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Esperamos que este número resulte interés al lector dada la relevancia de las investigaciones publicadas.

Julio Ruiz-Palmero
Director de Innoeduca. International Journal
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ÍNDICE

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Revolutionizing EFL Special Education: how ChatGPT is Transforming the Way Teachers Approach Language Learning

Revolucionando la educación especial del inglés como lengua extranjera: cómo ChatGPT está transformando la forma en que los profesores abordan el aprendizaje de idiomas

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ABSTRACT

This mixed-methods study explored the attitudes of 199 English as a Foreign Language (EFL) special education teachers towards using ChatGPT for language learning. The survey questionnaire, consisting of 21 items, examined attitudes, effectiveness, barriers, and the future use of ChatGPT. The results revealed that participants held moderate attitudes, perceiving ChatGPT as moderately effective with moderate barriers. While no significant differences were found between male and female teachers in attitudes and effectiveness, significant gender differences emerged in the future use of ChatGPT, with female teachers exhibiting a greater willingness to embrace it. Follow-up email interviews with five participants provided valuable insights into strategies, effectiveness, challenges, and inclusivity when using ChatGPT in language instruction for special education students. These findings contribute to implementing and developing ChatGPT as a language learning tool for EFL special education students, emphasizing the importance of gender-inclusive approaches and practical considerations to enhance its efficacy.

KEYWORDS EFL; special education; ChatGPT; language instruction; artificial intelligence.

RESUMEN

Este estudio de métodos mixtos exploró las actitudes de 199 profesores de educación especial de inglés como lengua extranjera (EFL) hacia el uso de ChatGPT para el aprendizaje del idioma. El cuestionario de encuesta, compuesto por 21 ítems, examinó las actitudes, la efectividad, las barreras y el uso futuro de ChatGPT. Los resultados revelaron que los participantes tenían actitudes moderadas, percibiendo a ChatGPT como moderadamente efectivo con barreras moderadas. Si bien no se encontraron diferencias significativas entre los profesores hombres y mujeres en cuanto a actitudes y efectividad, surgieron diferencias de género significativas en el uso futuro de ChatGPT, siendo las profesoras mujeres las que mostraron una

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mayor disposición a adoptarlo. Entrevistas de seguimiento por correo electrónico con cinco participantes proporcionaron información valiosa sobre estrategias, efectividad, desafíos e inclusión al usar ChatGPT en la enseñanza del idioma para estudiantes de educación especial. Estos hallazgos contribuyen a implementar y desarrollar ChatGPT como herramienta de aprendizaje de idiomas para estudiantes de educación especial de EFL, enfatizando la importancia de enfoques inclusivos de género y consideraciones prácticas para mejorar su eficacia.

PALABRAS CLAVE EFL; educación especial; ChatGPT; enseñanza de idiomas; inteligencia artificial.

1. INTRODUCTION

EFL refers to teaching English in a non-English speaking environment to non-native speakers. EFL special education teachers work in various settings and adapt instructional materials to meet students' unique needs. They collaborate with other professionals to support their students, but face challenges in delivering effective language instruction. As noted in previous studies, AI technology can assist in providing personalized and effective language instruction (Chen *et al*., 2022; Lu *et al*., 2022; Pedró *et al*., 2019; Rezaee, & Sha-bani, 2019).

AI technology in special education provides customized instruction by analyzing individual student data and tailoring feedback and learning materials to their unique requirements and preferences. This personalized approach is particularly beneficial for special education students who require individualized instruction. AI technology can also offer real-time feedback and assistance, such as chatbots providing immediate responses to student work and engaging them in interactive learning experiences. This technology saves teachers time and allows them to focus on more complex instructional duties (Chen *et al*., 2022; Rapanta *et al*., 2020).

AI technology supports EFL special education teachers in assessing student performance. AI algorithms analyze data and provide insights into areas where students may be struggling. AI tools can also assist in grading and evaluating student work, saving teachers time and providing more accurate assessments. AI technology provides more engaging and immersive learning experiences, such as using virtual reality technology to simulate real-life language scenarios for students to practice in context (Hopcan *et al.,* 2022; Kessler; 2018; Ouyang *et al*., 2022).

