as a perfectible example for public and private education systems to face the challenge of overcoming the existing unequal situation in this area (@prende.mx, 2020; Contenidos MéxicoX, 2020b). They also contribute to affirming that structuring a training program in this sense is essential to offer a formal, permanent professional development for those who will educate the citizens of the present century in this area (Segura and Escudero, 2017), so the design, implementation and evaluation of this program are proposed as emerging research axes.

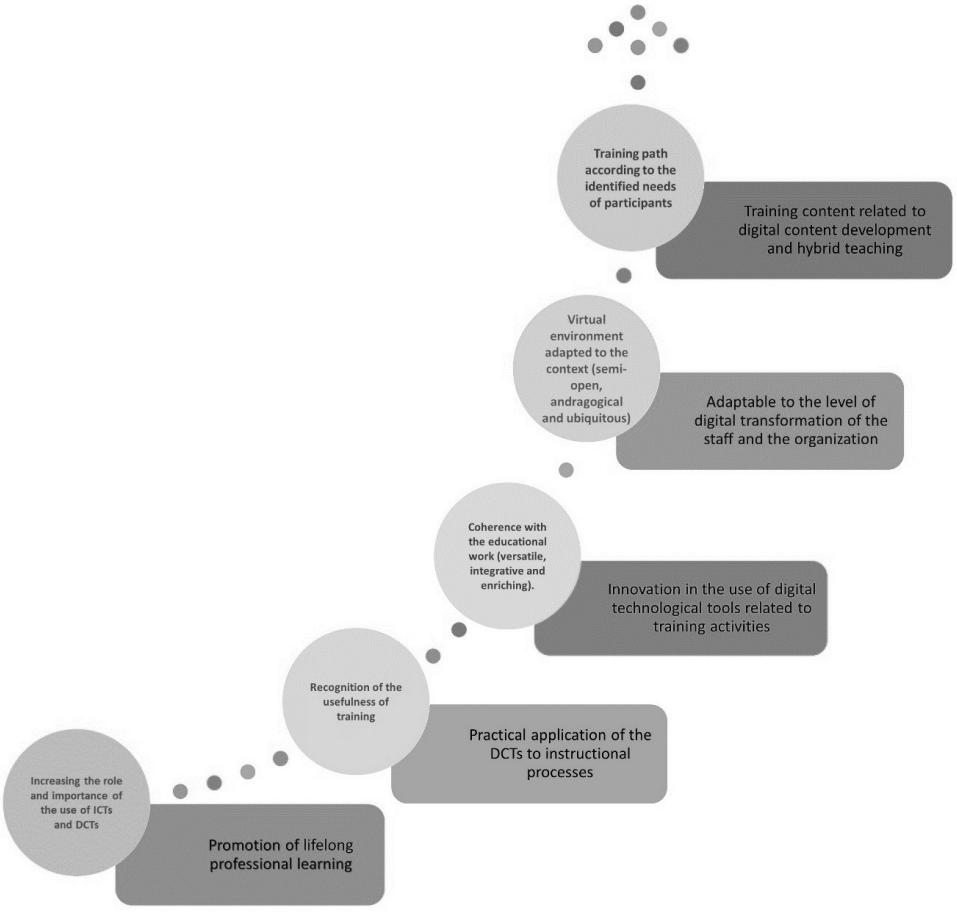

Figure 2. Indicators for the preliminary design of the model based on the analyzed categories.

Finally, they help to emphasize that the resulting training paths must be adapted to the pedagogical use of ICKDLT, so that through them continuity is provided and the educational service offered is enriched; it is proposed that the most profitable modalities for implementing them are those that allow adaptability and take into account the particular needs of the participants, with the framework of virtual learning environments being the most highly recommended for their flexibility, which would also lead to supporting another study based on this line of research.

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ARTICLE

Degree of acceptance of digital evaluation systems adapted to the use of educational technological resources based on Augmented Reality

Grado de aceptación de los sistemas de evaluación digitales adaptados al uso de recursos tecnológicos educativos basados en Realidad Aumentada

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Abstract: The use of immersive technologies, especially Augmented Reality (AR), is presently one of the main technological trends in the field of education. Some studies carried out in recent years in this field highlight that traditional evaluation systems continue to be used and raise the possibility of using adapted evaluation systems. This research, based on primary sources of information, seeks empirical evidence regarding the need to use digital evaluation systems adapted to technological resources in Science subjects and in stages of Compulsory Secondary Education. The methodology used is quantitative research based on the design and statistical analysis of the responses given by students to a questionnaire created *ad hoc*, administered to assess an AR educational resource used in class to explain a key concept in connection with the subject. The results obtained through the exploratory factorial analysis of the students' answers reveal, as a latent construct, a high level of acceptance of the digital evaluation system used. The analysis of the data obtained in this study allows us to establish the hypothesis that a digital evaluation system adapted to the use of an immersive AR technological resource can generate a positive impact on the students' learning process.

Keywords: Educative Technology, Augmented Reality, Evaluation, Sciences, Secondary Education.

Resumen: El uso de las tecnologías inmersivas, especialmente la Realidad Aumentada (RA), es una de las principales tendencias tecnológicas en el ámbito educativo actual. Algunos estudios recientes, realizados durante los últimos años en este campo, destacan que, los sistemas de evaluación utilizados siguen siendo de corte tradicional y plantean la posibilidad de utilizar sistemas de evaluación adaptados. Esta investigación, basada en fuentes primarias de información, busca evidencias empíricas sobre la necesidad de utilizar sistemas de evaluación digitales, adaptados a recursos tecnológicos, en asignaturas de Ciencias y en etapas de Educación Secundaria Obligatoria. La metodología utilizada es de corte cuantitativo y se ha basado en el diseño y análisis estadístico de las respuestas ofrecidas por los estudiantes a un cuestionario creado ad hoc, administrado para que valorasen un recurso educativo de RA utilizado en clase para la explicación de un concepto clave de la asignatura de Ciencias. Los resultados obtenidos a través del análisis de las respuestas ofrecidas por los estudiantes, revelan un elevado nivel de aceptación del sistema de evaluación digital utilizado. El análisis de los datos obtenidos en este estudio permite establecer la hipótesis basada en que un sistema de evaluación digital, adaptado al uso de un recurso educativo tecnológico e inmersivo de RA, puede generar un impacto positivo sobre el proceso de aprendizaje de los estudiantes.

Palabras clave: Tecnología Educativa, Realidad Aumentada, Evaluación, Ciencias, Educación Secundaria.

1. Introduction

The social systems in which we currently live are based on the use of technologies that facilitate almost unlimited access to information. Information is an essential element in a modern society, and its interpretation allows generating knowledge. Therefore, it can be considered that the information society has generated a knowledge society. The objective interpretation of information and the ability to share it easily using available technological resources as complementary tools are generating what some experts in the field of education call a learning society (Cabero et al., 2016).

Hence, the acquisition of skills and strategies that are characteristic of the digital era is of paramount importance in a learning society. This objective is one of the primary challenges and difficulties currently faced by individuals in terms of their digital competence. The significance of this challenge has been further highlighted during the COVID-19 pandemic, where the utilization of digital resources became indispensable in both society at large and in the field of education, enabling the continuation of distance learning processes. The lasting effects of this reliance on digital tools are still evident. Consequently, there has been a substantial increase in investments in educational technology, driving significant advancements in technological development as a whole. Notably, these advancements are prominent in immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) (Pelletier et al., 2021).

Recent research, such as the one conducted by Alalwan et al. (2020), suggests that teachers show a greater predisposition to use educational technological resources based on AR than to use VR. These investigations conclude that the use of this technology in educational contexts is appropriate. All of this positions AR as an educational resource with high potential for use in teaching and learning processes.

One of the main advantages of AR lies in its ability to visualize both physical phenomena and concepts associated with a high level of abstraction. Thus, this technology facilitates the interpretation of complex phenomena, those that require visualizing a three-dimensional component, and is also very useful for simulating or recreating educational spaces that are safer than real ones, such as laboratory environments (Akçayır, Akçayırb, Miraç, & Akif, 2016; Cai, Chiang, Sun, Lin, & Lee, 2017; Fombona & Pascual, 2017; Herpich, Fernanda da Silva, & Rockenbach, 2021; Tarng, Ou, Lu, Shih, & Liou, 2018).

AR is a technology with significant potential for implementation in education mainly because it can increase student motivation, thus leading to improvements in their academic results. All this gives AR high potential for use in different subjects and educational levels (Cabero-Almenara, Barroso-Osuna, Llorente-Cejudo, & Fernández, 2019; Han, Jo, Hyun, & So, 2015; Kim, Hwang, Zo, & Hwansoo, 2014).

The development of skills and strategies acquired through learning based on the use of educational technological resources cannot be achieved without the design and implementation of active methodologies that efficiently and effectively integrate the use of these educational resources. For some years now, educational experts such as Livingstone (2012) have even hypothesized that when evaluating these students' results with objective tests and traditional exams, the effects on academic

performance may not only remain unchanged but may also worsen, making them counterproductive. In fact , until now, innovative methodologies incorporating specific assessment systems adapted to the use of new technological resources have not been used. Instead, evaluations have been based on the use of evaluation systems considered traditional (Bacca et al., 2014; Brown et al., 2020, and Nieto, 2016).

In this context, it is necessary to adjust traditional evaluation systems to align them with the characteristics of new active methodologies that incorporate educational technological resources. However, there is currently a lack of specific criteria to achieve these objectives, despite a clear consensus among institutions on the importance of defining exactly how evaluation systems should be implemented in virtual teaching and learning environments. Most research conducted in this field has primarily focused on evaluating e-learning programs, leaving a significant gap in the literature. Therefore, there is a legitimate and well-founded need to conduct research based on primary sources of information in order to determine the appropriateness of specific applications, methodologies, and distinct features of digital evaluation systems adapted to the use of educational technologies, particularly immersive technologies like AR (Alkhattabi, 2017; Cabero-Almenara, Barroso-Osuna, Llorente-Cejudo, & Fernández, 2019; Fombona & Pascual, 2017; Prendes, 2015).

This research aims to provide answers to the aforementioned questions in order to understand the students' assessment of the use of an immersive educational technological resource based on AR and to determine the level of acceptance of a digital evaluation system adapted to the use of immersive educational technology. To this end, an attitudinal study has been conducted based on the development and validation of an ad hoc questionnaire (Carrascal et al., 2023; Delgado, 2021). The statistical analysis of the students' responses to the questions posed in the aforementioned questionnaire has allowed us to learn their opinion about the use of immersive educational technology for explaining key concepts in the subject. It has also made it possible to determine the main factors that intervene in and support the learning process based on the use of immersive technological resources of AR, as well as to explore other additional factors present in the educational process as a latent construct.

2. Method

The methodology employed in the study is quantitative in nature. It is based on the design and statistical analysis of responses obtained from a specifically created ad hoc questionnaire administered to the selected sample of students.

The main objective of the study is to examine students' assessments regarding the use of an immersive educational technological resource based on AR, aiming to enhance their academic performance. This objective is pursued by analyzing students' responses and specific factors such as motivation levels, acceptance of the technological resource, and comprehension of key concepts taught in class. Additionally, an exploratory analysis of the questionnaire's internal structure is conducted to identify potential underlying factors.

Considering the distinctive characteristics of the study, both general population characteristics and specific features of the participating sample have been taken into

account. The sample of student participants (n = 199) consists of fourth-year secondary school students in the subject of Biological and Geological Sciences , drawn from 16 educational institutions, including both public and private schools, located in the region of Cantabria.

The sample was chosen from the group of students who had previously participated in a performance study. All students involved in the attitudinal study had prior experience using an AR application in their Science class, which illustrated a key concept. Therefore, following criteria established by experts like Sáez (2017), the selected sample for the attitudinal study can be considered representative of the population it represents.

In order to collect the participants' opinions on specific aspects related to the methodology and technology used in the classroom, an instrument based on an ad hoc questionnaire was designed. The instrument was custom-designed to be integrated in the research process and was adapted from previous models proposed by other authors to determine both the level of motivation and the degree of acceptance generated in students by using technological resources in educational environments.

On one hand, the Technology Acceptance Model (TAM) was chosen as a reference in order to determine students' level of acceptance of technology in connection with the use of an innovative educational methodology that combines an AR technological resource for explaining key concepts in the subject and an adapted digital evaluation system.,. The TAM, initially proposed by Davis (1989), continues to be utilized in various research studies concerning the applicability of educational technology (Cabrero, Barroso, & Gallego, 2018).

In summary, the TAM model developed by Davis (1989) suggests that individuals who perceive a positive relationship between the use of a technological application and their performance will also increase their acceptance of the application. This, in turn, may lead to an improvement in academic outcomes.

This dimension consists of nine items (five items for the Perceived Utility indicator and four items for the Perceived Ease of Use indicator).

On the other hand, the Instructional Materials Motivation Survey (IMMS) has been adopted as a reference in order to determine the level of motivation evoked in students by the use of an innovative methodology that incorporates the use of an AR technological resource to explain key concepts in the subject, combined with an adapted digital evaluation system.. This survey, proposed by the education expert Keller (2010), aims to estimate attitudes based on student motivation generated during the learning process through the use of technological resources. To achieve this objective, the survey was specifically adapted for the current study.

This dimension, in turn, consists of a total of 13 items (four items for the Attention indicator, three for the Relevance indicator, three for the Confidence indicator, and three others for the Satisfaction indicator). In addition to gathering information on the two aforementioned dimensions of motivation level and degree of acceptance, a third dimension was added to the instrument, initially referred to as the level of understanding. This dimension was represented by a single indicator called Perceived Ease of Understanding Key Concepts, composed of six items.

Overall, the instrument consisted of a total of three dimensions, with seven indicators and 35 items, complemented by categorical variables related to the students and the educational institutions, such as gender, age, geographic location, etc. The questionnaire, administered in an online format, contained questions concerning both the AR application itself and the evaluation system students had used in class. This approach adheres to recommendations for instrument design and fulfills the minimum observation quantity requirement in this type of study (Hair, Black, Babin, & Anderson, 2018).

The wording of the questions or items was done taking into account the criteria and recommendations established by educational experts such as Sáez (2017) for the design of this type of questionnaire. In this regard, when drafting the initial version of the questionnaire, several fundamental issues were considered. In addition to collecting students' opinions, the administration of the questionnaire also aimed at assessing students' attitudes towards the use of an innovative methodology based on the utilization of an AR resource and an adapted evaluation system to improve their understanding of key concepts in the subject. According to authors like Sáez (2017), attitude can be considered as a construct that can be observed directly and objectively, since attitude, as a psychological trait, is acquired and structured through practice, and individuals respond in specific ways to concrete stimuli.

In order to obtain information in connection with students' attitudes, an attitudinal scale was used, allowing each student to rate their responses using a structured scoring system within intervals on the scale. Specifically, a Likert-type attitudinal scale was utilized, graded with response intervals from 1 to 5, where 1 represented complete disagreement and 5 represented complete agreement. The selection of the number of response options for the questions took into account that a higher number of responses would lead to greater reliability in the scale. However, considering the context and educational level of the participating student sample, it was also important to avoid including an excessive number of response options that could exceed the students' ability to discriminate when responding.

In consultation with teachers, it was also determined that a maximum completion time of 20 minutes should be established for the questionnaire, providing students with sufficient time to respond calmly to all the questions.

To ensure the content validity of the ad hoc instrument, two approaches were employed. Firstly, a review of relevant literature regarding dimensions and indicators was conducted (Davis, 1989; Keller, 2010). Secondly, a content validity analysis was performed through expert judgment. A group of 10 experts with experience in instrument design and data analysis, representing various fields of expertise, was selected. The initial version of the questionnaire, comprising 26 items, was sent to the panel of expert judges for review and analysis (Table 1).

Table 1. Structure of the instrument sent to the group of experts for their review and analysis.

Dimensions	Indicators	Items
Degree of motivation	Attention	1-4
	Trust	5-7
	Satisfaction	8-10
Level of acceptance of AR technology	Relevance	11-13
	Perceived Usefulness	14-17
	Perceived Ease of Use	18-20
Degree of understanding of key concepts	Perceived Ease of Understanding Key Concepts	21-26

The "Expert Competence Coefficient" or "K Coefficient" was utilized to determine with precision the level of expertise of the judges who were asked to analyze the initial attitudinal questionnaire Once the experts' responses to the questions were analyzed, and following the criterion established by authors like Cabero and Barroso (2013), whereby the opinions of experts with an Expert Competence Coefficient (K) below 0.8 (k<0.8) should not be considered, the evaluations provided by nine out of the initial 10 experts were ultimately taken into account (Table 2).

The "Aiken V coefficient" was utilized to assess the analyses conducted by the selected group of expert judges on the set of 26 items proposed in the initial version of the questionnaire,. Proposed by Aiken (1980), this coefficient has been employed in recent years in research studies across various fields such as psychology, medicine, and education (Sáez-López, Román-González, & Vázquez-Cano, 2016).

Table 2. Expert Competence Coefficient (K) values obtained

Expert	Knowledge Coefficient (Kc)	Argumentation Coefficient (Ka)	Expert Competence Coefficient (K)
1	0,90	1,00	0,95
2	0,90	0,90	0,90
3	0,80	0,80	0,80
4	0,80	1,00	0,90
5	0,60	0,70	0,65
6	0,90	0,90	0,90
7	0,80	1,00	0,90
8	0,80	1,00	0,90
9	0,80	1,00	0,90
10	0,90	1,00	0,95

The conclusions and results obtained from analyzing the responses and recommendations provided by the experts align with the analysis of the data obtained

from the judges' evaluations. Therefore, taking all this into account, the initial version of the questionnaire was modified following the recommendations and criteria set forth by the experts, resulting in a revised and corrected questionnaire structured in three dimensions, seven indicators, and a total of 35 items:

- Dimension: Level of Motivation. Indicators: Attention (items 1-7), Confidence (items 8-11), Satisfaction (items 12-16), and Relevance (items 17-21)

- Dimension: Level of Acceptance of AR Technology. Indicators: Perceived Utility (items 22-26) and Perceived Ease of Use (items 27-30)

- Dimension: Level of Understanding Key Concepts. Indicator: Perceived Ease of Understanding Key Concepts (items 31-35)

The attitudinal study aimed to answer the following fundamental questions: first, whether the use of an innovative methodology based on AR technology and an adapted evaluation system can have an impact on motivation and the level of acceptance of technology, and second, whether the use of AR technology as a complementary educational resource enhances students'understanding of key concepts in science subjects.

The internal consistency and reliability of the instrument were assessed by analyzing the students' answers to the questionnaire. Cronbach's Alpha procedure, recommended by experts such as Hair, Black, Babin, and Anderson (2018) for polytomous scales, was employed for that purpose. Upon analyzing the results and interpreting the instrument's overall Cronbach's Alpha value, an excellent value of 0.980 (Cronbach's Alpha) was obtained. This exceeds the criterion set by authors like Sáez (2017), indicating that the instrument demonstrates strong internal consistency, as the Cronbach's Alpha value is ≥ 0.9.

It is worth noting the excellent partial values obtained for each of the dimensions comprising the instrument: level of motivation, level of acceptance of AR technology, and level of understanding of key concepts. All of them show high Cronbach's Alpha values of ≥ 0.9.