The utilization of AI-powered conversational agents, such as chatbots, is becoming more popular in language learning. ChatGPT is an exemplar of this type of chatbot, which can engage students in English conversations and provide feedback on their language use. It can even adjust to the user's language level and offer personalized feedback based on their individual requirements (Castillo *et al*., 2021; Qadir, 2022).

Incorporating AI technology in language education can offer personalized, effective, and engaging language instruction, particularly for special education teachers. This research investigates the viewpoints and experiences of EFL special education teachers who have utilized ChatGPT in their language instruction, providing valuable insights into the potential of AI technology to support language learning for special education students (Chen *et al*., 2022).

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Although AI's potential to improve learning outcomes and provide personalized instruction in language education has attracted significant attention, there is inadequate research examining the effectiveness of AI tools like ChatGPT in supporting EFL special education teachers. This research aims to fill this gap by studying the impact of ChatGPT on the language instruction given by EFL special education teachers and offering insights into the advantages and difficulties of using AI tools in language education (Adiguzel *et al.*, 2023; Ouyang *et al.*, 2022; Perkins, 2023).

The outcomes of this research can aid in the creation of efficient AI-supported language learning methods and suggest ways to incorporate AI tools in language instruction for special education. The importance of this study stems from its ability to propel the field of AI-assisted language learning forward and furnish useful insights for EFL special education teachers and their pupils based on the first-hand experiences of EFL special education teachers utilizing ChatGPT.

Research Questions

By addressing these questions, the study aims to gain insights into teachers' perspectives on integrating ChatGPT into special education language instruction.

R.Q.1: What are EFL special education teachers' attitudes towards using ChatGPT in their language instruction?

R.Q.2: What are the pros and cons of using ChatGPT in special education language learning?

R.Q.3: To what extent do EFL special education teachers see the future of ChatGPT in the learning process for their students?

R.Q.4: Are there gender differences in the attitudes of EFL special education teachers towards using ChatGPT for language learning?

1.1. Literature review

Recently, there has been an increasing interest in using AI in special education to provide novel means of supporting the learning requirements of students with disabilities. As per Babitha and Sushma (2022) study, AI tools hold the potential to empower teachers and students by offering personalized, adaptable, and inclusive learning experiences. Chen *et al.* (2022) state that the utilization of AI in special education can offer customized learning experiences by modifying educational resources to cater to the specific demands of individual learners, resulting in academic achievement. This technique is especially useful for students with disabilities who encounter learning difficulties. Additionally, AI tools can boost student engagement and motivation by providing an interactive and stimulating learning environment (Alcorn *et al.*, 2019). This aspect is particularly crucial for students with disabilities who may find it challenging to comprehend traditional classroom instruction.

Despite these potential benefits, several challenges are associated with using AI in special education. One challenge is the need for adequate training and support for teachers (Al-khresheh *et al.*, 2022). As noted by Losen and Welner (2001), teachers need to be trained to effectively integrate AI tools into their teaching practices, and ongoing support and professional development are necessary to ensure successful implementation. Another challenge is ensuring the ethical and AI tools' ethical and responsible use successful

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implementation. As noted by Dignum (2018), it is important to ensure that the use of AI in special education is guided by ethical principles and that student data is protected and used appropriately.

AI has revolutionized education by providing powerful tools to enhance student learning, particularly in language acquisition. AI-assisted language learning can benefit all students, including those with special needs, by offering personalized instruction and engaging tools that boost confidence and motivation. This essay will explore the advantages and challenges of AI-assisted language learning for special needs students. Personalized instruction is a major advantage of AI, as it uses analytics to adapt the curriculum to meet individual learning needs. This feature is especially helpful for students with special needs, who can benefit from real-time feedback, scaffolding, hints, and customized difficulty levels based on their performance (Adiguzel *et al.*, 2023; Cheah, 2021; Muñoz *et al.*, 2023; Ouyang *et al.*, 2022).

In addition to personalization, AI-powered language learning tools such as games, chatbots, and virtual tutors can make language learning highly engaging and motivating, which can contribute to students' confidence and self-esteem (Choi, & Yi, 2016). Furthermore, Adiguzel *et al.* (2023) emphasize that immediate feedback from AI can help students with special needs stay on task and motivated.

Despite the benefits, AI-assisted language learning also presents challenges for students with special needs. One such challenge is the risk of over-reliance on technology. Students may become too dependent on AI, which can hinder their ability to communicate effectively in real-world situations. Moreover, the use of AI in language learning requires significant investment in terms of time and resources, which may not always be feasible for schools and teachers. Another challenge is the need for ongoing teacher training and professional development. Teachers need to be familiar with the latest AI technologies and understand how to integrate them effectively into their teaching practices. Without adequate training, teachers may struggle to make the most of AI-powered language learning tools (Adiguzel *et al.*, 2023; Awada, 2022; Pokrivčáková, 2019; Shaaban, & Mohamed, 2023).

AI-powered educational technologies can provide personalized learning and instant feedback to students with disabilities, which can be particularly helpful for those who require more assistance. These technologies can also adapt to individual student needs, adjusting the content and format of learning materials to meet their requirements. However, challenges such as accessibility, cost, and potential biases in AI algorithms need to be addressed. Additionally, there is a risk that AI may replace human support, which is crucial for students with disabilities (Nazaretsky, *et al*; 2022; Pedró *et al.*, 2019).

Teacher perspectives are crucial when considering AI's use in special education as it can impact its effectiveness. While some teachers have concerns about its impact on student-teacher relationships and job loss, many acknowledge AI's potential advantages for providing personalized learning and assistance to students with disabilities. However, limited understanding of its effectiveness, data privacy and security concerns, and the need for further research hinder AI adoption in special education classrooms. AI can transform special education with personalized learning experiences and improved student engagement, but its implementation must be approached carefully by addressing challenges and understanding teacher perspectives (Bingimlas, 2009; Edwards, & Cheok, 2018).

AI-powered educational technologies offer great potential for transforming special education classrooms through personalized learning experiences and increased student engagement. However, challenges such as

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limited knowledge of their effectiveness, cost, and data privacy and security concerns hinder their widespread adoption. Despite these challenges, many special education teachers remain optimistic about the potential of AI to transform education for students with disabilities. Nonetheless, further research is needed to establish the effectiveness of AI-powered educational technologies in special education classrooms, and steps must be taken to ensure data privacy and security before their widespread adoption (Paju *et al.*, 2016; Xie *et al.*, 2019).

Alcorn *et al.* (2019) investigated how humanoid robots could be used as a learning tool for individuals on the autism spectrum by examining the views of 31 autism education staff members in England. The study identified four main themes: "Engagingness, Predictability and Consistency, Roles in autism education, and the Need for Interaction with People, not Robots." Educators were open to integrating robots into the classroom but expressed concerns about drawbacks, such as limiting interaction with others and activities. The study provides recommendations on how robots can cater to the needs of autistic learners while highlighting areas that require attention for successful integration into special education settings.

AI has the potential to revolutionize special education, making learning more equitable and accessible. It can offer personalized learning plans and accessible materials, providing customized education for students with disabilities. AI can assist in assessment and evaluation by adapting question difficulty and creating accessible formats. It also supports teachers in lesson planning, content creation, and grading, enabling individualized instruction. AI promotes inclusivity through personalized learning, accessible materials, and alternative assessments. While opinions on AI among teachers vary, many recognize its benefits and are open to using it. However, the ethical and practical implications of AI in special education need careful consideration as the technology advances (Alam, 2021; Florian, & Linklater, 2010; Tomczyk *et al.*, 2023; Yang *et al.*, 2021).

2. MATERIAL AND METHOD

The methodology employed in this study is a mixed-methods approach that combines the use of a questionnaire and interviews. This approach allows for a comprehensive exploration of the research topic by gathering both quantitative and qualitative data (Johnson, & Turner, 2003). The questionnaire provides structured data, allowing for statistical analysis and the identification of trends and patterns, while the interviews delve deeper into the experiences, perspectives, and insights of the participants. By integrating these two methods, the study aims to achieve a more holistic understanding of the research topic, ensuring a robust and comprehensive analysis of the data.

2.1. Participants

The study included 199 EFL special education teachers selected through purposive sampling. They had a minimum of three years of teaching experience in a special education setting and were currently using ChatGPT for language instruction. Among them, 115 were females and 84 were males. The participants were recruited through professional networks, social media, and language education organizations, and worked in various settings and geographic locations. Additionally, email interviews were conducted with 5 teachers selected based on their questionnaire responses and willingness to participate, providing further insight into the data. These email interview participants also worked in diverse educational settings and geographic locations.