3. Results

Following the criteria of relevant experts such as Hair, Black, Babin, and Anderson (2018), an Exploratory Factor Analysis (EFA) was conducted to determine construct validity and to establish possible relationships between variables and dimensions or factors (Carrascal et al., 2023; Delgado, 2021). The use of this type of analysis is justified as one of the objectives of the attitudinal study was to explore the internal structure of the questionnaire through its main components and determine the presence of other underlying factors.

The coefficients of the correlation matrix were examined in order to verify the suitability of using this spific statistical analysis, , confirming the relationships between variable pairs. Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy were employed, yielding a value of 0.000 ($p < 0.05$) for the former

and 0.956 ($p > 0.5$) for the latter. This confirmed that all conditions were met for conducting an EFA.

Subsequently, after confirming the necessary conditions, a Factor Analysis was performed using the Principal Component Method, where the first factor explained the majority of variance in the variables. After determining the first factor, the remaining factors were selected from the remaining variability. Due to the complexity of interpreting factors, as they correlate with multiple variables, a Varimax rotation was applied to ensure that each selected factor was strongly represented by a specific set of variables, facilitating interpretation in theoretical terms. Initially, four main factors were obtained through this method.

Considering the evidence from the data analysis presented in Table 3, it was determined that extracting only three main factors was appropriate. This number of factors was considered sufficient as it significantly reduced the initial number of factors and accounted for nearly 70% of the total variance.

Table 3. Principal factors and total explained variance. Delgado (2021).

Componente	Autovalores iniciales			Sumas de extracción de cargas al cuadrado			Sumas de rotación de cargas al cuadrado		
	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado
1	21,361	61,033	61,033	21,361	61,033	61,033	11,453	32,722	32,722
2	1,774	5,068	66,101	1,774	5,068	66,101	9,563	27,324	60,046
3	1,072	3,063	69,165	1,072	3,063	69,165	3,191	9,119	69,165
4	1,039	2,967	72,132						
5	,829	2,367	74,499						
6	,787	2,248	76,747						
7	,739	2,111	78,858						
8	,622	1,778	80,636						
9	,542	1,549	82,185						
10	,535	1,528	83,714						
11	,514	1,468	85,182						
12	,471	1,346	86,527						
13	,414	1,182	87,709						
14	,353	1,010	88,719						
15	,346	,988	89,708						
16	,322	,921	90,628						
17	,321	,918	91,547						
18	,290	,830	92,377						
19	,267	,764	93,140						
20	,232	,664	93,804						
21	,230	,657	94,461						
22	,222	,634	95,095						

Componente	Autovalores iniciales			Sumas de extracción de cargas al cuadrado			Sumas de rotación de cargas al cuadrado		
	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado
23	,208	,595	95,690						
24	,205	,585	96,275						
25	,180	,513	96,788						
26	,164	,470	97,258						
27	,163	,465	97,723						
28	,138	,395	98,118						
29	,121	,347	98,465						
30	,116	,331	98,796						
31	,107	,305	99,101						
32	,096	,274	99,375						
33	,084	,239	99,614						
34	,071	,203	99,817						
35	,064	,183	100,000						

Taking into account the criteria established by relevant measurement experts such as Abad et al. (2011), extracting more factors than necessary can result in a single variable representing multiple factors, although the appropriate structure is generally maintained. On the other hand, the choice of three main factors is justified, as selecting a fourth factor would not significantly improve the model fit and would introduce greater complexity for interpretation. Recommendations from experts such as Lorenzo-Seva and Ferrando (2013) suggesting that each factor should be represented by at least two theoretically related items were considered to interpret the obtained factors.

The variables that correlated most strongly with each of the aforementioned factors were studied for the purpose of assigning them names. The results obtained from the analysis allow naming the factors (components) as follows:

- First Factor: Level of motivation
- Second Factor: Degree of acceptance of AR technology
- Third Factor: Degree of acceptance of adapted digital assessment system

A detailed examination of the students' ratings was conducted by means of a descriptive analysis of the questionnaire items. The thorough analysis of the data obtained from the students' responses reveals mean scores above the theoretical average of the scale in all three dimensions of the questionnaire.

Students believe that the regular use by teachers of immersive technological resources based on AR would enhance their academic performance, primarily because they perceive a greater ease in understanding key concepts explained by their teachers compared to using textbooks or even non-immersive technologies.

Similar evaluations were also obtained for the adapted digital method employed to assess the students' acquired knowledge, indicating that students consider the use of this system as necessary and complementary to the utilization of immersive technological resources like AR to improve both their academic performance and their grades.

Therefore, after analyzing the items, the questionnaire's functionality to detect and determine students' opinions regarding the use of an innovative educational methodology based on the combination of AR resources and an adapted digital assessment system has been confirmed.

To further delve into the analysis of the students' ratings, homogeneity in the responses to each item was also examined. The obtained data serve as an indicator of the reliability of these ratings, establishing the instrument's relevance in identifying the most robust aspects related to the use of an educational resource based on AR technology and an adapted digital assessment system as essential pillars of an innovative educational methodology.

It is worth noting that the analysis of the data obtained from the students' responses revealed low standard deviations concerning their ratings, both for individual items and the overall average. This indicated a moderate homogeneity in the responses, reflecting a clear uniformity in the students' opinions regarding the use of the specific innovative educational methodology employed in this study.

In conclusion, the analysis of the students' responses confirms the functionality of the questionnaire as a valid instrument to collect their opinions. Additionally, it enables determining the most robust and vulnerable aspects of using a specific innovative educational methodology based on the use of technological resources for educational and assessment purposes, which were fundamental objectives of this study.

4. Conclusions

The analysis of the data obtained in this study on the factorial structure of the questionnaire administered to students reveals the existence of a factor related to the degree of acceptance of digital assessment systems adapted to the use of educational technological resources based on AR, which overall was positively valued by the study participants. The data confirm that the set of three factors, consistingof the level of motivation, the degree of technological acceptance, and the degree of acceptance of an adapted digital assessment system, represents best the data structure as a construct (Carrascal et al., 2023; Delgado, 2021).

These findings suggest the need to incorporate adapted assessment systems as part of educational methodological strategies that are based on the use of educational technology in general and immersive resources based on AR in particular. This finding is consistent with the hypothesis proposed by digital technology experts like Livingstone (2012), suggested in reports published by international organizations (OECD, 2015) and upheld by educational experts such as Nieto (2016) and Blázquez, Alonso, and Yuste (2017) in terms of enabling a positive effect produced by the use of an innovative methodology in combination with a digital and adapted assessment

system, thus inducing profound methodological changes that favor the improvement of teaching and learning processes in Science subjects. These changes are based on the acquisition of specific skills and strategies related to the educational technological resource that cannot be effectively and efficiently achieved or quantified with traditional assessment systems.

The main contribution of this research lies in empirically validating the central hypothesis of the theoretical model proposed. This hypothesis is based on the assumption that the use of an innovative educational methodology that combines the use of an immersive AR resource and an adapted digital assessment system leads to improvements and gains in the learning process of secondary school Science students.

These findings provide empirical evidence and fill the current gap in the literature identified by authors such as Alkhattabi (2017), Cabero-Almenara et al. (2019) and Fombona and Pascual (2017) regarding the specific features that should characterize active educational methodologies based on immersive technological resources and the need to incorporate digital assessment systems integrated in these methodologies.

The level of difficulty involved in designing, developing, and implementing an innovative educational methodology based on the use of technological resources requires carrying out complementary studies in order to expand the data obtained through this research process. Further studies should include Confirmatory Factor Analysis (CFA) with the main objective of verifying the degree of fit of the model proposed in this study with additional results.

In this regard, it is worth noting that due to the intrinsic characteristics of these types of studies, the complexity in their design, the access to the groups of students that make up the selected sample, etc., the research has been conducted exclusively in educational centers located in the region of Cantabria. The data obtained in this study should be compared with data obtained from its implementation in other territories, with other samples of students and in different educational centers.

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ARTICLE

Open Educational Resources (OER) in Brazilian theses and dissertations between 2002 and 2019

Recursos Educacionais Abertos (REA) nas teses e dissertações brasileiras entre 2002 e 2019

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Abstract: An analysis of the research scenario on integrating OER in the teaching-learning process is systematized. We analyzed 118 pieces of research produced in Brazil from 2002 to 2019, composing a set of 25 dissertations, 57 academic theses, and 36 professional theses. The texts were extracted from the databases of the CAPES Catalog of Dissertations and Theses and the Digital Library of Dissertations and Theses (BDTD, from the Portuguese Biblioteca Digital de Teses e Dissertações). The scenario design started from the aggregation of results focusing on a) the temporal evolution of the research, b) the localities, c) the administrative dependence of the Teaching Institutions, and d) the area of knowledge. Complementarily, the findings from the four guiding questions made it possible to conclude that there were few pieces of research investigating the integration of OER in the teaching-learning process, especially within the context of Technical and Vocational Education (TVE) and Graduate School. Moreover, the study revealed that, among the 5Rs of OER, the practice most promoted by the pieces of research within the scope of the teaching-learning process was reuse, which is directly associated with retain and redistribute. This indicates the need to expand and strengthen the continuing education actions aimed at the practice of the other two Rs: revise and remix. Finally, the study pointed out the need for research that performs articulations with educational public policies so that they may generate creation and sharing, in addition to consolidating the international open education movement.

Keywords: Open Educational Resources, Open Education, Educational Public Policies, Technical and Vocational Education, Systematic Review.

Resumo: Sistematiza-se análise acerca do cenário das pesquisas sobre a integração dos REA no processo ensino-aprendizagem. Foram analisadas 118 pesquisas produzidas no Brasil entre 2002 a 2019 compondo um conjunto de 25 teses, 57 dissertações acadêmicas e 36 dissertações profissionalizantes. Os textos foram extraídos das bases de dados do Catálogo de Teses e Dissertações da CAPES e da Biblioteca Digital de Teses e Dissertações (BDTD). O delineamento do cenário iniciou a partir da agregação de resultados com foco na: a) evolução temporal das pesquisas; b) localidades; c) dependência administrativa das Instituições de Ensino e d) área do conhecimento. Complementarmente, os achados oriundos das quatro perguntas orientadoras possibilitaram concluir que existiam poucas pesquisas que investigavam a integração dos REA no processo ensino-aprendizagem, principalmente no contexto da Educação Profissional e Tecnológica (EPT) e da Pós-Graduação. Além disso, o estudo revelou que dentre os 5R dos REA, as práticas mais fomentadas pelas pesquisas no âmbito do processo ensino-aprendizagem são o reusar que está associado diretamente ao reter e ao redistribuir. Isso sinaliza para a necessidade de se ampliar e fortalecer as ações de formação continuada voltadas para a prática dos outros dois R que são o revisar e o remixar. Para finalizar, o estudo apontou a necessidade de pesquisas que realizem articulações com as políticas públicas educacionais, para que possam gerar criação e compartilhamento, além de consolidar o movimento internacional da Educação aberta.

Palavras chave: Recursos educacionais abertos, Educação aberta, Políticas públicas educacionais, Educação Profissional e Tecnológica, Revisão sistemática.

1. Introduction

The educational scenario established due to the COVID-19 pandemic revealed deficiencies that traditional education and teaching have relative to the integration of technologies in the teaching-learning process. This pointed to the need to «advance from the condition of users of technologies (located in the field of consumption) to the condition of creators, co-producers, and multipliers of knowledge», especially free and open knowledge (Mallmann & Mazzardo, 2020, Subchapter 4 of Chapter I).

This process demands the training of teachers with Technological-Pedagogical Fluency (Educause, 2019; Mallmann et al., 2013; Pelzel, 2019), capable of giving didactic-pedagogical meaning to integrating technological resources guided by epistemological and political conceptions. Continuing education is encouraged by current public policies and institutional programs, such as the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In this sense, UNESCO highlights the potential of OER and encourages the 5Rs, which include the reuse, adaptation, production, and sharing to improve access to knowledge in formal and informal education (Law No. 13005/2014; UNESCO, 2015, 2017, 2019).

Efforts to produce and disseminate Open Educational Resources (OER) have been taking place since 2002 when the term was created during the Educational Forum on the Impact of Open Courseware for Higher Education in Developing Countries (UNESCO, 2002). In this sense, in the guidelines for Open Educational Resources in Higher Education (UNESCO, 2015), OER are defined as

> teaching, learning, and research materials in any medium available in the public domain made available under open licenses, allowing access, use, repurposing, reuse, and redistribution by third parties, with few or no restrictions. The use of open technical standards improves access and reuse potential (UNESCO, 2015, p. v)

Thus, OER are centered on three basic principles: a) free educational content for teaching, learning, research, and knowledge production; b) licenses with flexibility for publication, distribution, and legal reuse of educational resources; and c) open technical formats to allow modification. The studies by Wiley (2007, 2014) are references to the five freedoms (5Rs) of openness of OER. The author originally defined open content through the 4Rs, which include the freedoms/rights to reuse, revise, remix, and redistribute. However, in 2014, they made it explicit that they considered the freedom to retain a principle underlying open content (Blessinger & Bliss, 2016).

Thus, the 5Rs (Wiley, 2007, 2014) are the freedoms to:

- Retain: make copies (download, duplicate) and control copies of the resource;
- Reuse: use in various manners (virtual environment, website, blog, video, image, sound, text, etc.);
- Revise: adapt, adjust, modify, or alter the content, which includes translating it into another language, braille, or sign language;

- Remix: combine the original or adapted content with other open content to create a resource;

- Redistribute: share with others copies of the original or adapted content, as well as the remixed versions.

In this scenario, this article contributes by systematizing studies on the state of the art of Brazilian dissertations and theses about OER. Gaps for future studies are pointed out that may foster the integration of OER into the teaching-learning process at the most diverse levels and modalities of teaching, as well as implement and create demands for educational public policies to consolidate Open Education.

The present text is structured in four sections: introduction, methodology, discussion, and conclusion. In the methodology, a thorough report is made of the entire systematic review process adopted. The discussion topic presents the data and respective analyses that project the recent scenario of Brazilian dissertations and theses involving OER. Finally, the conclusion resumes the main points of this systematic review and points out viable paths to strengthen and foster the integration of OER in the educational context.

2. Methods

In the literature, one may find the systematic review process is conducted in different numbers of stages, ranging from three to ten (Costa & Zoltowski, 2014; Gomes & Caminha, 2014; Lupepso et al., 2016; Munzlinger et al., 2012; Okoli, 2019; Sampaio & Mancini, 2007; Santana, 2019). Upon analyzing the methodological stages suggested by the authors above, it was possible to observe that they basically consist of performing three steps: planning, execution, and summarization. This is in line with the words of Kitchenham (2004), who stated that there are different suggestions for conducting a systematic review, but the process is usually divided into three main phases: planning, conducting, and reporting.

With minor modifications, this systematic review rested on the three stages proposed by Munzlinger et al. (2012), subdivided into nine substages (Figure 1).

To outline the scenario of Brazilian dissertations and theses regarding OER, the period from 2002 to 2019 was delimited in the databases of the CAPES Catalog of Dissertations and Theses (CAPES CTD, from the Portuguese Catálogo de Teses e Dissertações)[1] and the Digital Library of Dissertations and Theses (BDTD, from the Portuguese Biblioteca Digital de Teses e Dissertações)[2] according to the stages described below. The time interval was determined from the year the term OER was coined (UNESCO, 2002) to the year preceding this systematic review.

[1] Available at https://catalogodeteses.capes.gov.br/catalogo-teses/#!
[2] Available at https://bdtd.ibict.br/vufind/

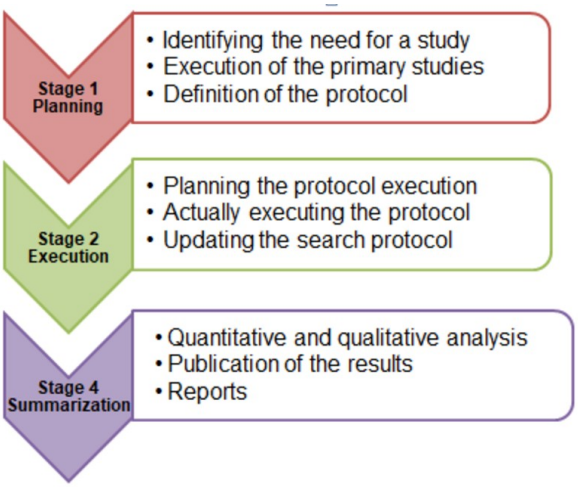

Figure 1. Stages of the systematic review. Source: Lauermann (2022, p. 54) based on the stages proposed by Munzlinger et al. (2012)

2.1. Planning and formalization of the research via protocol

The first stage of a systematic review is planning, which consists of identifying the need for a study, the execution of the primary studies, and the definition of the protocol to be followed during the review. The identification of the need is linked to the choice of theme and problem. Thus, the generating theme for this systematic review was «The scenario of the dissertations and theses about OER carried out in Brazil from 2002 to 2019», and the guiding research problem was «What were the pieces of research involving OER carried out in the teaching context of Technical and Vocational Education (TVE)?». The interest in TVE was because it was the scope of the doctoral research by Lauermann (2022).

The substage of execution of the primary studies encompasses the previous studies carried out in various resources related to the theme (books, scientific articles, reports, theses, dissertations, etc.) that supply the researcher with information about the area, helping them mature the theme and research problem. This is in addition to enabling the identification of keywords related to the theme/problem.

To continue the methodological process, the following objectives were listed: 1) to map and analyze the state of the art of the dissertations and theses about OER developed in Brazil and 2) to uncover theoretical or research gaps.

From the objectives, the following guiding questions were specified:

1) Which pieces of research sought to investigate the integration of OER into the teaching-learning process?
2) At which levels of teaching were the pieces of research carried out?
3) How has the promotion of the practice of the 5Rs (Wiley, 2007, 2014) been taking place in the teaching-learning process?
4) How were the public policies of induction to OER articulated in the pieces of research developed within the context of the teaching-learning process?

Subsequently, to encompass all the dissertations and theses carried out in Brazil involving OER, «Recursos Educacionais Abertos» («Open Educational Resources») and the acronym REA (OER) were stipulated as keywords. The last substage of the first stage is the creation of the protocol, which is a methodological sequence of steps that will conduct the research process. According to Munzlinger et al. (2012), a protocol consists of the transcription of the items defined in the previous substages (identification of the need, problem, objectives, and questions that guided the research), selection criteria (inclusion and exclusion), and definition of the databases to be searched. «A predefined protocol is necessary to reduce the possibility researcher bias» (Kitchenham, 2004, p. 4), and it «may be updated during the later phases» (Munzlinger et al., 2012, p. 7).

Following this guidance, the protocol[3] that guided this systematic review was created. Complementing the protocol, the fields of the form[4] used to catalog the data during the reading of the examined pieces of research were defined. It is in this substage that the selection criteria are defined. Thus, based on the guidelines by Munzlinger et al. (2012), Inclusion Criteria (IC) and Exclusion Criteria (EC) were listed to obtain coherent and consistent results (Table 1).