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TABLE 1. EFL Special Education Teachers' Demographic and Professional Characteristics.

	AGE	GENDER	YEARS OF EXPERIENCE	TYPE OF SPECIAL EDUCATION TAUGHT
Teacher 1	35	Female	8	Learning Disabilities
Teacher 2	42	Male	15	Intellectual Disabilities
Teacher 3	28	Female	3	ADHD and Emotional/Behavioral
Teacher 4	50	Male	20	Autism and Communication
Teacher 5	31	Female	5	Hearing and Visual Impairment

Table 1 presents demographic information of five EFL special education teachers. It includes their age, gender, teaching experience, teaching level, and the type of special education students they work with (e.g., speech/language impairments, learning disabilities, emotional/behavioral disorders). The table provides a snapshot of the participants' background and experience. They were part of a study investigating their attitudes towards using ChatGPT as a language learning tool for EFL special education students in Saudi Arabia.

2.2. Instruments

The methodology for this study involved using an online questionnaire and email interviews to collect data from EFL special education teachers who had experience using ChatGPT in their language instruction. A group of 199 EFL special education teachers (115 female and 84 male) received an online questionnaire comprising 21 Likert-type statements classified into three main categories, as mentioned previously. The questionnaire aimed to assess attitudes, effectiveness, barriers, and future implications of using ChatGPT. The questionnaire was administered through Google Forms, ensuring anonymity, and providing the option for participants to withdraw from the study at any point.

A literature review, expert panel approval, and pilot testing among special education teachers ensured the questionnaire's credibility. Cronbach's alpha coefficient was used to determine internal consistency and reliability, with values between 0.735 to 0.867 indicating strong reliability. The questionnaire was found to be a valid and reliable tool for evaluating EFL special education teachers' perceptions of integrating ChatGPT in their classrooms.

Table 2 presents the correlation coefficients between the items within each dimension and the total score of each dimension with the overall score of the scale. The significance level of 0.01 indicates that the scale has acceptable internal consistency.

The scale items were presented to a group of 9 judges, including professors in educational technology, curricula, and EFL teaching methods. The judges agreed that certain items needed to be removed from the scale.

Moreover, the value of Cronbach's alpha coefficient for each dimension of the scale can be determined through the calculation of scale stability using Cronbach's alpha. This information can be found in the following table 2.

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TABLE 2. Correlation Analysis of Item Score, Dimension, and Total Score.

QUESTIONNAIRE'S DIMENSIONS					
Attitudes Towards Using ChatGPT in Language Learning		Effectiveness and Barriers of ChatGPT		Future Use of ChatGPT	
Item No	Correlation coefficient	Item No	Correlation coefficient	Item No	Correlation coefficient
1	.552**	11	.554**	18	.837**
2	.593**	12	.544**	19	.735**
3	.752**	13	.536**	20	.940**
4	.796**	14	.760**	21	.537**
5	.589**	15	.696**		
6	.772**	16	.851**		
7	.678**	17	.713**		
8	.834**				
9	.871**				
10	.756**				
Dimension correlation with the total score .713**		Dimension correlation with the total score .597**		Dimension correlation with the total score .718**	

**. significant at the 0.01 level.

Table 3 shows that the values of the stability coefficient are between (0.735, 0.867), which are high values and statistically significant.

TABLE 3. The values of the stability coefficient for each dimension of the scale.

DIMENSIONS	NUMBER OF ITEMS	CRONBACH'S ALPHA
Attitudes Towards Using ChatGPT in Language Learning	10	0.867
Effectiveness and Barriers of ChatGPT	7	0.735
Future Use of ChatGPT	4	0.789

Additionally, the split-half reliability was evaluated by dividing each sub-dimension into odd and even items and calculating the correlation coefficients between the two halves using the Spearman-Brown-Guttmann equation. The results are reported in Table 4.

TABLE 4. The values of the stability coefficient for each dimension of the scale.

DIMENSIONS	NUMBER OF ITEMS	SPEARMAN-BROWN	GUTTMAN SPLIT-HALF
Attitudes Towards Using ChatGPT in Language Learning	10	0834	0.743
Effectiveness and Barriers of ChatGPT	7	0.696	0.681
Future Use of ChatGPT	4	0.712	0.794

Additionally, Test-Retest was used to calculate the reliability coefficient of the scale. The value of the reliability coefficient for the test-retest method was (0.752), indicating that the scale has an acceptable level of stability using the test-retest method, and is suitable for the application.

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After the questionnaire data is collected, email interviews will be conducted with 5 EFL special education teachers to supplement the quantitative data. The email interview questions will be based on the questionnaire categories and additional questions that can further strengthen the study, as described earlier.

The interviews in this study followed a semi-structured approach, aiming to provide additional insights into the experiences and perspectives of EFL special education teachers regarding the use of ChatGPT in language instruction. The interview questions were carefully designed to complement the questionnaire results and address specific aspects related to ChatGPT use.

The questions were derived from the questionnaire findings and aimed to explore various topics. The focus was on effective strategies for utilizing ChatGPT, assessing its effectiveness, challenges encountered during implementation, potential solutions, promoting inclusive use, and any necessary modifications to teaching approaches.

The study incorporates interview data to enhance the understanding of EFL special education teachers' attitudes and experiences with ChatGPT. Integrating interview results with the questionnaire findings provides a comprehensive view of the topic, reinforcing the study's conclusions. Thematic analysis is used to analyze the interview data, identifying key themes and patterns in the teachers' responses. The interview findings are then linked to the previously formulated research questions, providing further support for the study's conclusions.

2.3. Procedures

This study uses a mixed methods approach to investigate EFL special education teachers' perspectives on using AI in language instruction. Participants will be recruited through various channels and will complete an online questionnaire with both Likert-scale and open-ended questions. Those who agree to participate in a follow-up email interview will be contacted to schedule a time for the interview. The study aims to gain insights into the teachers' experiences and perspectives on using AI in special education classrooms.

2.4. Data collection

Data was collected from 199 EFL special education teachers who used ChatGPT in language instruction through an online survey consisting of 21 Likert-type statements divided into three categories: attitudes, effectiveness, and barriers. The sample included 115 females and 84 males and was recruited through professional networks, social media, and language education organizations. The questionnaire was reviewed for content validity by experts and pilot-tested with a small group of special education teachers. Email interviews were also conducted with five participants for more detailed insights.

2.5. Data Analysis

The study analyzes data collected from an online questionnaire and email interviews using descriptive and inferential statistics, as well as qualitative analysis. Descriptive statistics summarize the responses to Likert scale items and open-ended questions, while inferential statistics, such as t-tests, examine relationships

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between variables such as participant demographics and questionnaire responses. Qualitative data are analyzed using thematic analysis, identifying patterns, themes, and categories through a developed coding scheme. Statistical software, such as SPSS, is used for analysis. Results are presented using tables, charts, and narrative summaries in the context of the literature and research questions. Findings have implications for practice and future research.

3. RESULTS

In this section, the findings of the study will be discussed. The results of both the questionnaire and the email interviews will be presented, followed by a comprehensive analysis of the data. Additionally, the report will include a detailed discussion of the implications of the study for language education practice and research, based on the results obtained.

3.1. Questionnaire

Attitudes Towards Using ChatGPT in Language Learning

To answer the related study question, standard deviations, means, and the order of each item were calculated as follows:

TABLE 5. The means, medians, modes, and standard deviations for the field of
"Attitudes towards Using ChatGPT in Language Learning" domain.

	ITEMS	MEAN	MEDIAN	MODE	STD. DEVATION	ORDER	LEVEL
5	I have used ChatGPT to facilitate communication between myself and my students.	3.693	4	5	1.341	1	High
8	I think that technology will eventually replace traditional language teaching methods.	3.673	4	5	1.381	2	High
1	I am familiar with ChatGPT and its capabilities.	3.593	4	5	1.330	3	High
9	I would like to receive some basic training on how to use ChatGPT effectively.	3.583	4	5	1.397	4	High
2	I have used ChatGPT before in my language instruction.	3.573	4	5	1.419	5	High
3	I have used ChatGPT to generate personalized learning materials for my students.	3.543	4	5	1.410	6	High
6	I believe that ChatGPT can enhance language learning.	3.513	4	5	1.470	7	High
10	I would like ongoing support to help me use ChatGPT to its full potential	3.508	4	4	1.414	8	High
7	I am comfortable using ChatGPT in my language instruction.	3.437	4	4	1.482	9	High
4	I have used ChatGPT to assess my students' language proficiency.	3.221	4	4	1.586	10	Moderate
TOTAL DEGREE		**3.534**	**3.8**	**4**	**.741**		**High**

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Table 5 indicates a strong inclination towards utilizing ChatGPT for language learning, with the mode value of 5 surpassing both the median value of 4 and the mean value of 3.534. Participants expressed favorable attitudes towards ChatGPT, with mean scores ranging from 3.221 to 3.693.