Table 1. Inclusion and exclusion criteria. Adapted from Lauermann (2022, p. 58)

Inclusion Criteria	IC1) Master's or doctoral research carried out from 2002 to 2019
	IC2) Existence of a full text
	IC3) Pieces of research developed with intervention in the teaching-learning process
	IC4) Pieces of research that articulated with public policies of induction to OER
	IC5) Pieces of research that focused on the practice of the 5Rs, not necessarily all
Exclusion Criteria	EC1) Pieces of research that did not address or superficially addressed the OER theme
	EC2) Pieces of research not fully available for downloading or reading
	EC3) Duplicate research
	EC4) The piece of research only mentions OER in the availability of the final product of the professional master's program, provided under a Creative Commons license (Open Educational Resource)

During the searches, it was noticed that many professional master's studies were listed because they contained the term «Recurso Educacional Aberto» («Open Educational Resource») among the information (metadata) provided to the CAPES repository about the availability of the final product, thus the creation of the criterion EC4.

The choice of the two databases, CAPES CTD and BDTD, was motivated by their national scope and the amount of research they contain. It should be noted that, as the focus of the review was concentrated on the scenario of research on OER in Brazil, the databases chosen were Brazilian.

[3] The protocol may be consulted in Appendix A of the doctoral dissertation by Lauermann (2022).
[4] The form for cataloging the data is available in Appendix B of Lauermann (2022).

2.2. Execution of the protocol

The protocol execution stage comprises the substages of planning the protocol execution, actually executing the protocol, and updating the search protocol (Munzlinger et al., 2012).

It is in the substage of planning the execution of the protocol that the search string is defined, in addition to its calibration and adaptation according to the searched database. The search string is formed by keywords and logical operators (AND, OR, NOT, etc.) and is used to search digital databases.

The search string was initially defined as follows: «Recurso Educacional Aberto» OR «Recurso Digital Aberto» («Open Educational Resource» OR «Open Digital Resource»). First, search tests were performed using only the term «Recurso Educacional Aberto» («Open Educational Resource») and its plural in the CAPES CTD database. During these tests, this database was found to differentiate between lowercase and uppercase letters. Moreover, other tests were performed, such as using the truncation character (asterisk/*) and double quotes or parentheses encompassing the search string. However, the first did not guarantee the sequential search for the words in the string, allowing them to be randomly distributed in the text, and the use of quotes or parentheses did not return any records.

During testing, two more terms were added to the set of keywords in the search string: «objeto de aprendizagem aberto» («open learning object») and «material educacional aberto» («open educational material»), in addition to their respective plurals, as it was observed that these terms were used in the texts with the connotation of open educational resources. The result of the search for these terms and their respective plurals was the same. Subsequently, a test was performed with the combination of the terms, which were previously tested separately, using the logical operator OR to observe the behavior of the system.

Hence, after the calibration tests performed using the CAPES CTD database, the following search string was obtained considering the most comprehensive result:

> "RECURSO EDUCACIONAL ABERTO" OR "Recurso Educacional Aberto" OR "Recurso educacional aberto" OR "recurso educacional aberto" OR "RECURSOS EDUCACIONAIS ABERTOS" OR "Recursos Educacionais Abertos" OR "Recursos educacionais abertos" OR "recursos educacionais abertos" OR «recurso digital aberto» OR «recursos digitais abertos» OR «objetos de aprendizagem abertos»
>
> («OPEN EDUCATIONAL RESOURCE» OR «Open Educational Resource» OR «Open educational resource» OR «open educational resource» OR «OPEN EDUCATIONAL RESOURCES» OR «Open Educational Resources» OR «Open educational resources» OR «open educational resources» OR «open digital resource» OR «open digital resources» OR «open learning objects»)

It is important to mention that the CAPES CTD search system is stable and reliable; however, one must consider the particularity of the system to differentiate lowercase from uppercase letters. Subsequently, we performed search tests in the BDTD database, which does not distinguish between lowercase and uppercase letters. As in the previous case, we first tested the search for each of the terms [«recurso educacional aberto» («open educational resource»), «recurso digital aberto» («open

digital resource»), and «objeto de aprendizado aberto» («open learning object»)] and their respective plurals isolatedly. From the result of these searches, tests were carried out combining more than one term in the same search string. Hence, after this calibration stage, the search string used in the BDTD was

> "Recurso educacional aberto" OR "Recursos educacionais abertos" OR «Objetos de aprendizagem abertos» OR «Recursos digitais abertos»
>
> («Open educational resource» OR «Open educational resources» OR «Open learning objects» OR «Open digital resources)

With the search strings defined, we proceeded to the substage of the actual execution of the protocol. It is at this time that the protocol is updated since, as it is executed, one may encounter situations that reflect the need to adjust it. It is important to mention that the team that executed the protocol, formed by two doctoral candidates and a scientific initiation student, held three meetings, which generated adjustments that rendered the protocol clearer and more objective. This was important so that the understanding was common to all and there was no discrepancy in the findings. Even after this final protocol refinement, it was agreed that the doubts should be clarified as a team. Such meetings were called by Gomes and Caminha (2014, p. 406) «consensus meetings» and are defined as «discussion spaces to solve mishaps that may come to arise, avoiding biases or excessive dissonance among those conducting the research».

The execution of the protocol involves the selection, classification, and reading of the pieces of research. The selection was carried out in two moments. First, a preliminary selection was made based on reading the titles, keywords, and abstracts of the pieces of research without their more in-depth reading, as proposed by Arimoto (2016) and Okoli (2019). Subsequently, the potentially relevant studies were selected and read in full.

Hence, the preliminary selection of the studies was carried out based on the following metadata: title, keywords, and abstract. The CAPES CTD database was searched from February 10 to 19, 2020, and the BDTD database from February 20 to 21, using the search strings previously mentioned, returning the set of studies presented in Table 2. When the information in the metadata was not enlightening, the piece of research was sought in full by downloading the file to avoid leaving relevant studies out of the systematic review, as advised by Sampaio and Mancini (2007).

Table 2. Number of studies from the initial search. Source: Prepared by the authors

	CTD da CAPES	BDTD	Total
Dissertations	30	14	44
Academic theses	68	40	108
Professional theses	91	17	108
Total	189	71	260

After applying exclusion criteria EC1, EC2, EC3, and EC4, 122 studies were selected for reading, as shown in Table 3. Of this total, 57 pieces of research came from

the CAPES CTD database, corroborating the results obtained by Teodoroski (2018), although it is not possible to identify the exclusion criteria adopted by the author.

Table 3. Pieces of research selected after applying the exclusion criteria. Source: Prepared by the author.

		Dissertations	Academic theses	Professional theses	Total
CAPES CTD database	Initial Search1	30	68	91	
	EC1	5	3	3	
	EC2	2	6	0	
	EC3	11	36	14	
	EC4	0	0	52	
	Subtotal1	12	23	22	
BDTD database	Initial Search2	14	40	17	
	EC1	0	1	0	
	EC2	1	2	1	
	EC3	0	0	1	
	EC4	0	0	0	
	Subtotal2	13	37	15	
	Total	25	60	37	122

Note 1: Subtotal1 = Initial Search1 – (EC1+EC2+EC3+EC4)
Note 2: Subtotal2 = Initial Search2 – (EC1+EC2+EC3+EC4)
Note 3: Total = Subtotal1 + Subtotal2
Note 4: The pieces of research that fit more than one exclusion criteria, e.g., EC1 and EC4, are listed in only one criterion (column) for there to be no duplicity in counting the same piece of research.

After reading the 122 selected pieces of research, it was found that four addressed the OER theme superficially, so they were excluded as per criterion EC1, leaving a set of 118 pieces of research composed of 25 dissertations, 57 academic theses, and 36 professional theses. The information about the selected studies was recorded in the fields of the form (database, title, author, type of research, advisor, year, abstract, keywords, etc.[5]), and disregarded studies were also recorded (title, author, abstract, link to the file, and reason for exclusion) in a separate tab of the spreadsheet identified by «excluded pieces of research», used to catalog the information about the pieces of research, as recommended by Okoli (2019).

2.3. Summarization

The summarization stage includes the organization of the quantitative and qualitative indicators of interest to the research obtained through the process of extracting data from the analyzed publications, in addition to the publication of the results obtained from the systematic literature review (Munzlinger et al., 2012), which will be presented and discussed in the following section.

3. Results

The results discussed in this section are an excerpt from the systematic review that makes up the doctoral research of Lauermann (2022). In the first part, the quantitative and qualitative data will be systematized with the purpose of presenting the scenario

[5] The complete spreadsheet may be found in Appendix B of Lauermann (2022).

of research on OER in Brazil. Subsequently, the data will be analyzed focusing on the guiding questions:

1) Which pieces of research sought to investigate the integration of OER into the teaching-learning process?
2) At which levels of teaching were the pieces of research carried out?
3) How has the promotion of the practice of the 5Rs been taking place in the teaching-learning process?
4) How were the public policies of induction to OER articulated in the pieces of research developed within the context of the teaching-learning process?

Thus, to map the scenario of research involving OER in Brazil, data were collected on the distribution of the studies: a) over the years, b) by state, c) by administrative dependence, in addition to the public/private ratio, and d) by area of knowledge.

Figure 2 shows the distribution of the pieces of research over the years. One may observe that although the term OER was coined in 2002, the first doctoral dissertation was only published in 2008. In this research, Dutra (2008) based themselves on the concept and characteristics of OER and the open licenses to define Open Learning Objects and propose a set of recommendations for the encapsulation and use of such objects to support formative evaluation and reusability. The records obtained by Heredia (2015) from the articles indexed in the Web of Science database also point to the first publication in 2008. However, the mapping carried out by the author is limited to the diagnosis and characterization of scientific production on OER within the scope of higher education.

From 2009 to 2013, research on OER remained modest, with only four more studies. It was only from 2014 onward that research involving this theme took off, reaching its peak in 2017. This increase in the number of publications from 2014 was also found in the studies by Teodoroski (2018), whose mapping in theses and dissertations dates from 2010 to 2015. Contrary to the findings in the present systematic review, the research by Borges et al. (2020), carried out from 2014 to 2018, pointed out 2017 as the year with the lowest number of scientific productions in Brazil and Spain. The authors highlighted that the most significant number of publications occurred in 2015, for which the present study also found a considerable number of pieces of research.

It is inferred that the growth from 2014 is related to the incentive generated from the publications of the Guidelines for Open Educational Resources (OER) in Higher Education by UNESCO et al. and COL (2011) and the Paris OER Declaration by UNESCO (2012), on the world stage, and the launch of the OER Notebook, a notebook for teachers by Educação Aberta (2013), and the book titled «Recursos Educacionais Abertos – práticas colaborativas e políticas públicas» («Open Educational Resources – collaborative practices and public policies») by Santana, Rossini, and Pretto (2012) on the national stage.

Another hypothesis that arises is linked to the increase in undergraduate programs in the distance learning format promoted by the Open University of Brazil

(UAB) from 2006 onward. According to a consultation of the e-MEC Portal[6], one may observe that the expansion of these programs intensified from 2014 onward. Therefore, it is considered that the production of didactic materials for such programs caused the need to deepen the studies on copyright and, consequently, on Creative Commons licenses and OER, which may have been reflected in the composition of the research themes. In addition, it is thought that there may be a relationship between the UAB guidelines regarding the production of these materials for distance learning programs and the proliferation of OER, which also affects the feeding of government and institutional repositories of educational resources

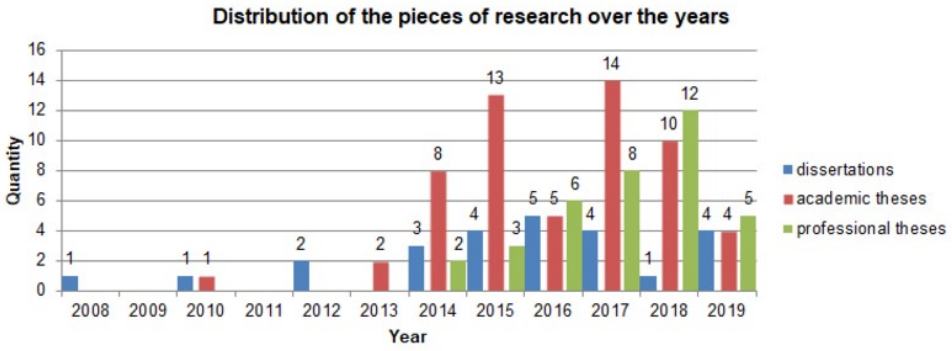

Figure 2. Pieces of research over the years. Source: Lauermann (2022, p. 74)

Regarding the distribution of the pieces of research by Brazilian states (Figure 3), it was found that Paraná (PR) emerged with a total of 30 studies, followed by São Paulo (SP) with 24 and Rio Grande do Sul (RS) with 23. If we consider the distribution by region, the South region of Brazil had the highest number of pieces of research, totalizing 58, followed by the Southeast with 36.

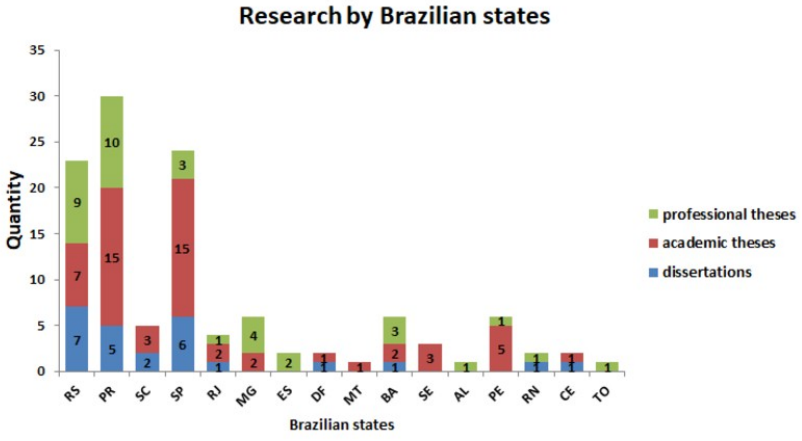

Figure 3. Pieces of research in the Brazilian states. Source: Lauermann (2022, p. 75)

It is believed that this number of publications in the state of Paraná may have been promoted by initiatives such as the Portal REA Paraná (Paraná OER Portal), a program of open educational practices and resources created in 2014 from the joint

[6] Available at http://emec.mec.gov.br/.

action between the Federal University of Paraná (UFPR) and the Federal University of Technology – Paraná (UTFPR). Similarly, in RS, the REAMAT project[7] was created for collaborative OER writing on mathematics topics and their applications. Moreover, in its Strategy 7.10, the RS State Education Plan (PEE, from the Portuguese Plano Estadual de Educação) (Law No. 14705 of June 25, 2015) encourages the production and integration of OER in school practices. Similarly, in São Paulo, the movement in favor of OER was fostered by Portal REA Brasil (Brazil OER Portal), created in 2008, and by the publication of Decree No. 52681 of November 26, 2011, by the Municipal Department of Education of São Paulo, with Article 1 providing that intellectual works produced for educational, pedagogical, and related purposes within the scope of the municipal public education system must be licensed for free use, including copying, distributing, and transmitting, observing the conditions of preservation of attribution to the author and non-use for commercial purposes.

It is also pointed out as a hypothesis the growing initiatives of teaching institutions to implement digital repositories/collections to store and disseminate the resources and research produced and make them public. It is assumed that these initiatives may have contributed to the search for information and the development of studies on copyright and OER.

The analyzed data revealed that the federal institutions concentrated most of the productions, a total of 67, followed by the private institutions with 30 and state institutions with 21 pieces of research. One may deduce that the return on investments of governments and funding agencies affects the amount of research carried out in federal public institutions. Adding the federal institutions (57%) and the state institutions (18%), we observed a number of pieces of research from the public network (75%) far higher than that of the private network (25%), as shown in the chart in Figure 4. This reinforces the struggles for the valorization of education and research, especially considering recent years, with public education in the three spheres being so devalued and research being threatened by cuts in graduate scholarships and blockades of resources from the ministries.

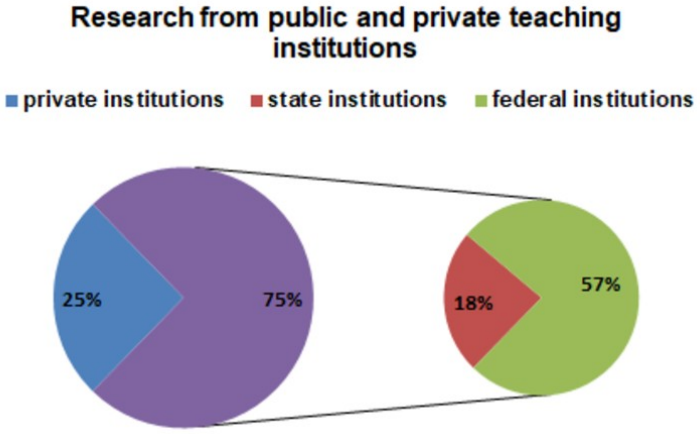

Figure 4. Pieces of research from public and private teaching institutions. Source: Lauermann (2022, p. 78).

[7] Available at https://www.ufrgs.br/reamat/index.html

To conclude this first part of data analysis and discussion, Figure 5 presents the distribution of research related to the OER theme by area of knowledge, considering the CAPES table of areas of knowledge and the information registered on the Sucupira Platform about the evaluated and recognized Programs. From it, one may determine that the area of Education emerged with 32 pieces of research, corresponding to 27% of the research about OER produced in Brazil. This result is in line with the analyses produced by Heredia (2015), who also highlighted in the first place the area of Education among the areas of knowledge referenced in the articles that were part of their body of research.

Figure 5 also reveals that the Interdisciplinary area appeared in second place with 24 pieces of research, equivalent to 20%, followed by the Teaching area with 21 (18%). It was already expected that the areas of Education and Teaching would stand out due to the close relationship of OER with the teaching-learning process, but the revelation of these data is due to the dissemination of OER in other areas such as Electrical Engineering, Agronomy, Law, Administration, and Art.

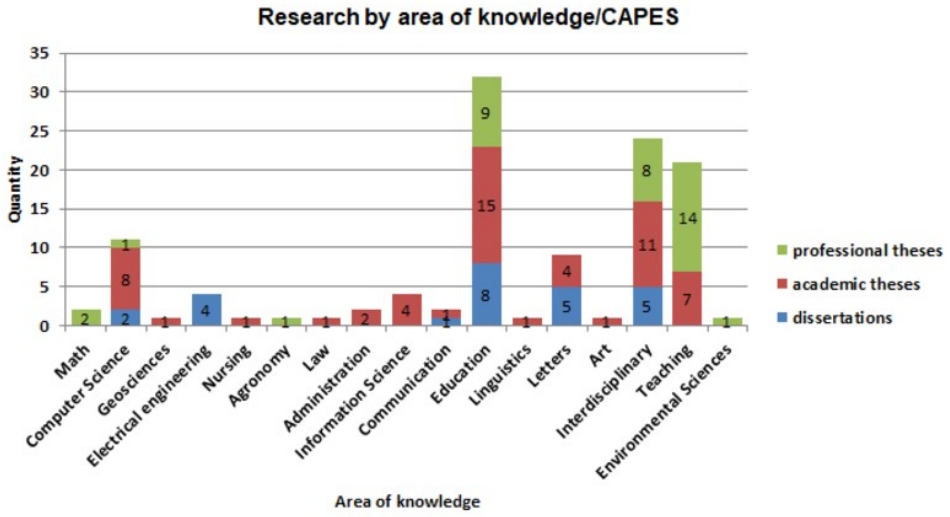

Figure 5. Pieces of research by area of knowledge. Source: Lauermann (2022, p. 78)

Moving on to the second part of this data analysis, to answer the guiding question of «Which pieces of research sought to investigate the integration of OER into the teaching-learning process?», the 118 selected pieces of research were explored. Of the 25 dissertations analyzed, 12 conducted research with OER in the context of the teaching-learning process in loco (in person or remotely). In turn, among the theses, there were seven pieces of research among the 57 academic master's theses and 12 among the 36 professional master's theses, totalizing 31 pieces of research[8] corresponding to only 26%. This result signals a field of research still lacking studies related to integrating OER in the teaching-learning process.