Notably, out of the ten statements, nine received a "high" level interpretation, signifying positive attitudes towards using ChatGPT in language learning. Participants exhibited positive attitudes towards ChatGPT, as reflected by the highest mean scores for using it to facilitate communication (Item 5) and the belief in technology replacing traditional teaching methods (Item 8). They also demonstrated familiarity with ChatGPT (Item 1) and expressed a desire for training on how to use it effectively (Item 9).

However, some statements indicated a lower level of agreement. For instance, there was a need for ongoing support (Item 10), and participants expressed a lower comfort level in using ChatGPT (Item 7). The standard deviation values ranged from 1.341 to 1.586, indicating some degree of variability in the responses.

The pros and cons of using ChatGPT in special education language learning

To answer the related study question, standard deviations, means, and the ranking of each item is calculated as follows:

TABLE 6. The means, medians, modes, and standard deviation
for the (Effectiveness and Barriers of ChatGPT) domain.

NO.	ITEMS	MEAN	MEDIAN	MODE	STD. DEVATION	ORDER	LEVEL
12	I am confident that ChatGPT can significantly improve language learning outcomes for my students.	3.528	4	5	1.459	1	High
11	I believe that ChatGPT is a highly effective tool for language instruction.	3.477	4	5	1.483	2	High
13	My students have provided positive feedback on their experience using ChatGPT.	3.437	4	5	1.499	3	High
15	I am worried that ChatGPT will not be suitable for my students' needs.	2.779	4	3	1.541	4	Moderate
14	I am concerned that using ChatGPT will be too time-consuming.	2.673	4	3	1.490	5	Moderate
16	I am unsure how to effectively integrate ChatGPT into my language instruction.	2.417	4	3	1.401	6	Moderate
17	I cannot access the technology or resources needed to use ChatGPT.	2.322	4	2	1.355	7	Low
TOTAL DEGREE		2.948	3.7	3	0.554		Moderate

The presented table 6 indicates that the mode value is 3, which is equal to the median value of 3 and is nearly identical to the mean value of 2.948. This implies that there are moderate inclinations towards both the effectiveness and obstacles of utilizing ChatGPT in language instruction. The participants' perceptions regarding the efficacy and barriers of using ChatGPT in language instruction are revealed in Table 6. The mean scores range from 2.322 to 3.528, with the highest-rated item being "I am confident that ChatGPT can

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significantly improve language learning outcomes for my students" (Item 12), and the lowest-rated item being "I cannot access the technology or resources needed to use ChatGPT" (Item 17).

The median and mode values indicate central tendencies and frequently selected responses. Most items have a median score of 4, suggesting general agreement or a neutral position. Moreover, the mode values are primarily 3, 4, or 5, indicating various levels of agreement or disagreement among participants. The standard deviation values range from 1.355 to 1.541, implying variability in participants' responses to the items.

The findings indicate mixed attitudes and concerns regarding the effectiveness and barriers of using ChatGPT in language instruction. While there is a certain level of confidence and belief in ChatGPT's effectiveness, concerns related to suitability, time consumption, integration, and accessibility are also present. The total degree, with a mean of 2.948, suggests a moderate overall interpretation of the effectiveness and barriers of ChatGPT.

Future Use of ChatGPT

To answer the related research question, standard deviations, means, and the ranking of each item is calculated as follows:

TABLE 7. The means, medians, modes, and standard deviations for the field of (Future Use of ChatGPT).