It is inferred that the longer time required to carry out doctoral research favors the development of long-term research inserted in the teaching-learning context, which is why the proportion of research at this level is higher than that of the master's

[8] The list of the 31 pieces of research may be found in Appendices D and E of Lauermann (2022)

level, either academic or professional. In addition, it was observed during the analysis that most professional master's programs require the development of a final product, in these cases an OER, which may have contributed to the higher proportion of research developed in the teaching-learning process compared to the academic master's programs, given that, in many cases, the application for evaluating such resources was carried out in the classroom. These results show the importance of this type of study, both to disseminate the integration of OER in the educational context and to provide knowledge of the challenges experienced and advances achieved regarding integrating OER into school practices.

To answer the second guiding question of «At which levels of teaching were the pieces of research carried out?», the 118 selected studies were considered, not just those developed during the teaching-learning process. The result of this analysis is represented in the chart in Figure 6, in which one may observe that, among the doctoral and academic master's research, the studies focused on Higher Education stood out compared to those on Elementary School, High School, TVE, and Graduate School. This did not occur for the professional master's programs, for which there was a higher concentration of studies in Elementary and High School. It is inferred that this results from the fact that many researchers are inserted in this teaching context, which may have aroused their interest in developing the final products of their theses aimed at their areas of activity.

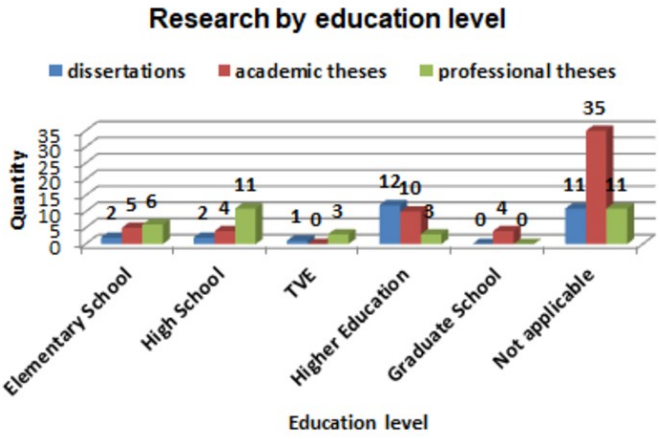

Figure 6. Pieces of research by education level. Source: Lauermann (2022, p. 80)

It is important to highlight that some of the pieces of research were carried out at more than one level of education, as was the case of the five occurrences of doctoral research developed in Elementary School, High School, and TVE that come from only three pieces of research.

The 57 pieces of research classified as «Not applicable» were focused on: a) the technological area, with the development of tools for the production, adaptation, and/or evaluation of OER; b) the technological area, with the production of OER or repositories; c) university management; d) non-formal education; e) continuing education; f) repositories; g) information management; h) the teaching-learning process without intervention (theoretical) or i) with theoretical reflections about OER.

Another fact that Figure 6 reveals is that, of the 118 pieces of research analyzed, 32% were conducted in Basic Education, while only 4% in TVE and 4% in Graduate School. Such data indicate a lack of research integrating OER into these educational contexts. The findings regarding TVE converge with the results of an exploratory study commissioned by UNESCO-UNEVOC in 2017 with the objective, among others, of mapping the scenario of using OER in Technical and Vocational Education and Training (TVET). The data collected from June to November 2017 revealed that TVET is an almost neglected area in the OER space. By the end of this study, no substantial research on OER in TVET had been conducted (UNESCO-UNEVOC et al., 2018). In other words, the Brazilian scenario reflects the international scenario regarding the lack of research on this topic in the context of TVE.

In this sense, to further refine the results of the present systematic review, we listed the pieces of research that sought to investigate the integration of OER into the teaching-learning process in loco developed in TVE, and only three studies were obtained, presented in Box 1.

A more detailed analysis of these pieces of research may be found in Lauermann (2022). However, it is worth making some notes here. Although the research by Quadros (2016) is a study of OER production and application in the teaching-learning process in loco, its primary focus was on the resource developed and on gamification, without delving into how the integration of OER was dialogued with students. Similarly, both Vieira (2015) and Fetzner Filho (2015) did not discuss with their students the integration of OER in the teaching-learning process. The students carried out their activities without being aware of the principles underlying OER or that they were using OER. This form of integration of OER into school practices does not contribute to their promotion, much less to raising awareness of their basic principles of democratization of knowledge.

Box 1. Pieces of research carried out in the teaching-learning process in loco in the context of TVE. Source: Lauermann (2022, p. 81)

Type	Research	Education Level
DD	Quadros, G. B. F. de. (2016). A gamificação no ensino de línguas online. [Doctoral Dissertation]. Catholic University of Pelotas.	Higher Education (pilot research) Technical Course and High School
PM	Vieira, M. de A. (2016). Cenários futuros sobre as culturas docentes: um estudo sobre a livre colaboração. [Professional Master's Thesis]. Federal Institute of Education, Science, and Technology of Espírito Santo.	Technical Course in Informatics integrated into High School
PM	Fetzner Filho, G. (2015). Experimentos de baixo custo para o ensino de Física em Nível Médio usando a placa Arduino-UNO. [Professional Master's Thesis]. Federal University of Rio Grande do Sul.	Technical Course in Electromechanics integrated into High School and Technical Course in Mechanics integrated into High School

From the analysis of the 31 studies stemming from the first guiding question, we sought to answer the third one: «How has the promotion of the practice of the 5Rs

been taking place in the teaching-learning process?». Thus, the result represented in Figure 7 was obtained. At this time, it should be noted that the same piece of research may promote the practice of more than one R and that, although production is not part of the 5Rs, we chose to maintain it in the analysis to signal that much of the incentive to reuse comes from the application in the teaching-learning process of OER produced during the research.

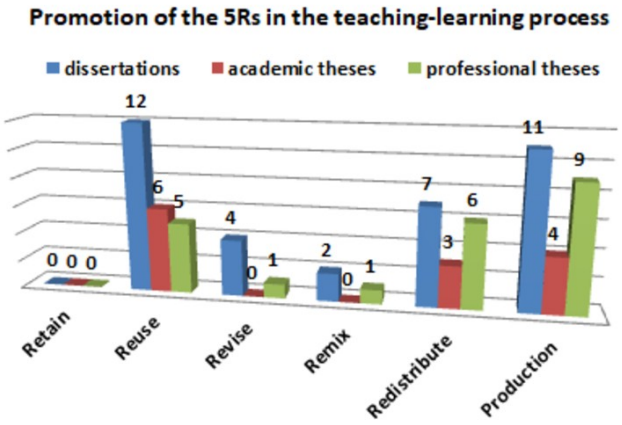

Figure 7. List of the promotion of the 5Rs in the teaching-learning process. Source: Lauermann (2022, p. 84)

Another necessary observation is that, although the studies do not directly mention retaining, this practice is linked to reusing, revising, or remixing since, to carry out these three practices, it is necessary, before all else, to retain the resource, i.e., download or copy it. Moreover, the fifth R, retaining, was only introduced in 2014 (Blessinger & Bliss, 2016; Wiley, 2014).

The chart in Figure 7 also reveals that the practices most promoted by the pieces of research in the teaching-learning process were reuse and redistribute. These data are in line with what researchers have found in all editions of the Small Open Online Course (SOOC) «REA: Educação para o Futuro» («OER: Education for the Future») (Mallmann et al., 2017) and the studies by Coletto and Braga (2022), who concluded that remixing is not a current practice because it presents technical difficulties and there is incompatibility of licenses and a lack of tools.

In addition, it was observed during the reading of the pieces of research that many of the resources produced during the studies, called OER, were not distributed with the permissive licenses, which mischaracterized them as OER. Likewise, it was found that many of the OER produced during the pieces of research were not made available on the Internet, thus impacting the practice of the R of redistributing and, consequently, compromising the continuity of the virtuous cycle (Mallmann, 2018; Windle et al., 2010).

The analysis of the pieces of research also alerted to the need to deepen and broaden the discussion about OER in the educational context so that teachers and students may differentiate them from other educational resources, thus minimizing mistakes made evident in some pieces of research, such as considering YouTube videos made available under a standard license as OER or considering a repository as an OER.

It is understood that to be educational, a resource needs to have pedagogical intentionality so that the didactic transposition occurs in the context of the teaching-learning process, as is the case of articles, slides, images, videos, and maps, among others. A repository, in turn, is a place used to store such items.

Finally, we resorted again to the 31 pieces of research to answer the question of «How were the public policies of induction to OER articulated in the pieces of research developed within the context of the teaching-learning process?». Thus, we arrived at the data represented in the chart in Figure 8, which reveal that, of all the pieces of research analyzed, only five doctoral studies, i.e., 16%, articulated in their writings the national public policies of induction to OER in the teaching-learning process, with 71% not even mentioning them.

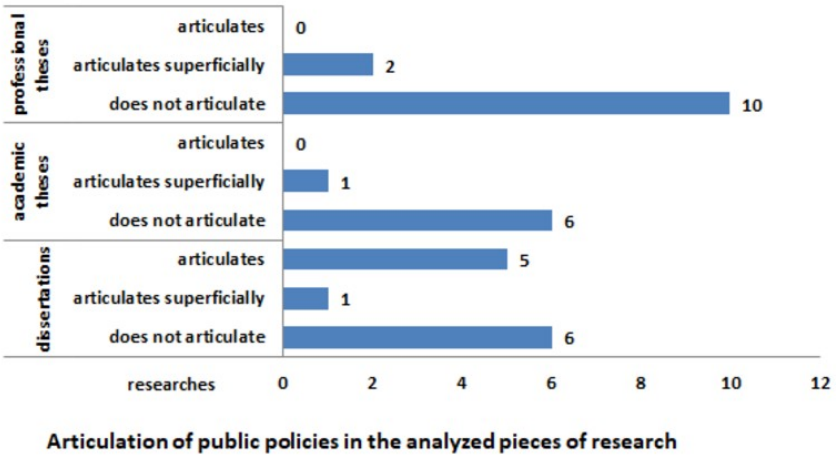

Figure 8. Articulation of public policies in the analyzed pieces of research. Source: Lauermann (2022, p. 86)

These results are concerning, considering that it is from the educational public policies that the demand for teacher training and financing of actions aimed at research and the promotion of OER until its effective integration into teaching practice occurs. It is also worth noting that some of the analyzed studies mentioned the importance of public policies to promote OER but did not point to any of the existing national or regional policies. In turn, others articulated educational public policies, yet focused on special education, curriculum, initial and continuing education, distance education, rural education, environmental education, and digital inclusion, among others.

4. Conclusions

Research on OER was expanded since the mapped reviews analyzed the period from 2002 to 2019. Advances were made in the understanding of OER because, in addition to the qualitative analyses related to the scope of this review, it broadened the spectrum of analysis by systematizing records of research conducted by year, administrative dependence, the public/private relationship, area of knowledge, and education level.

After applying the screening and analysis criteria of the studies categorized in this systematic review, we arrived at a set of 118 pieces of research, including 25 doctoral dissertations, 57 academic master's theses, and 36 professional master's theses. The amount of research found in the most diverse areas of knowledge shows the relevance of the theme involving OER to consolidate Open Education.

It was observed that, although OER are gaining space in public policies, there is a need to create more promotion to encourage and expand the OER movement in public and private teaching institutions. Support for the advancement of OER in the educational context may be made possible by the government through a) financing of OER initiatives and institutional repositories; b) research; c) teacher capacity-building; d) encouraging open access; e) creating public policies integrated into initial and continuing education programs that enable the effective integration of OER into teaching practices. There is still a mismatch between these practices and the guidelines established in official documents.

In this sense, initial and continuing education programs are presented as potential strategies to disseminate the integration of OER into the educational context insofar as they can promote critical reflections from problematizing dialogues around topics such as OER, open licenses, closed licenses, and copyright. Other viable paths may be free courses, interdisciplinary dialogues in schools, teaching, research, and extension projects, and events such as congresses, symposia, seminars, etc. Another evidence derived from the results was the need for more research on integrating OER into the teaching-learning process within the context of TVE and Graduate School. The development of such research may contribute to expanding knowledge about OER in these educational spaces and the practice of the 5Rs.

However, even though there are still obstacles to be overcome, such as the implementation of public policies and lack of funding, one cannot fail to highlight institutional initiatives such as the Educopédia, EduCapes, Portal Dia a Dia Educação of Paraná, the Fiocruz Institutional Repository (ARCA), REliA, the GEPETER OER Repository, the REA.br project, and ProEdu, among others, which strengthen and disseminate OER in the educational context.

In conclusion, it is recorded that educational public policies play a crucial role in this scenario that aims to disseminate knowledge by integrating OER into school spaces. There is still a vast field of research to be explored so as to contribute with directions for the implementation of policies, including institutional ones, to leverage the democratization of access to knowledge through open education.

5. Acknowledgment

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ARTICLE

Teacher competencies, technology and personality among secondary education master's students

Competencias docentes, tecnología y personalidad de los estudiantes del Máster de Secundaria

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Abstract: This study, carried out for predictive and diagnostic purposes, analyses the acquisition of teacher competencies and the integration of technology in learning, as related to personality, among students on the Master's in Secondary Education at the University of Castilla-La Mancha (Spain). Methodology: 241 students (105 men and 136 women) from the 2019–2020 cohort took part. To evaluate the self-efficacy of teacher competencies, the scale of six competencies was used, taking into account the context of practice. To assess the impact of technology on learning, the bifactorial scale of learning and learning strategies was used, and the BFI-10 questionnaire was used to assess personality traits. A correlation analysis was carried out, 12 mediation models were calculated, and a bootstrap analysis was conducted to calculate the indirect effects of the mediations. The results show that the acquisition of all teacher competencies is significantly and positively correlated with technology learning, particularly subject knowledge, and methodological competence, where the traits of conscientiousness and openness are significant. Of the 12 mediation models, the model that showed partial mediation was competence for collaboration with tutors, predicted by technology learning, mediated by conscientiousness. The findings show an understanding of how to steer university training in the context of the current education system.

Keywords: Competences, Technology, Personality, Secondary Master.

Resumen: Con fines predictivos y de diagnóstico, se presenta un estudio en el que se analiza la adquisición de las competencias docentes, la integración de las tecnologías en el aprendizaje, relacionado con la personalidad, de los estudiantes del Máster de Secundaria de la Universidad de Castilla-La Mancha. Metodología: han participado 241 estudiantes (105 hombres y 136 mujeres) del cuso académico 2019-2020. Para evaluar la autoeficacia de las competencias docentes se utilizó la escala de 6 competencias teniendo en cuenta el contexto real de práctica; para valorar el impacto que generan las tecnologías en el propio aprendizaje la escala bifactorial factor de aprendizaje y factor estrategias de aprendizaje y para evaluar los rasgos de la personalidad se utilizó el cuestionario BFI-10. Se llevó a cabo un análisis correlacional, se calcularon 12 modelos de mediación y se realizó un análisis de bootstrap para el cálculo de los efectos indirectos de las mediaciones. Los resultados arrojan que la adquisición de todas las competencias docentes tiene una correlación significativa y positiva con el aprendizaje de las tecnologías, destacando la competencia del conocimiento de la asignatura y competencia metodológica, donde el rasgo de responsabilidad y apertura son significativos. De los 12 modelos de mediación el modelo que mostró mediación parcial fue la competencia para colaborar con los profesores predicho por el aprendizaje de las tecnologías, mediado por la responsabilidad. Lo hallado representa comprender cómo guiar la formación universitaria para poder dar respuesta al sistema educativo actual.

Palabras clave: Competencias docentes, Tecnología, Personalidad, Máster de Educación Secundaria.

1. Introduction

The new socialising functions ascribed to teachers, and the increasingly important role of the integration of information and communications technologies (ICTs) into teaching practice, have led to dramatic changes in how teaching is carried out in recent years (Tello and Aguaded, 2009). This presents new educational challenges in terms of the development of competencies among future teachers, as related to personality, meaning new levels of good practice must be met in initial training.

It is clear that any attempt to change the education system goes hand in hand with the initial training of teachers, demanding analysis, reflection, planning and organisation of professional development, even staying one step ahead of the system itself, to ensure that future teachers are not out of step when they enter the job market.

University programmes are key. Students are immersed in a teaching-learning process where they must learn the competencies demanded of them in practice and which shape the excellent, effective teacher (Del Valle and Rodriguez, 2017).

In developing these competencies, the perception of self-efficacy is a significant variable (Bandura, 1997; Van Dinther, Dochy and Segers, 2011; Van Dinther et al., 2013). There are studies on the importance of teacher self-efficacy carried out with working teachers (Tschannen-Moran and Woolfolk Hoy, 2001; Woolfolk Hoy and Davis, 2006), which should also be carried out with students. It is clear that the earlier teacher self-efficacy beliefs can be shaped, the greater the possibility to adjust the training received by students, depending on the reality of the situation (Bandura, 1997, Woolfolk Hoy and Burke-Spero, 2005). The important role technology currently plays should also not be forgotten it is technology that sets the pace in education. Educational innovation has shown the importance of integrating digital technologies into learning. In relation to future teachers, it is assumed that as digital citizens they have a good command of technology (Prensky, 2001; White and Le Cornu, 2011). Nevertheless, some studies show that technical competence does not always meet the needs of future teachers to integrate technologies as learning tools (Arabit-Garcia et al., 2021; Ferrero-de-Lucas et al., 2021; González, Román and Prendes, 2018; Prendes et al., 2017; Tadeu, 2020), since the way in which one learns, the type of professional environment and personality traits interact and influence one another (Segura, 2022; Zhang, 2004).

Therefore, evaluating for predictive and diagnostic purposes the students´ self-efficacy in the acquisition of teacher competencies and the integration of ICTs in learning, as related to personality, sheds light on how to steer university training in the context of the current education system on Master's in Secondary and High School Education, Professional Training and Language Teaching (MUFPS).

1.1. Teacher competencies

Self-efficacy from the perspective of Bandura's (1997) cognitive social theory is significant in any human domain (Pajares, 1996; Schunk, 2003). In the field of education, teacher self-efficacy is defined as the belief that the teacher has the capacity to have a positive effect on their students' learning (Villaverde-Caramés et al., 2021; Birisci and Kul, 2019; Cajo and Gisbert-Cervera, 2022; Mérida-López and Extremera, 2019; Costa, Palma, and Salgado, 2021). Studies analyse teacher self-efficacy through

student performance and motivation (Caprara et al., 2006; Muijs and Reynolds, 2001), effectiveness of practices (Chacon, 2005; Depaepe and König, 2018; Woolfolk and Hoy 1990; Woolfolk et al., 1990), attention given to students with specific educational needs (Collado-Sanchis et al., 2020; De Dios et al., 2019; Murillo et al., 2020) and personal well-being (Klassen and Chiu, 2011; Shoji et al., 2016; Zee and Koomen, 2016).

Therefore, effectively carrying out teaching tasks requires good command of a range of different types of knowledge and abilities, as well as affective-motivational dispositions (De Coninck et al., 2020; Guerriero, 2017). In addition, it is important to recognise that work on teacher self-efficacy is most fruitful at the early stages of the learning process (Bandura, 1997). Thus, this study is of particular interest since it analyses teacher competencies acquired at an early stage, with a direct impact on teaching (De Coninck et al., 2020; Pfitzner-Eden, 2016).

Different studies have assessed the teacher self-efficacy of student teachers. Tigelaar et al. (2004) have developed and validated a scale to evaluate teacher competencies in higher education, identifying four competencies: person as teacher, expert on content knowledge, facilitator of learning processes, and organiser and scholar/lifelong learner. Studies in this area include those by Baena-Extremera, Granero-Gallegos and Martínez-Molina (2015), Del Valle, De la Vega and Rodriguez (2015), Hernández et al. (2010), Luna and Reyes (2015), Sanz, Hernando and Mula (2015), and Valdivieso, Carbonero and Martín-Antón (2013), highlighting four teacher competencies (command of teaching content, didactic teaching knowledge, management/organisation of the session, leadership capacity and relations with others), although it is worth reflecting on whether this covers the full complexity of the educational context. Pendergast, Garvis and Keogh (2011) and Ekici (2018) apply the Teachers' Sense of Efficacy Scale (TSES) (Tschannen-Moran and Woolfolk Hoy, 2001) to students. Based on the TSES, Van Dinther et al. (2013) validate another self-efficacy measurement scale for student teachers, identifying six competencies (interpersonal competence, pedagogical competence, subject knowledge and methodological competence, organisational competence, competence for collaboration with colleagues, and competence for reflection and development), spanning the complexity of real experiences in practice, where teacher competencies are developed.

Therefore, it seems important that student teacher training programmes pay attention to the development of teacher competencies (Van Dinther et al., 2013), as part of the learning process in the context of real practice.

1.2. The integration of technology

There is currently a great deal of interest in the general incorporation of ICTs in education (Ballesteros et al., 2010). Initial teacher training is no exception, since this represents a crucial learning tool (Gil and Roca-Piera, 2011; Oliver, 2011; Selwyn, 2012).

Through the integration of ICTs in education, students can develop new teaching-learning strategies and activities which in the past were unimaginable. Prieto et al. (2010) recognise how ICT implementation impacts university teacher training programmes as a means of accessing, discovering, and processing information and generating communication. This involves new challenges for student teachers, since having a command of ICTs strengthens the development of teachers' professional competencies (Abarca, 2015; Coscollola and Fuentes, 2010; Edmunds, Thorpe and

Conole, 2012; Peinado and Navarro, 2014; Silva, Usart and Lázaro-Cantabrana, 2019), leading to methodological innovation, which increases motivation and participation among students, which is related in turn to an improvement in academic performance, impacting the self-regulation of the self-efficacy of the student teacher.

Therefore, it is interesting to analyse the level of use and command of ICTs, understood as available technological resources, since this represents a challenge in the development of teacher competencies (Alcántara, 2015; Pontes-Pedrajas, 2005; Tumino and Bournissen, 2019; Unigarro, 2004). This paper aims to analyse the level of impact ICT implementation has on the learning process. That is, the extent to which the use of ICTs as a tool supports the learning of teacher competencies, constituting a complex digital literacy generating knowledge construction, including knowing how to use ICTs in the classroom, as well as how to design practices in a given context, as noted by Ketil (2019), in order to minimise the anxiety this can cause among students (Erdener and Kandemir, 2019).

Students' perception of ICTs must be carefully analysed, since this is at the forefront of the enormous educational change currently being witnessed (Cosi et al., 2020; Sanz-Ponce, Hernando-Mora and Mula-Benavent, 2015).

In the academic literature, two distinct lines of study can be found. The first focuses on the levels of digital competence (skills, capabilities, and attitudes) that teachers should develop by including ICTs in their practice and professional development (Lázaro, Usart and Gisbert, 2019; Tourón et al., 2018; Usart, Lázaro and Gisbert, 2021), in line with proposals by the European Union and the Spanish Ministry of Education. The second is focused on evaluating the impact of ICTs on learning itself, concluding that ICTs help build knowledge and lead to cognitive improvement among students (Balas-Nakash et al., 2010; Tumino and Bournissen, 2019; Riascos-Erazo, Quintero-Calvache and Ávila-Fajardo, 2010), in relation to the learning of competencies among student teachers.

Hence, in line with this second line of enquiry, we aim to analyse the effect of the integration of ICTs on the learning of competencies among student teachers, in the context of real practice, since the perception of the usefulness and ease of use of ICTs fosters a positive attitude towards the incorporation of technology in the professional environment (Edmunds, Thorpe and Conole, 2012).

1.3. Personality

According to Bandura's triadic model (1997), behaviour is the result of the interaction between person and environment, which are intertwined with each other, transferable to the educational context in accordance with teacher self-efficacy. Therefore, the personality of student teachers could be seen as a valuable element in the development of teacher competencies, since it is through personality that one is able to perform behaviours and understand the different behaviours of others (Phares, 1996).

Since the twentieth century, personality has been analysed in detail through different theories. Although personality is not a new area of study, there is currently a trend to identify the different traits and to measure this construct through factors. There are two approaches: one weaker, which considers traits as constructed

dispositions that do not necessarily imply something endogenous and genotypical (Romero, 2005), and another stronger approach focused on the traits model and on the growing interest in the factorial study of personality (McCrae and Costa, 1990), known as the big five factor model (BFF). Of the many questionnaires developed, Cupani et al. (2019) identify the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow and Swann, 2003), the Mini-IPIP (Donnellan et al., 2006), the BFI-2-S and BFI-2-XS (Soto and John, 2017), the Abridged Big Five (Langford, 2003), the Five-Item Measure of the Big Five (Aronson, Reilly and Lynn, 2006) and the Big Five Inventory-10 questionnaire (BFI-10; Rammstedt and John, 2007), which are of interest here since they have adaptations for adults (Castro, 2002; Castro and Casullo, 2001) and for university students (Domínguez-Lara and Merino-Soto, 2018).

Therefore, the aim of the present study is to analyse the degree of self-efficacy of teacher competencies acquired by MUFPS students, taking into account ICT learning, mediated by the main personality traits.

2. Methods

The study is descriptive, quantitative, correlational, and transversal (Montero and León, 2007).

2.1. Participants

A total of 241 students took part in the study, selected according to the criteria of currently being enrolled on the MUFPS course at the University of Castilla-La Mancha (UCLM), as part of the 2019–2020 cohort. Of these, 105 were male, between the ages of 20.30 and 59.60 years (M = 28.46; SD = 6.98), and 136 female, aged between 20.30 and 57.40 years (M = 27.99; SD = 6.90). The sample has a similar distribution of men (43.6%) and women (56.4%). Access to the course came via doctoral degree (2), master's degree (46), bachelor's degree (160), graduates (30) or an entrance exam (3).

2.2. Instruments

To evaluate the self-efficacy of the students' teacher competencies, the Van Dinther et al. (2013) scale was used (CFI = .918; RMSEA [90%] = .061), made up of six factors (interpersonal competence (INT) = .736; pedagogical competence (PED) = .784; subject knowledge and methodological competence (SKM) = .856; organisational competence (ORG) = .882; competence for collaboration with tutors (COL) = .804; competence for reflection and development (REF) = .887), and 22 items (INT = 2; PED = 4; SKM = 5; ORG = 4; COL = 3; REF = 4). Response options were on a scale of 0– 100, where 0 = not at all true, 50 = moderately true, and 100 = completely true. For example: INT = 'I have seen what has happened in the classroom. I have encouraged positive behaviour'; PED = 'I have shown my interest in each student'; SKM = 'I have used varied learning activities and I have motivated students'; COL = 'I have been conscious of differences in the cultural background of my internship tutor and other tutors. I have been open to their advice'; REF = 'I have asked for advice from others to support my development. I have reflected critically on my learning process'.

To evaluate the impact of ICTs on learning in terms of knowledge construction and cognitive improvement among students, we used Tumino and Bournissen's (2019)

bifactorial scale, which includes a learning factor (items 1, 2, 4, 8, 10, 12, 13 and 14) and a learning strategies factor (items 3, 5, 6, 7, 9, 11, 17, 18, 19 and 20), using the Varimax rotation. Kaiser-Meyer-Olkin = .946 and Bartlett's test of sphericity $p < .05$, showing the suitability of the sample for analysis. Cronbach's alpha coefficient = .9 for both factors. Response options are on a Likert-type scale with five options: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. For example, for the learning factor, the following statement was posed: 'The use of technological tools stimulated greater interest in practices', and for the learning strategies factor: 'The use of ICTs in practices helped my approach to the subject matter'.

To evaluate the students' personality traits, we used the BFI-10 questionnaire (CFI = 1.000; RMSEA [90%] = .000 [.000,.057]) for university students. Rammstedt and John (2007) show that this instrument has high levels of reliability and validity, being adjusted for acquiescence. It evaluates five personality traits, with the following internal consistency: extraversion (E) = .775; agreeableness (A) = .732; conscientiousness (C) = .780; neuroticism (N) = .779; openness (O) = .786. It consists of 10 items (two per factor, one for each pole of the dimension), with two descriptors each. The response options are presented on a Likert-type scale with five choices, ranging from 1 = strongly disagree to 5 = strongly agree. Examples of items per factor include: 'I see myself as someone who is reserved' (E); 'I see myself as someone who is generally confident' (A); 'I see myself as someone who does a thorough job' (C); 'I see myself as someone who relaxes, who copes well with pressure' (N); 'I see myself as someone who has an active imagination' (O).

2.3. Procedure

The questionnaire was sent via email to the MUFPS students at the end of their external placement module. It was completed in a single session, with no time limit. Prior to responding to the questionnaire, students were informed about the aims of the study, guaranteeing the confidentiality of results, and emphasising the voluntary nature of participation. In addition, they were told about the ethical standards of the study through an informed consent form, adhering to the ethical principles of the Declaration of Helsinki (2015).

2.4. Data analysis

SPSS version 26.0 (2019) was used to carry out the data analysis for the descriptive statistics, and Pearson correlations to determine which personality traits could be mediators in the models. Twelve mediation models were tested using the personality variables that showed a significant relationship with the six competence factors. Each of the six mediation models was repeated separately using ICT learning and strategies as predictors.

To maintain statistical strength, without the need to assume multivariate normality in the sample distribution, a bootstrap analysis was carried out to calculate the indirect effects of the mediations (Mallinckrodt et al., 2006).

3. Results

Table 1 shows the results of the Pearson correlation analysis. As can be seen, this shows that the acquisition of teacher competencies is significantly and positively correlated with the impact of ICT learning in both factors. The correlation with the highest value is subject knowledge and methodological competence with ICT learning (r = .574, p = .00) and with ICT learning strategy (r = .631, p = .00). The correlation with the lowest value is competence for collaboration with tutors with ICT learning (r = .421, p = .00) and with ICT learning strategy (r = .438, p = .00). In terms of personality traits, conscientiousness, neuroticism, and openness correlate positively with teacher competencies collectively, while extraversion shows a negative correlation. The highest value is for subject knowledge and methodological competence with conscientiousness (r = .187, p = .00), and the lowest value is for pedagogical competence with extraversion (r = -.140, p = .00). Finally, personality traits such as conscientiousness and openness correlate positively with ICT learning, with conscientiousness having the highest value (r = .184, p = .00) and extraversion the lowest (r = -.162, p = .00). With regard to ICT learning strategy, openness has the highest value (r = .171, p = .00) and neuroticism the lowest (r = .137, p = .00).

Table 1. Results of the correlation analysis.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Learning												
2. Strategies	,890**											
3. Interpersonal	,553**	,609**										
4. Pedagogical	,487**	,572**	,807**									
5. Knowledge	,574**	,631**	,830**	,879**								
6. Organisation	,487**	,563**	,764**	,842**	,886**							
7. Collaboration	,421**	,438**	,487**	,611**	,665**	,699**						
8. Reflection	,535**	,561**	,657**	,713**	,744**	,756**	,708**					
9. Extraversion	-,162*	-,154*	-,140*	-,125	-,161*	-,186**	-,045	-,114				
10. Agreeableness	,026	-,009	,033	,032	,010	,050	,040	,100	,296**			
11. Conscientiousness	,184**	,153*	,096	,173**	,187**	,149*	,241**	,152*	-,368**	-,195**		
12. Neuroticism	,122	,137*	,141*	,173**	,174**	,186**	,155*	,153*	-,385**	-,235**	,470**	
13. Openness	,167**	,171**	,024	,155*	,148*	,149*	,141*	,175**	-,292**	-,106	,570**	,336**

*** p < .001, ** p < .01, * p < .05

A total of 12 mediation models were calculated. For each of the six competency factors, the two ICT factors (learning and strategies) were used as predictors. The mediators were those variables that showed a significant relationship in the previous analysis (Table 1). The only model that showed partial mediation was competence for collaboration with tutors, predicted by ICT learning, mediated by conscientiousness (IC [0.13 – 0.44]) (Table nº 2).

Table 2. Mediation models.

Independent variable	Mediating variable	Dependent variable	Effect of I on M	Effect of M on D	Total effect	Direct effect	Indirect effect	
I	M	D	(a)	(b)	(c)	(c')	Li (c')	Ls (c')
Learning	Extraversion	Interpersonal	-0,22*	-0,98	14,62**	14,85**	-0,22	0,88
	Extraversion		-0,21*	0,59			-0,33	0,75
Strategies		Interpersonal			16,03**	16,33**		
	Neuroticism		0,2	0,87			-0,28	0,77
	Conscientiousness		0,28**	1,02			-0,26	0,98
Learning		Pedagogical			11,83**	12,29**		
	Openness		0,26**	0,64			-0,43	0,82
	Conscientiousness		0,23*	0,81			-0,14	1,23
Strategies	Neuroticism	Pedagogical	0,2	1,22	13,93**	14,40**	-0,19	0,87
	Openness		0,27**	0,12			-0,57	0,63
	Extraversion		-0,22*	-0,76			-0,25	0,84
Learning	Conscientiousness	Knowledge	0,28**	1,01	13,23**	13,72**	-0,23	1,03
	Openness		0,26**	0,07			-0,59	0,57
	Extraversion		-0,21*	0.26***			-0,31	0,67
	Conscientiousness		0,23*	0.21			-0,17	0,9
Strategies		Knowledge			14,62**	15,06**		
	Neuroticism		0,2	0.21			-0,25	0,72
	Openness		0,27**	0.21			-0,68	0,39
	Extraversion		-0,22*	-1,67			-0,1	1,19
Learning	Conscientiousness	Organisation	0,28**	0,08	11,24**	11,81**	-0,58	0,7
	Openness		0,26**	0,61			-0,45	0,73
	Extraversion		-0,21*	-1,19			-0,19	0,97
	Conscientiousness		0,23*	-0,6			-0,54	0,53
Strategies		Organisation			13,07**	13,63**		
	Neuroticism		0,2	1,39			-0,12	0,86
	Openness		0,27**	0,16			-0,53	0,59
	Conscientiousness		0,28**	2,43*			0,13	1,44
Learning		Collaboration			7,95**	8,54*		
	Openness		0,26**	0,66			-0,68	0,28
	Conscientiousness		0,23*	0,16			-0,12	1,05
Strategies	Neuroticism	Collaboration	0,2	0,82	12,11**	12,53**	-0,24	0,7
	Openness		0,27**	0,81			-0,3	0,75
	Conscientiousness		0,28**	0,14			-0,51	0,54
Learning		Reflection			11,60**	11,95**		

Independent variable	Mediating variable	Dependent variable	Effect of I on M	Effect of M on D	Total effect	Direct effect	Indirect effect	
I	M	D	(a)	(b)	(c)	(c')	Li (c')	Ls (c')
	Openness		0,26**	1,16			-0,19	0,9
	Conscientiousness		0,23*	0,16			-0,47	0,51
Strategies	Neuroticism	Reflection	0,2	0,82	12,11**	12,53**	-0,22	0,68
	Openness		0,27**	0,81			-0,29	0,74

*** p < .001, ** p < .01, * p < .05

4. Conclusión

The acquisition of all teacher competencies correlates significantly and positively with the impact of both components of ICT learning (learning and strategies) in the MUFPS training programme, since ICT learning contributes to knowledge construction and cognitive improvement among students (Balas-Nakash et al., 2010; Tumino and Bournissen, 2019; Riascos-Erazo, Quintero-Calvache and Ávila-Fajardo, 2010). Logically, subject knowledge and methodological competence stands out since this is where the usefulness and ease of use of ICTs is perceived. This perception turns into a positive attitude towards the future incorporation of ICTs in the professional environment (Abarca, 2015; Coscollola and Fuentes, 2010; Edmunds, Thorpe and Conole, 2012; Peinado and Navarro, 2014; Silva, Usart and Lázaro-Cantabrana, 2019).

The analysis of personality traits shows that conscientiousness, neuroticism, and openness correlate positively with teacher competencies collectively, including interpersonal competence, pedagogical competence, subject knowledge and methodological competence, organisational competence, competence for collaboration with tutors and competence for reflection and development, with the highest value being found for subject knowledge and methodological competence with conscientiousness. These are relevant aspects, given that being conscientious or able to control one's impulses, being self-disciplined and highly capable of organisation, being sensitive to threats, having an active imagination, having an aesthetic sensitivity, paying attention to feelings, showing a preference for variety and possessing intellectual curiosity all grant the MUFPS students certain qualities that will allow them to act in a certain way, setting themselves apart from other professionals, suggesting a prosperous future. It is understood that although personality is shaped by temperament, personality traits can be modified through learning (Lamb and Bornstein, 1987).

Forms of learning, the type of professional environment and personality traits all interact and influence one another (Segura, 2022; Zhang, 2004). Hence, discovering and putting into practice the importance of being conscientious and determined, or being sensitive to threats and being open to new experiences, are dimensions that identify the future teacher (Van Dinther et al., 2013; Del Valle and Rodriguez, 2017).

In fact, the behaviour of the future teacher will be the outcome of the interaction between the person and the environment, following Bandura's triadic model (1997). Therefore, it may be said that demonstrating desirable personality traits

to student teachers may be a valuable aspect in the development of teacher competencies in the MUFPS training programme, since it is thanks to personality that a person is able to enact behaviours and to understand the different behaviours of others (Phares, 1996). Furthermore, personality traits such as conscientiousness and openness correlate significantly with ICT learning.

Going deeper into the analysis, of the 12 mediation models, the only one that showed partial mediation was competence for collaboration with tutors, predicted by ICT learning, mediated by conscientiousness, applicable in the sphere of education. The fact that more mediation models were not found may be because correlation is used to analyse the role of some variables that are not always clear (Jiménez et al., 2007). In many studies, personality traits are not always consistent with the variables that they relate to in the field of education. It is possible that the instrument used to analyse personality traits was not suitable and that we need to design a questionnaire that meets the needs of the work sphere. However, it is true that mediation was carried out to find out whether the analysis provided relevant information. Moreover, theoretical models in which a large number of variables are linked are very often contrasted, but frequently without being explicit in terms of the statistical relationships between the variables included (beyond their sign), meaning the mediation effect can be theoretically assumed. This is especially true in pedagogical interventions where, given the difficulties in experimental application, analysis of the relationships between variables can give important suggestions for interventions.

We will continue to study how to relate teacher competencies, ICT learning and personality traits, with the aim of finding a model that responds to the variables that form an excellent and effective teacher. It is only by contrasting the variables involved in the practical context that we can create training programmes for future secondary education, high school, professional training, and language teachers.

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ARTICLE

Recommendation System model integrated with Active Methodologies, EDM, and Learning Analytics for dropout mitigation in Distance Education

Um modelo de Sistema de Recomendação integrado a Metodologias Ativas, MDE e Learning Analytics para a mitigação de evasão em EaD

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Abstract: Distance Education enabled educational practices based on digital platforms. Despite its wide adoption, the high dropout rates are a reason for concern for teachers and institutional managers. There are initiatives to mitigate this situation, such as Educational Data Mining (EDM), Learning Analytics (LA), and the use of Recommendation Systems (RS). Although effective in specific aspects, these techniques lack mechanisms for students' motivation and pedagogical intervention by teachers, as they do not present methodological proposals to encourage learning. Therefore, this article describes an RS model that shows a differential integration of the pedagogical approach of Active Methodologies with the support of Educational Data Mining and Learning Analytics techniques to identify students with dropout risks and enhance permanence. For this, a prototype was implemented, and a case study was carried out with professors from two universities to assess functionality and acceptance. According to the TAM Model, more than 87% of teachers agree with the ease of use, and 77% agree that RS can be helpful in students' teaching and learning process. Therefore, the model contributes to teaching practices, encourages collaborative learning, and favors monitoring this process and the activities developed by the students.

Keywords: Recommendation System, Active Methodologies, Educational Data Mining, Learning Analytics, Dropout.

Resumo: A Educação a Distância possibilitou práticas educacionais baseadas em plataformas digitais. Apesar de sua ampla adoção, os altos índices de evasão são motivos de preocupação de professores e gestores institucionais. Existem iniciativas para mitigação desta situação, como a Mineração de Dados Educacionais (MDE), Learning Analytics (LA) e o uso de Sistemas de Recomendação (SR). Apesar de efetivas em aspectos específicos, estas técnicas carecem de mecanismos para a motivação dos alunos e intervenção pedagógica dos professores, pois não apresentam propostas metodológicas para incentivar a aprendizagem. Diante disso, esse artigo descreve um modelo de SR que apresenta como diferencial a integração da abordagem pedagógica das Metodologias Ativas com o suporte das técnicas de Mineração de Dados Educacionais e de Learning Analytics para identificar os alunos com riscos de evasão e potencializar a permanência. Para isso, foi implementado um protótipo e realizado um estudo de caso com docentes de duas universidades para a avaliação de funcionalidade e aceitação. De acordo com o Modelo TAM, mais de 87% dos docentes concordam com a facilidade de uso e 77% concordam que o SR pode ser útil no processo de ensino e aprendizagem dos alunos. Portanto, pode-se concluir que o modelo contribui para as práticas de ensino, incentiva a aprendizagem colaborativa e favorece o acompanhamento desse processo e das atividades desenvolvidas pelos alunos.

Palavras-Chave:: Sistema de recomendação, Metodologias ativas, Mineração de dados Educacionais, Analítica da aprendizagem, Evasão.

1. Introduction

The high dropout rate of students in courses offered in the Distance Education modality worries educational institutions managers and teachers, who are looking for alternatives to identify situations likely to give up and motivate students to remain in their studies. In this context, some studies use Educational Data Mining (EDM) and Learning Analytics (LA) techniques to identify students likely to drop out of the course (Marques et al., 2019). However, they are restricted to identifying these possibilities without subsequent effective action in this scenario (Widyahastuti & Tjhin, 2018). After identifying the dropout tendency, the decision-making to mitigate this problem usually depends on the teacher or manager, who needs to use educational methodologies to rescue and encourage the student to remain in the course.

Active Methodologies are pedagogical approaches in which students participate as protagonists of the learning process, encouraged to relate to colleagues for the development of activities, and collaborating for the intellectual growth and improvement in the performance of those involved (Guo et al., 2018). One of the dropout prevention hypotheses in Distance Education is the use of Active Methodologies integrated with Recommender Systems (RS) and Virtual Learning Environments (VLE) in order to help teachers in the teaching and learning process and reduce the dropout rates, enhancing permanence (Chandrasekaran et al., 2016; Leite & Ramos, 2017; Lima & Siebra, 2017; Leite et al., 2019).

Studies performed by Chandrasekaran et al. (2016) and Leite & Ramos (2017) assess that the integration of Active Methodologies to RS can be an effective retention mechanism, expanding the potential for student engagement and learning sharing (Lima & Siebra, 2017; Leite et al., 2019). Once the cases associated with dropout risks due to EDM and LA are identified, the Active Methodologies encourage student collaboration through various resources, from recommended reading materials to interaction with the virtual environment, engaging and stimulating them and regarding your learning. Therefore, this would be a resource that, according to Cunha & Siebra (2016), can contribute to collaborative learning and act to mitigate dropout. However, according to Leite et al. (2019), the use of Active Methodologies still needs to be observed in Distance Education.

Given this context, this article presents a proposal for integrating Active Methodologies with EDM and LA to mitigate dropout risks and enhance student permanence. To this end, an RS model was developed, which stands out for integrating the pedagogical approach of Active Methodologies with the support of EDM and LA techniques. The main difference of this work is integrating a motivational step into the students' work, using Active Methodologies for this.

This article is organized into 4 sections. Section 2 proposes an RS model integrated with Active Methodologies with support from EDM and LA, the tools for development, and the case study. Section 3 presents the results obtained from the evaluations and the critical analysis of the proposal. Finally, section 4 includes conclusions and suggestions for future work.

1.1. Related Works

This section presents works by other researchers who address the use of Active Methodologies, EDM, LA, and RS in the context of Distance Education courses. Given the study, the possibility of expanding the use of technologies and methods in this area was verified.

According to Ferreira et al. (2017), Moraes & Stiubiener (2019), and Leite et al. (2019), it is possible to verify a growth in scientific productions on RS, which is justified by the difficulty of selecting resources for teaching-learning in the face of excellent availability. Campos et al. (2017) cited several examples of RS, such as PMoodle, Broad-RSI, CA-Learning, LORSys, Dica, Mobile, e-Lors, RecoaComp, and RS Collaborative Móvel, among others. Rolim et al. (2017) presented a system capable of classifying, through machine learning, student postings in VLE forums and recommending auxiliary study material available as YouTube videos. Acosta et al. (2018) developed a system that uses Project-Based Learning as a teaching method focusing on the student and collaboration between peers, capable of suggesting complementary materials from activities proposed by the teacher in that same environment. Ferreira et al. (2015) developed a content recommendation model called UbiGroup for learners to recommend Learning Objects (LO) according to the profiles and context that are inserted, supporting the teacher in the search and selection of materials.

Regarding EDM and LA, research approaches such as techniques, algorithms, and attributes are the most frequent themes in the studies studied. Classification and prediction techniques are widely used to analyze students' learning behavior and performance, as presented in the works by Ramos et al. (2018), Kostopoulos et al. (2019), and Queiroga et al. (2019), enabling timely and effective interventions to mitigate dropout. Regarding algorithms, Random Forest and Logistic Regression are used for predicting and detecting dropout risks in the works of Ramos et al. (2017), Queiroga et al. (2019), and Waheed et al. (2020). Finally, regarding search attributes, Kostopoulos et al. (2019) investigated demographic data, which represent the profile characteristics of students; Santos et al. (2016), Ramos et al. (2018), and Brito et al. (2019) explored performance data, such as grades obtained in questionnaires and assessments.

The use of Active Methodologies is expanding in face-to-face teaching and distance education, as it has the potential to make classes more exciting and modern (Almeida et al., 2020; Leite & Ramos, 2017; Fernández-Robles et al., 2019). Lima et al. (2020) found that 76.7% of teachers sought to improve their teaching methods using Active Methodologies. Chandrasekaran et al. (2016) showed that 67% of respondents felt comfortable using the methodology in the learning process, as it offers the student the opportunity to express individual experiences, share ideas in groups, promotes the development of social skills for those who have difficulty teacher-centered learning, assigns much of the responsibility for learning to the teacher, and enriches them with aspects of critical thinking and problem-solving. In addition, it stimulates autonomy and interaction, encouraging them to learn from each other and to perceive and develop self-learning and communication in work groups. As for the teacher, he helped in the teaching and learning process, making him more proactive and capable of improving student performance with actions that minimize the dropout risk.

No examples of Active Methodologies integrated with EDM and LA techniques were found. Consequently, none of the works considered integrating these techniques into Active Methodologies in an RS that could help the teacher in teaching and benefit student learning. Given this and to propose practical actions to mitigate dropout, it is considered that the insertion of these methodologies together with RS, EDM and LA techniques allows for an advance in the process of personalization and improvement of teaching and learning since students are identified according to their work history and with that the RS carries out a process in which it recommends and instigates the use of LO and the reading of complementary materials, encouraging communication and interaction between users and the virtual environment, autonomy and self-learning, and in groups, stimulating collaborative and pedagogical practices.

2. Method

In order to qualify to learn and contribute to mitigating dropout risks in Distance Education, an RS model was developed that integrates Active Methodologies with EDM and LA techniques.

2.1. General description of the proposed model

The proposed model involves a set of steps that are performed in an integrated manner and differ in resource availability, supporting students and teachers. Figure 1 illustrates the overview of the RS model from the professor's point of view, which involves integrated functioning with Active Methodologies, EDM, and LA.

The Course and Discipline module registers the name of the course, discipline, academic period offered, and the number of enrolled students. The Connection module has two functionalities to be chosen by the teacher. The first, EDM, integrates the VLE database and the Academic System (AS) to access demographic data, academic profile records, and average performance in student activities. Once obtained, the supervised learning technique is used with the Random Forest (Breiman, 2001) and Naive Bayes (Lewis, 1998) algorithms to generate trend patterns to be observed. The second feature makes it possible to use the scoreboard extracted from the VLE with demographic and performance data.

The Ranking module involves classifying students in descending order according to the average of the evaluation activities. The Active Methodologies module allows the teacher to choose the number of students per group and the learning strategy. Some of the possible examples are: (i) Problem-Based Learning – PBL (Silva & Silva, 2020), (ii) Flipped Classroom – FC (Bergmann & Sams, 2016), or (iii) Peer Instruction – PI (Araújo & Mazur, 2013). The choice must be made at each performance of the evaluative activities since it directly interferes with the average of the discipline and, consequently, the formation of the groups. This module aims to assist in developing various skills and abilities that are increasingly required in the contemporary world.

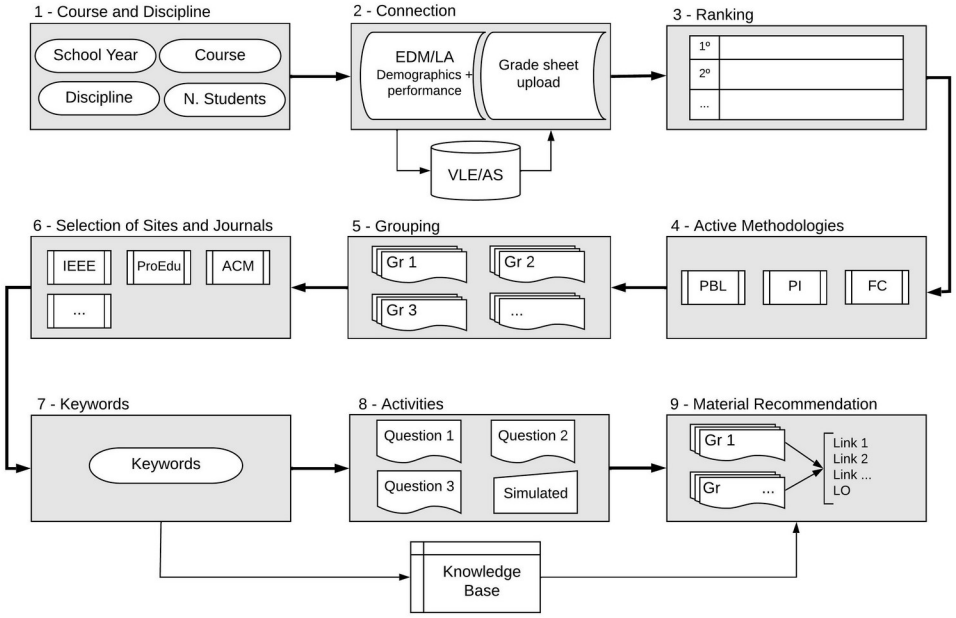

Figure 1. RS model integrated with Active Methodologies, EDM, and LA, from the teacher's point of view

The Grouping module allows the teacher to obtain support in forming groups of students, and according to Pallof & Pratt (2002), when students work collaboratively, they tend to produce more profound knowledge as they cease to be independent to become interdependent.

The Sites and Magazines Selection module allows the teacher to choose magazines or national sites such as Public Domain Portal, International Bank of Educational Objects, ProEdu, EduCAPES, and the international ones IEEE, ACM, Scielo, Merlot, Google Scholar, for the search of complementary materials for reading and improvement, such as articles, videos, and LO. The Keywords module consists of registering keywords related to the subject's content, used to search for complementary materials. The Activities module proposes the registration of research questions or problems for the resolution of the formed groups, with support through the reading of the complementary materials and the performance of the simulated activities registered in this stage as reinforcement activities.

The Material Recommendation module selects complementary materials and Learning Objects returned by the search algorithms implemented through the BeautifulSoap technology, according to the registration of keywords and an indication of websites and magazines. The teacher can mark among the results the material that will be presented in the RS at the student's level of vision, forming a knowledge base for future suggestions. The RS allows viewing and extracting reports that demonstrate the participation and execution of activities by members of the groups through access log data and verification of completion of activities. In this work, the Hybrid RS model is used, which collects user information for explicit or implicit recommendations, records, and interactions. A definitive collection of user data occurs when users know they are providing their information, which is what is used in this work. Implicit user data collection indirectly accesses information about the user.

Figure 2 shows the components available to the student, composed of a set of integrated modules displayed in a single interface.

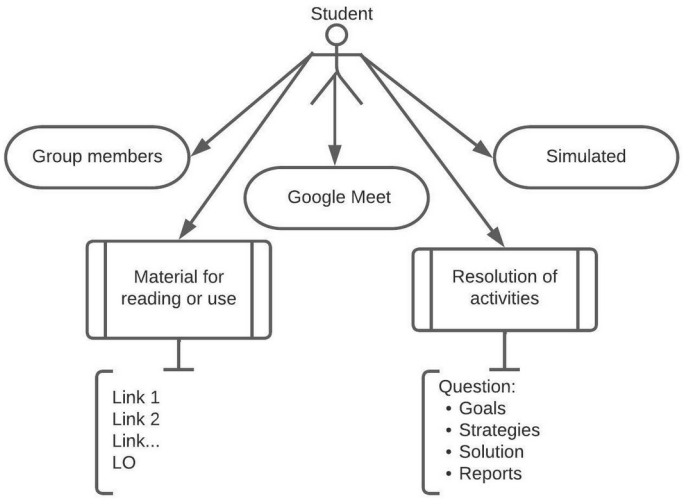

Figure 2. RS integration model, from the student's point of view.

The Group Members module displays the name and contact e-mail of all participants in the group, defined according to the criteria established by the teacher and groupings performed by the RS. The Online Meetings module allows web conferences to be held at any time via a communication platform (for example, Google Meet), which can be shared by group members and other guests, including the subject's teacher, in order to monitor development and encourage the exchange of experiences, learning, and discussion of doubts.

The Simulated module allows access to activities registered by the teacher to reinforce learning. For this, students can also count on the Online Meetings module, which allows web conferences to resolve and share knowledge. The Materials for Reading or Use module presents links to articles or LO previously selected by the teacher on websites and national and international magazines. These serve as a theoretical/practical basis for solving the activities.

The Activities module for realization presents questions or problems the teacher defines for the group to solve. It is required to fill in the objectives, strategies, and solutions and post a descriptive report of the activities carried out. It is emphasized that these can be carried out individually and at any time. However, it is essential to highlight that the reports present access records via log that demonstrate the participation and execution of activities by group members.

2.2. Implementation

Based on the proposed model, an RS prototype was developed following the Model-View-Controller (MVC) architectural pattern, with the Python programming language, the Django and BootStrap Frameworks, the JQuery and BeautifulSoap Libraries, and, as a database, SQLite.

Figure 3 shows the RS components with the teacher and student module based on the integration models in Figures 1 and 2. The teacher's interface needs to connect the VLE and AS database to collect demographic and performance data right after the first evaluation of the subject offered. In this interface, it is necessary to consult the databases of websites and national and international electronic journals to identify complementary materials and learning objects that will be recommended to students. In the student's interface, the data presented are the results of registrations made by the professor and queries to external databases.

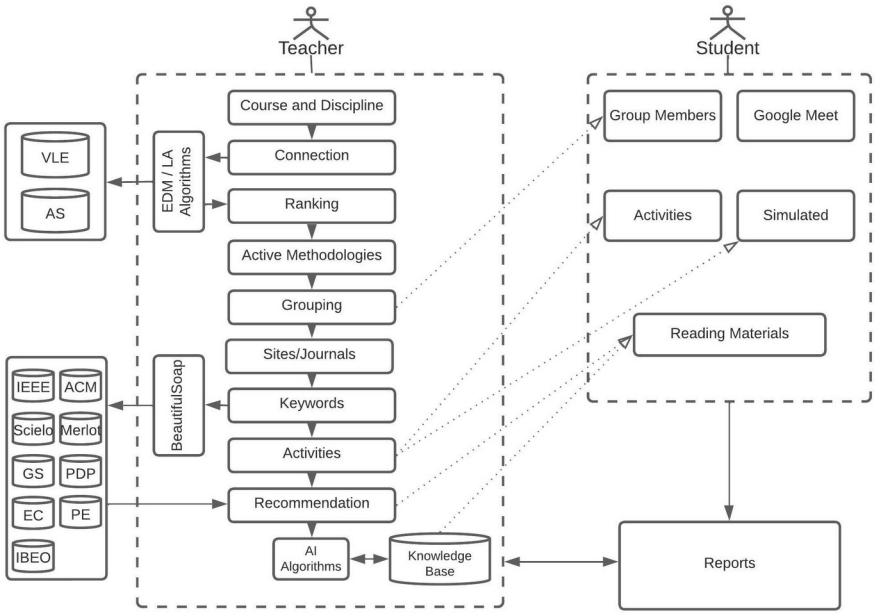

Figure 3. RS Components.

Initially, a standard interface requires registration and authentication for faculty or student users, followed by filling in personal data and identifying the profile. After access, in the professor's interface, it is possible to register, view and edit the data of the discipline offered; in the student's interface, view the linked disciplines and contents registered by the professor. For the demonstration, a case study was carried out.

2.3. Case study

After the development of the RS prototype, a case study was carried out with professors from two universities in Brazil to obtain the application's evaluative results. "It is a research method that generally uses qualitative data, collected from real events, to explain, explore or describe current phenomena inserted in their context" (Yin, 2015).

The first evaluation consisted of verifying the functionality and presentation of the RS interfaces by a guest professor from the Bachelor of Science in Computer Science course. The second they were focused on acceptance of the RS. For that, a video with examples of application use and a questionnaire containing ten statements with a quantitative approach was made available to professors from different areas of

knowledge at two universities invited by email. The answers were collected through the Google Form tool. The evaluation was based on the concepts of the TAM Model - Technology Acceptance Model (Marangunié & Granié, 2014; Pinto et al., 2019), which evaluates: a) Perceived Ease of Use - the degree to which a person believes that using an information system will be effortless; b) Perceived Usefulness – the degree to which a person believes that using a system can improve their performance. According to Pinto et al. (2019), the TAM Model is considered one of the essential methods researchers use to describe the acceptance of a given technology, as it indicates the influence of human factors on adopting new tools.

Table 1. Assessment Questionnaire

Assessment	Affirmation
Perceived Ease of Use	1. RS is easy to understand
	2. RS interface information is clear
	3. It is possible to use little effort the resources available in the RS
	4. RS reproduces material recommendation functionality
	5. RS service integration provides a more agile and enjoyable way of working
Perceived Usefulness	6. RS facilitates the use of Active Methodologies
	7. The RS favors the formation of groups of students for the practice of collaborative teaching
	8. The use of the RS facilitates the teacher's work in the task of recommending complementary materials
	9. The use of RS can help to mitigate the risks of dropping out of school
	10. I would use RS for the teaching and learning process

Responses were standardized on a five-point Likert scale, ranging from "Strongly Agree", "Agree", "Neither Agree nor Disagree", "Disagree", and "Strongly Disagree". Table 1 presents statements from 1 to 5 about ease of use and 6 to 10 about perceived usefulness.

Assessments involving students and teachers in a regular context were not carried out due to the impossibility of the period of the Covid-19 pandemic that occurred in 2020 and 2021.

3. Results

In order to show the results, the answers were divided according to evaluation criteria. The first, which consisted of checking the functionalities and interfaces, was carried out by a professor who teaches Introduction to Databases to a class of 30 students. The second evaluation, referring to the acceptance of the RS, involved 13 teachers.

3.1. Evaluation of RS functionality and interfaces

Figure 4 shows the first stage of the RS, which consists of registering data for the course and discipline offered by the teacher. The academic period defined was 2021/1, Bachelor's Degree in Computer Science, subject Introduction to Databases, and the number of 30 students.

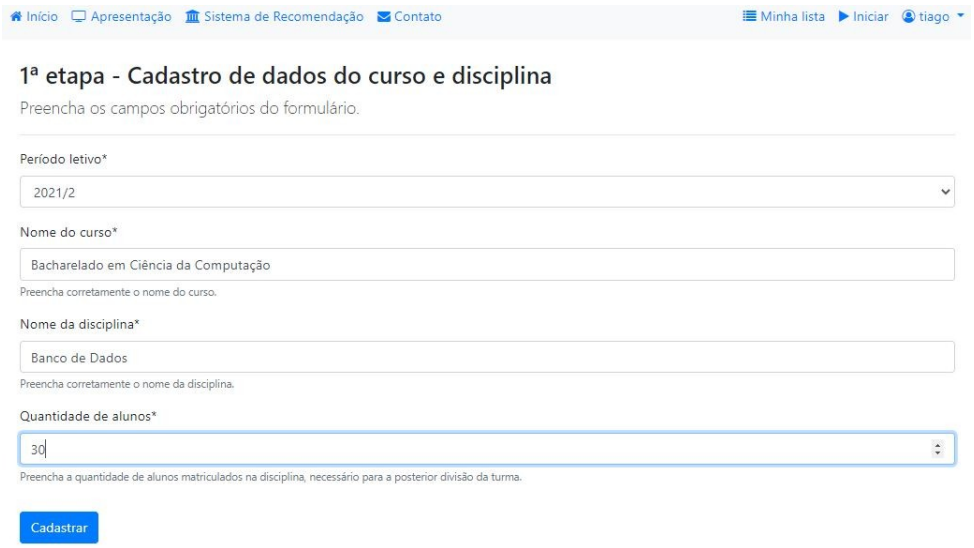

Figure 4. Course Data Registration module interface.

Figure 5 shows the Connection module interface, the second stage of the RS, in which the teacher can choose between searching for demographic and performance data in the institution's AS and VLE for the EDM and LA or uploading the VLE grade table. In this case, an upload containing enrolled students' demographic and performance data was carried out.

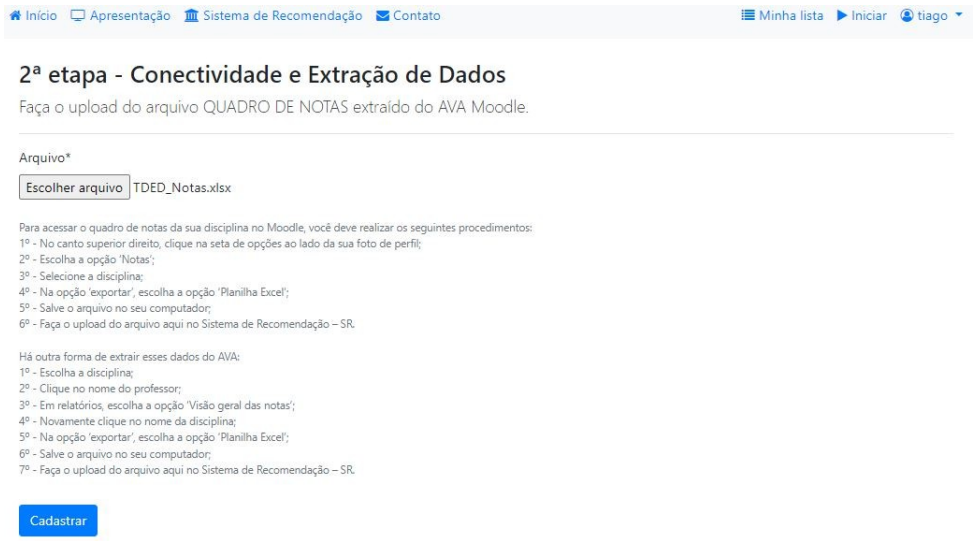

Figure 5. Connection module interface.

In the third step, the Ranking module, students were classified in descending order and displayed in a list to the teacher containing first name, last name, email address, and student grade before and after classification, as shown in Figure 6.

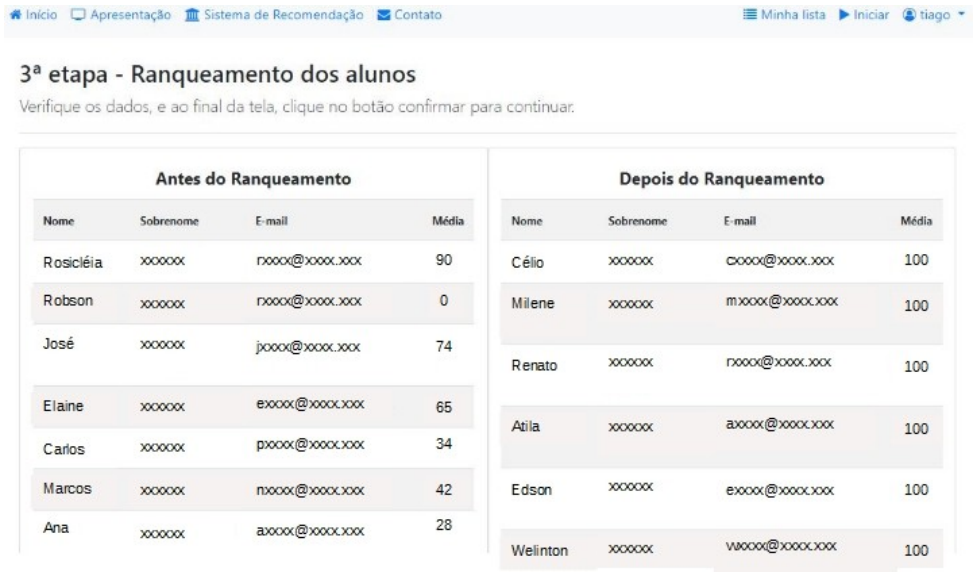

Figure 6. Ranking module interface.

The Active Methodologies module allows the teacher to choose the teaching method. In this case, the methodology chosen was Problem-Based Learning (PBL), and the number of 5 students per group, as shown in Figure 7, which according to Alves et al. (2020), tends to privilege students' prior knowledge, encouraging an investigative learning environment through the construction of hypotheses and experiments.

Figure 7. Active Methodologies module interface.

After ranking the students, the Grouping module shown in Figure 8 is responsible for forming groups as defined in the previous step by the teacher, with the presentation of the members and their respective contacts, who will have activities to be carried out and will have the indication of materials for reading and LO.

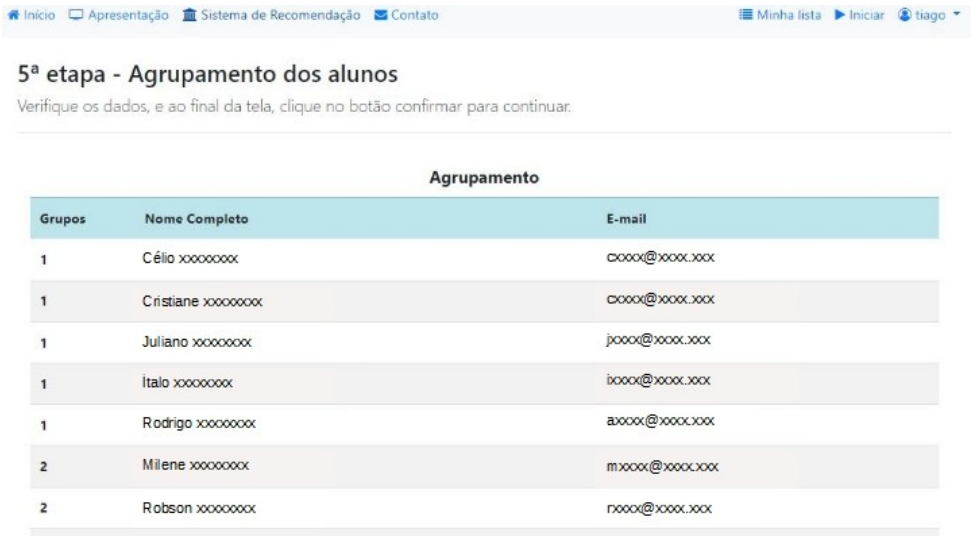

Figure 8. Grouping module interface.

Figure 9 shows the interface of the Sites and Magazines Selection module, in which the teacher can choose which databases the RS should search for complementary materials that will be recommended for reading or learning. This choice can be from one or several websites and magazines, at the teacher's discretion, and in English or Portuguese. In this case, Figure 9 shows the selection of the IEEE – Institute of Electrical and Electronics Engineers database.

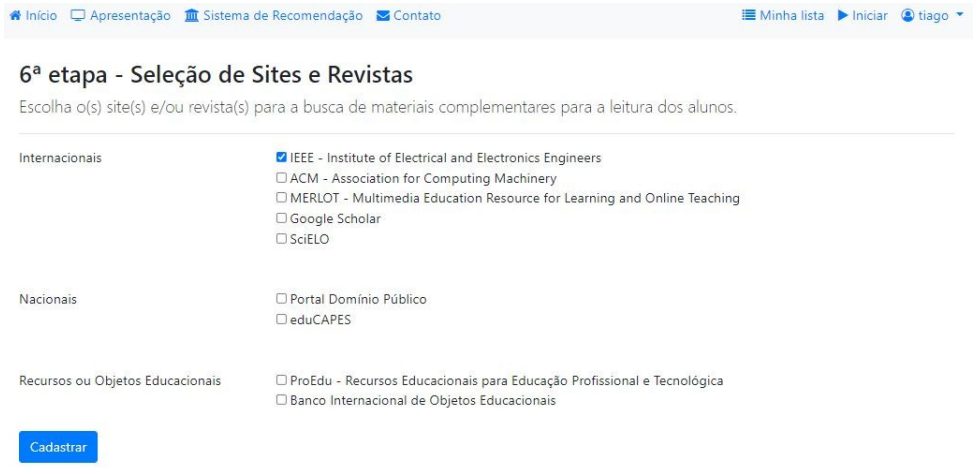

Figure 9. The site and Journal Selection module interface.

About Figure 10, the Keyword Registration module allows the inclusion of three terms that will be used for the search for materials. In this case, the words "education data mining," "dropout," and "distance education" were registered by the teacher in the RS.

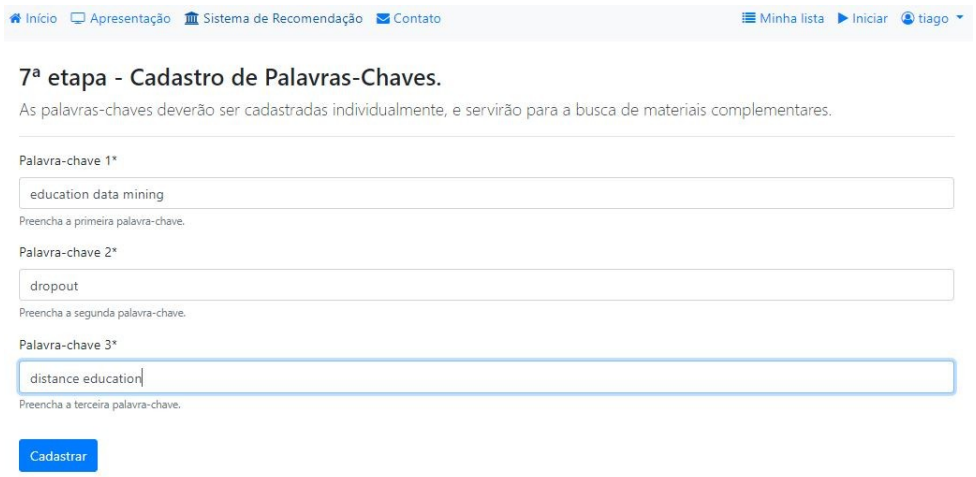

Figure 10. Keywords module interface.

The Activities module allows the teacher to register questions/problems and simulations for the students to solve according to the defined Active Methodologies. As the case study chosen was PBL, the teacher defined 3 questions/problems and a simulation referring to the content addressed for the students to solve, as shown in Figure 11.

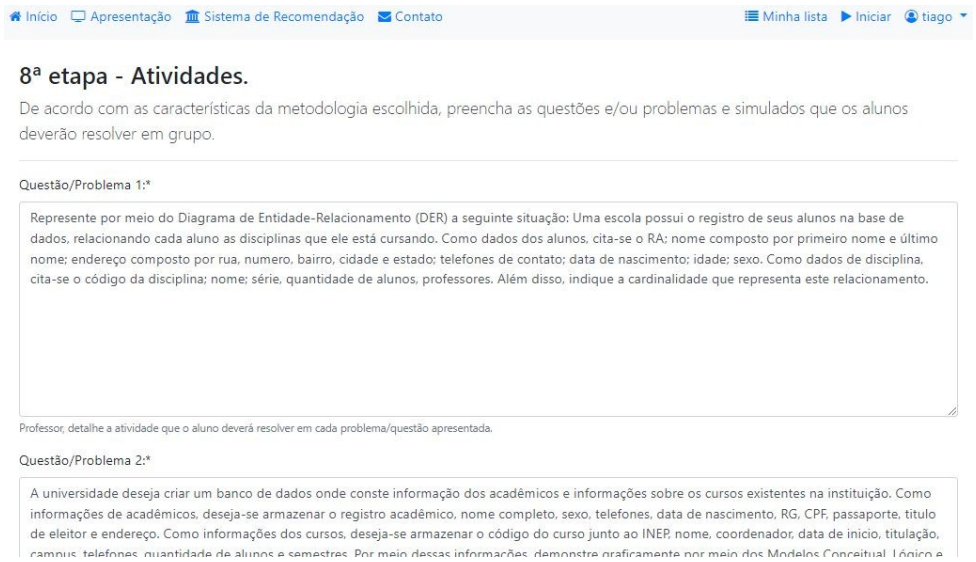

Figure 11. Activities module interface.

Finally, Figure 12 shows the result of the complementary materials for reading or learning objects obtained through the BeautifulSoap Library and keywords registered by the teacher in the indicated websites and magazines. Note that each material contains the name of the consulted database, the title of the work, and the access link, as well as a functionality that allows the teacher to choose whether or not to display the material returned to the groups of trained students.

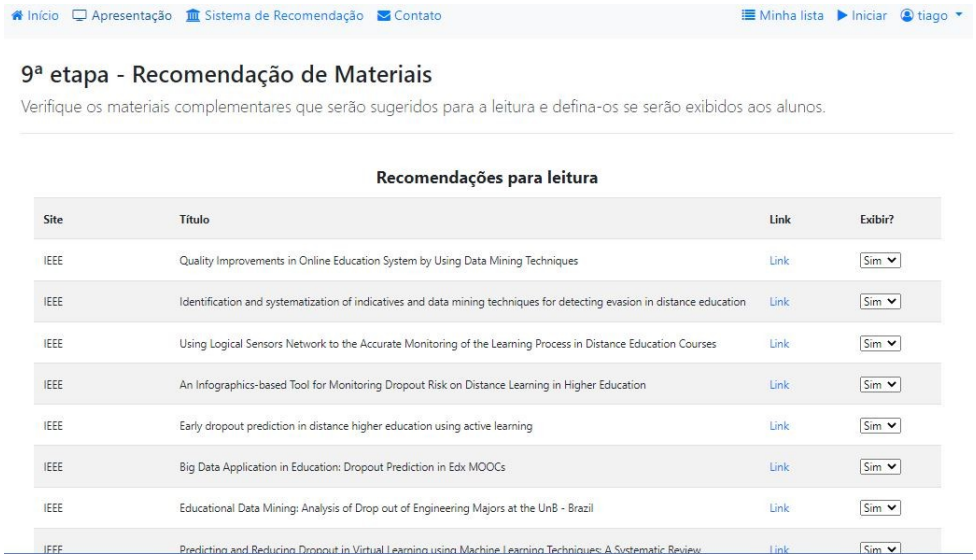

Figure 12. Material Recommendation module interface.

Given this, through the case study, it was possible to use and test the functioning of the model according to the proposed objectives, promoting the indication of complementary materials for the study of groups of students formed after

the identification by EDM and LA rules and that, as a pedagogical practice, it proposes the use of Active Methodologies with potential for collaboration and exchange of experiences and knowledge among students.

Figure 13 shows the student's interface, where the other members of the group are introduced to him; the Google Meet link for holding online meetings; simulated testing activities; materials for reading or use, such as articles and learning objects; and the activities proposed by the teacher for the accomplishment.

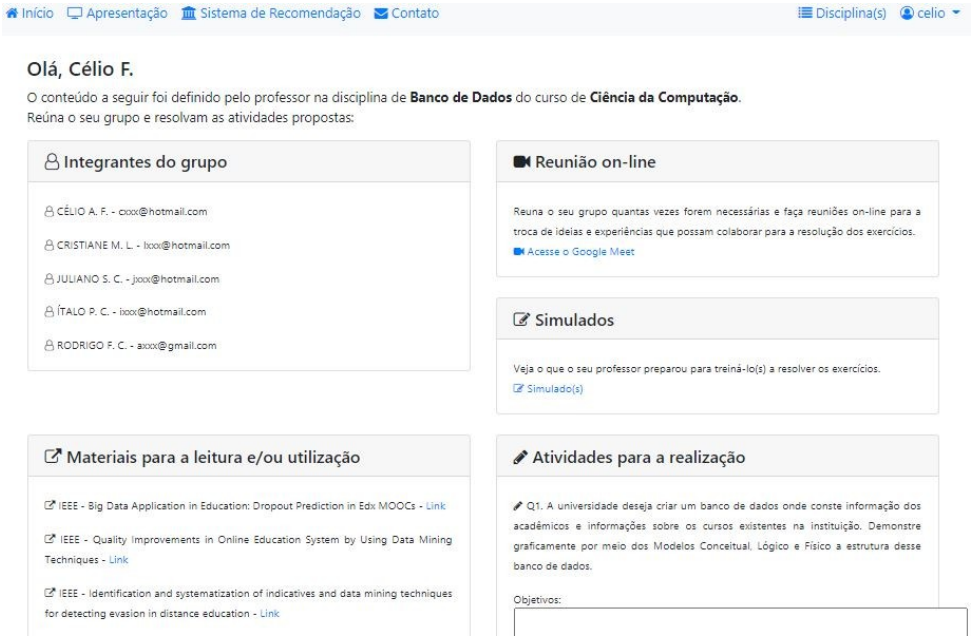

Figure 13. Student module interface.

3.2. RS acceptance assessment

This section presents the results of the verification of acceptance of the RS by teachers who were invited to participate in the survey. The participants were 13 professors from different areas of knowledge from 2 Brazilian universities, who promptly answered the questionnaire with 10 statements prepared according to the TAM Model, which evaluates the ease of use and perceived usefulness. A text box for teachers' comments was also provided.

The results obtained in statements 1 to 5 indicate that 49.2% strongly agree, 38.5% agree, and 12.3% neither agree nor disagree about the ease of use of the RS, as shown in Figure 14, demonstrating the satisfaction of more than 87% of participants. There are no responses that disagree with these statements.

Regarding question 1, which deals with the ease of understanding the RS, 53.8% of teachers strongly agree, 38.5% agree, and only 7.7% neither agree nor disagree. There were no responses that disagreed with the statement. In question 2, 69.2% of the professors strongly agree, and 23.1% agree that the information on the RS interface is

straightforward, totaling more than 92% of the responses. Only 7.7% of teachers neither agree nor disagree. There were no responses that disagreed with the statement.

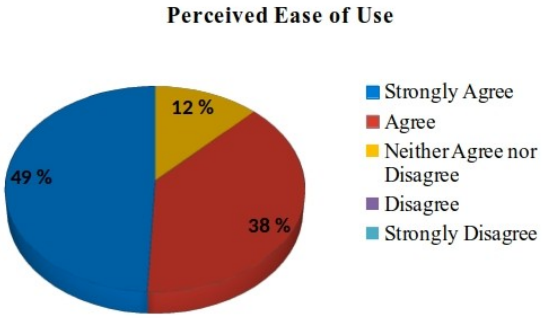

Figure 14. Result of questions about ease of use.

Regarding question 3, which states that it is possible to use the resources available in RS with little effort, 46.2% of teachers strongly agree, 38.5% agree, and 15.4% neither agree nor disagree. There were no responses that disagreed with the statement. Regarding question 4, which states that the RS reproduces the material recommendation functionality, 38.5% of teachers strongly agree, 53.8% agree, and 7.7% neither agree nor disagree. There were no responses that disagreed with the statement. In question 5, which deals with the integration of RS services by providing a more agile and pleasant way of working, the percentages of 38.5% of teachers were obtained in agreeing and strongly agreeing, and 23.1% did not agree or disagree. There were no responses that disagreed with the statement.

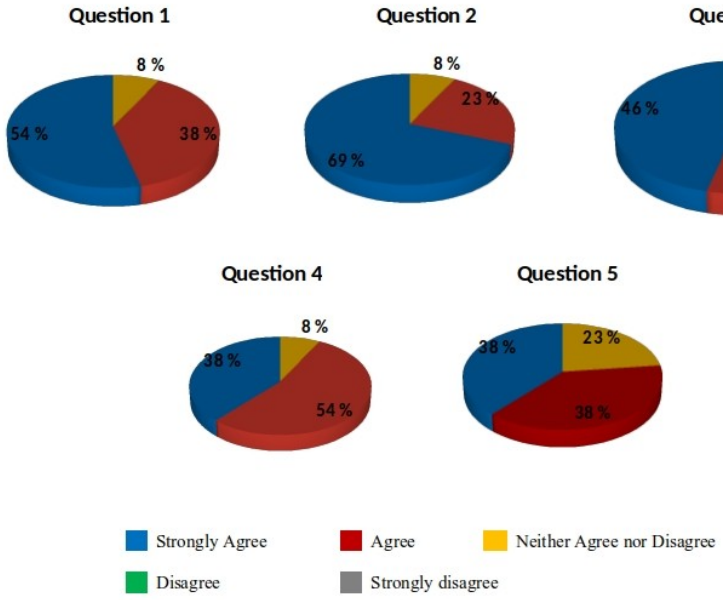

Figure 15. Resultados detalhados das questões de 1 a 5 que trata sobre a facilidade de uso

Regarding statements 6 to 10, which deal with the usefulness of the RS, 38.5% of teachers strongly agree, 38.5% agree, 18.5% neither agree nor disagree, 3.1% disagree, and 1.5% strongly disagree. The percentages show that 77% agree that the RS can be valid for the teaching and learning process and is well accepted. Figure 16 shows the result of the questions about perceived usefulness.

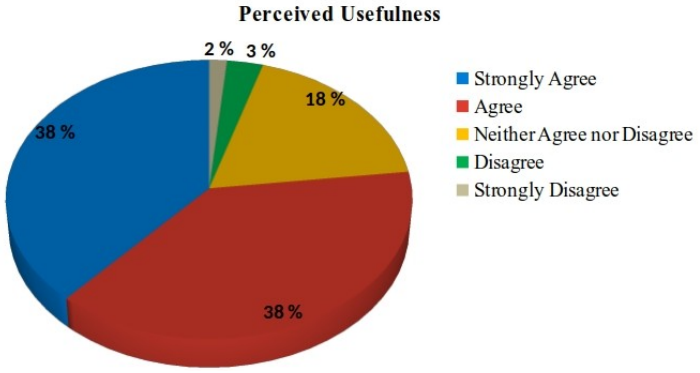

Figure 16. Result of questions about perceived usefulness.

Regarding the integration of Active Methodologies to an RS, the results of statement 6 demonstrate how much the RS facilitates the use of this methodology by teachers since the percentages of 38.5% were observed in the answers agree and strongly agree, reaching 77% to the opinion of the public participating in the research.

Regarding question 7, which states that the RS favors the formation of groups of students for collaborative teaching, 61.5% of teachers strongly agree, and 23.1% agree. The percentages of 7.7% were observed in neither agree nor disagree and disagree. There were no responses that strongly disagreed. Therefore, more than 84% of teachers agree that RS favors the formation of groups.

In question 8, the results indicate that 38.5% of the teachers strongly agree and 53.8% agree. This shows a high degree of satisfaction with the RS when recommending complementary materials for the students to read, reaching the objective of the model development, and assisting in the learning process.

Regarding question 9, which relates the use of RS with the possibility of helping to mitigate the risk of dropout by students, 46.2% of teachers answered that they neither agree nor disagree, 38.5% agree, and 7.7% strongly agree. The high rate of neither agree nor disagree may mean the need to make identifying students prone to dropping out more evident, the use of Active Methodologies for collaborative teaching, and the indication of complementary material for learning.

Finally, question 10 asked the teacher if he would use RS for the teaching and learning process. 46.2% strongly agree, 38.5% agree, 7.7% neither agree nor disagree, and 7.7% strongly disagree. There were no responses that disagreed with the statement. The results indicate that more than 84% of the teachers would use the RS for the student's learning process.

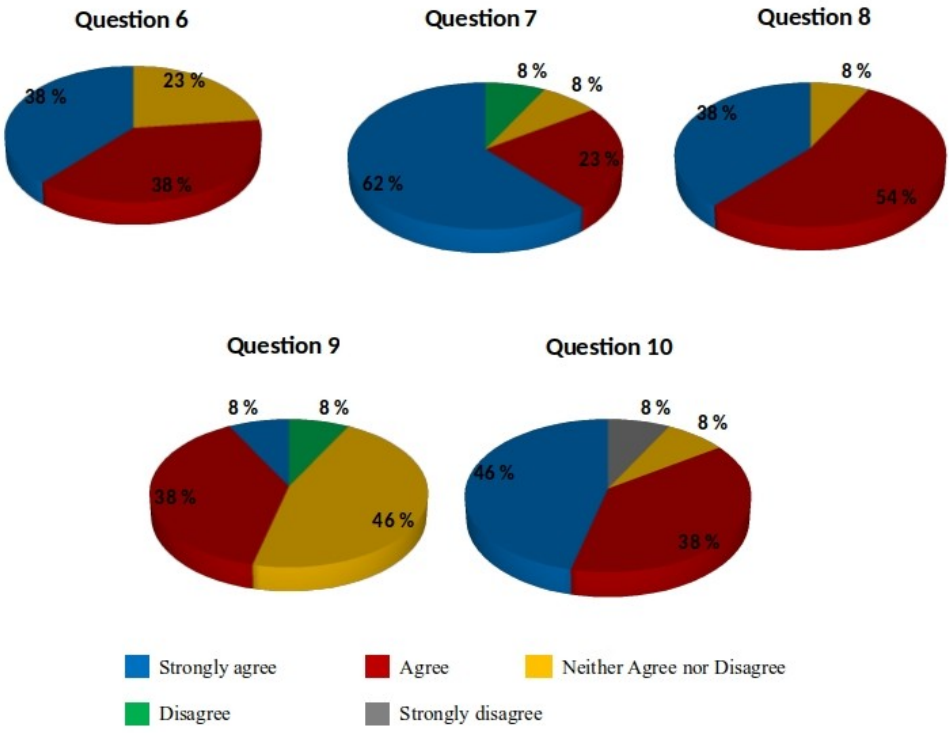

Figure 17. Detailed results of questions 6 to 10 dealing with perceived usefulness.

In order to obtain suggestions for improvements, a space was made available in the questionnaire for the teacher to write freely. Among the suggestions are: a) formation of groups: create opportunities to form groups manually, based on interest, personal affinity, and psychological and emotional profiles; b) selection of materials: manual indication of links.

3.3. Critical analysis of the proposal

According to research, none of the studies considered integrating Active Methodologies with EDM and LA techniques in an RS to reduce dropout risks and improve student learning. It is known that the EDM and LA techniques are widely used and have contributed significantly to teaching. However, the scope of the most significant contribution has been only in identifying students prone to dropping out of courses. In this sense, measures to contain this high index need to be taken in addition to this action. Using Active Methodologies integrated into the RS would favor the relationship between teachers, tutors, and students. It would make the process more attractive and updated, meeting the needs and expectations of a technologically inserted society.

Corroborating the proposal presented here, works such as Chandrasekaran et al. (2016), Leite & Ramos (2017), Lima & Siebra (2017), Leite et al. (2019), and Andrade et al. (2021) consider the possibility of adding Active Methodologies to the techniques to contribute to mitigating dropout and increasing student permanence.

Active Methodologies support teachers in teaching practices and monitoring the learning process and performance of activities developed by students. At the same time, it works with students, encouraging them to be more proactive and collaborative in a more engaging, participative methodology involving the group context.

The evaluation allowed the verification of functionality and integration between the developed components, indicating its viability as an RS model. The results are promising since the RS can help the teacher in the selection of complementary materials and encourage the relationship between students for the learning process, corroborating with the aspirations of Costa et al. (2013) when stating that, in most cases, RS have some limitations when used in educational contexts, and that therefore, additional requirements should be added in the design and development.

4. Conclusions

This work presented an RS model integrated with Active Methodologies, EDM, and LA to detect students prone to dropping out and mitigate this possibility. In order to help the student and the teacher in the process, several functionalities are proposed, such as the orientation of complementary reading materials to the student and the possibility for the teacher to choose the Active Methodologies to be applied to the groups formed by the tool in the teaching process and learning, in order to inhibit the possibility of evasion and increase the student's interest in the content and permanence.

Studies found no evidence of RS that integrate Active Methodologies, EDM, and LA. However, these studies point to the growth and importance of improving the ways of teaching and learning. The integration of these techniques and methods, as evaluated in the proposed RS model, provides a step forward for this process, not only in identifying students prone to dropping out of the course but also in supporting and improving learning. RS fosters this by providing opportunities for reading complementary materials, autonomy, and individual experiences, sharing ideas in groups, developing social skills for those with learning difficulties centered only on the teacher, and responsibility for learning and problem-solving. With Active Methodologies and innovative techniques, the teacher can create mechanisms to engage and challenge the student, generating more chances to encourage the student to stay in the course.

The results obtained are promising since, in the evaluation of the functionalities and interfaces of the RS model by a teacher, it was possible to certify its correct functioning. In evaluating acceptance by teachers from different areas of knowledge, the results indicated that more than 87% of teachers agreed with the ease of use and more than 77% with the usefulness in the teaching and learning process when teachers were asked if they would use RS in the teaching and learning process, more than 84% agreed with the statement, which may indicate the relevant contribution of RS.

Therefore, as future work, it is intended to experiment on a large scale with the proposed model with the highlighted technologies, which directly involve students and professors from different courses. It is also intended to monitor the academic life of students identified as likely to drop out to verify whether the use of RS with Active Methodologies was able to encourage them to continue their studies. Finally, improve

the features of group formation and selection of complementary materials suggested by the teachers.

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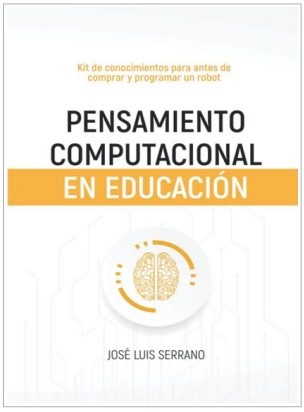

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RESEÑA / RESENHA / REVIEW

Serrano, J.L. (2022). *Pensamiento computacional en educación*. Amazon

Jesús Acevedo-Borrega *

«Pensamiento Computacional en Educación: Kit de conocimientos para antes de comprar y programar un robot / Computational Thinking in Education: Kit of knowledge before buying and programming a robot» (download) by José Luis Serrano, a recognised expert in educational technology, is an essential compass for teachers, tutors and anyone interested in the integration of Computational Thinking as part of education.

Serrano is Associate Professor of Educational Technology at the University of Murcia, Ph.D. in Educational Technology, Master in Educational Psychology, Bachelor in Pedagogy and Senior Technician in Early Childhood Education. He uses his extensive experience in the field to demystify and correctly convey Computational Thinking. Far from being a ready-made recipe, Serrano provides a toolkit based on scientific and experiential knowledge so that the reader can make informed decisions and design their own activities that include programming and robots.

The book is divided into three main sections, exploring a different dimension of Computational Thinking. In the first section, the author focuses on the theory and foundations of Computational Thinking, providing a solid basis for understanding what it is and how it can be applied in education. In the second section, he delves into the complex and essential questions and answers surrounding Computational Thinking, presenting the 5PC Model, a step-by-step approach to its development. This section also addresses the potential difficulties that can arise from optimising and automating solutions, providing a more nuanced and realistic view of the implementation of Computational Thinking. And finally, in the third section, he provides practical resources for action, offering readers the necessary tools to correctly implement Computational Thinking in their educational practice.

In the first pages, Serrano begins by explaining the purpose of the book and demystifies Computational Thinking, showing it as more than just a tool for solving problems. The author stresses the importance of differentiating between components and peripheral skills, providing a clear vision of what Computational Thinking really entails. Chapters on teaching and learning Computational Thinking, as well as how to activate it, offer practical and accessible strategies for educators. A vital first few pages to solidify a well scaffolded theoretical foundation.

In the second part, Serrano delves into the complex and essential questions and answers surrounding Computational Thinking. The author presents the 5PC Model, a step-by-step approach to developing Computational Thinking, which will be of great use to educators looking for a structured guide. Five steps starting with learning by thinking, moving through real problems, unplugged activities and robot programming, and ending with exposure to resources. Five steps that anchor problem solving through practice, peripheral and cross-cutting skills and methods. The author also addresses the possible difficulties that can arise from optimising and automating solutions.

For the last part, Serrano provides practical resources for taking action from a rich variety of 34 educational resources, including websites, presentations, videos and other resources. This chapter is especially useful for those who are ready to start implementing what they have learned in the first two sections.

All in all, «Pensamiento Computacional en Educación: Kit de conocimientos para antes de comprar y programar un robot / Computational Thinking in Education: Kit of knowledge before buying and programming a robot» is a must-read for anyone,

professional or amateur, seeking to understand and implement Computational Thinking in an educational context. Serrano not only demystifies the concept, but also provides a practical and accessible guide to its implementation, allowing readers to make informed decisions and design their own teaching strategies.

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Example: Morales and Vallejo (1998) found... / Almeida, Manzano and Morales (2000)... / In later appearances: Almeida et al. (2000).

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Verbatim quotations. Short quotations, two lines or less (40 words), may be incorporated into the text using single inverted commas to indicate them. Longer quotations are separated from the text by a space at each end and tabulated from the left margin; there is no need to use inverted commas here. In both cases the page number of the quotation is indicated. Punctuation, spelling and order must correspond exactly to the original text. Any changes made by the author should be clearly indicated (e.g. italicisation of some words for emphasis). When material is omitted from quotations it is indicated by a parenthesis (. . . .). Material inserted by the author to clarify the quotation should be placed in square brackets [...]. The source of a quotation should be cited in full, author, year and page number in the text, plus a full reference in the bibliography.

Example: «in recent years there has been an increasing interest in the study of new technologies in early childhood education» (Mateos, 2001, p. 214).

Secondary quotations. Occasionally, it will be considered necessary to present an author's idea, revised in a work other than the original one in which it was published.

Example: Classical conditioning has many practical applications (Watson, 1940, cited in Lazarus, 1982) ... Or: Watson (cited in Lazarus, 1982) argues the versatility of classical conditioning applications ...

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Examples of references, according to APA standard (7th edition)

BOOKS

Spector, J. M. (2016). *Foundations of educational technology: Integrative approaches and interdisciplinary perspectives*. Routledge.

BOOK CHAPTERS

Jagannathan, S. (2021). The digital learning oportunity. En S. Jagannathan (Ed.), *Reimagining digital learning for sustainable development: How upskilling, data analytics, and educational technologies close the skills gap* (pp. 17-35). Routledge.

ARTICLES

Valverde-Berrocoso, J., González-Fernández, A., & Acevedo-Borrega, J. (2022). Disinformation and multiliteracy: A systematic review of the literature. *Comunicar*, *XXX*(70), 97-110. https://doi.org/10.3916/C70-2022-08

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Valverde-Berrocoso, J. (2013). El acceso abierto al conocimiento científico. Barcelona: Universidad de Barcelona. Recuperado a partir de http://diposit.ub.edu/dspace/handle/2445/36335

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