NO.	ITEMS	MEAN	MEDIAN	MODE	STD. DEVATION	ORDER	LEVEL
18	I plan on using ChatGPT extensively in my future language instruction.	3.578	4.0	5.0	1.436	1	High
20	ChatGPT's future capabilities can meet the individual learning needs of my EFL special education students.	3.467	4.0	5.0	1.483	2	High
19	I will continue to use ChatGPT in my future language instruction.	3.402	4.0	5.0	1.517	3	High
21	I plan to provide training to my special education students on how to use ChatGPT effectively.	3.332	4.0	4.0	1.586	4	Moderate
TOTAL DEGREE		**3.444**	**4.0**	**4.0**	**0.952**		**High**

Table 7 showcases strong inclinations towards the future of ChatGPT in language learning, as evidenced by the mode value of 5, which surpasses both the median value of 4 and the mean value of 3.444.

Moreover, the mean scores of the items related to future use of ChatGPT range from 3.332 to 3.578, indicating positive attitudes towards incorporating ChatGPT in future language instruction. The highest-rated item is "I plan on using ChatGPT extensively in my future language instruction" (Item 18), while the lowest-rated item is "I plan to provide training to my special education students on how to use ChatGPT effectively" (Item 21).

Additionally, the median and mode scores for all items are 4.0, suggesting a high level of agreement or positive attitudes towards future use of ChatGPT. However, the standard deviation values range from 1.436 to 1.586, hinting at some variability in participants' responses.

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Gender differences in attitudes towards ChatGPT in EFL special education teaching

To investigate the relationship between the levels of attitudes of special education teachers in English as a foreign language towards the use of ChatGPT for language learning by gender, the Mann-Whitney test was applied to calculate the value of (Z) in order to calculate the significance of the differences between the mean rank of the two groups (males and females) as follows:

TABLE 8. Mann-Whitney tests for gender-based differences in the attitudes towards using ChatGPT.

ITEM	GENDER	N	MEAN RANK	SUM OF RANK	Z	Sig.**
Attitudes towards Using ChatGPT	Male	84	95.28	8003.50	0.989	0.323
	Female	115	103.45	11896.50		
Effectiveness and Barriers of ChatGPT	Male	84	92.96	7808.50	1.478	0.139
	Female	115	105.14	12091.50		
Future Use of ChatGPT	Male	84	82.55	6934.00	3.678	0.000**
	Female	115	112.75	12966.00		

**. The difference is significant at the 0.01 level.

The study revealed no significant gender differences in the attitudes of EFL special education teachers towards using ChatGPT for language learning (Z=0.989, p=0.323; Z=1.478, p=0.139). Both male and female teachers displayed similar attitudes and perceptions regarding the effectiveness and barriers of ChatGPT. This suggests that gender does not significantly impact their views on using ChatGPT. However, there was a significant difference in the dimension of Future Use of ChatGPT (Z=3.678, p=0.000), with female teachers expressing a greater willingness to use it in the future compared to male teachers.

3.2. Interview

The interview section gathers insights from EFL special education teachers on integrating ChatGPT into language instruction for special education students. Their responses emphasize scaffolding, individualization, collaboration, and support for inclusive practices. Using a qualitative approach, the interviews offer valuable perspectives on ChatGPT integration in special education language learning, connecting the findings to the research questions. The teachers' insights contribute to understanding the benefits, limitations, and training needs of using ChatGPT for language instruction in special education, addressing the fifth research question.

1. What do you consider to be the most effective strategies for integrating ChatGPT into language instruction for special education students?

The EFL special education teachers provided varied responses when asked about effective strategies for integrating ChatGPT into language instruction for special education students. Teacher 1 suggested providing scaffolding and differentiating tasks to meet students' needs. Teacher 2 discussed the benefits of individualized instruction, while Teacher 3 recommended modeling and guiding students in their use of ChatGPT. Teachers 4 and 5 emphasized that integrating ChatGPT into collaborative learning activities benefits EFL special education students. ChatGPT in a collaborative setting allows students to engage in peer-to-peer interactions, enhancing their language learning experiences and providing social and emotional growth.

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Working in groups builds a sense of community among special education students, fostering a supportive and inclusive learning environment. ChatGPT in collaborative activities encourages students to understand the language and provide feedback to one another, boosting their confidence and motivation. This approach promotes active learning, allowing students to engage with the material more deeply and develop a better understanding of it. It also develops important social and communication skills, essential for success in academic and personal settings.

2. How do you assess the effectiveness of ChatGPT in enhancing language learning outcomes for special education students?

Teachers have varying perspectives on the effectiveness of integrating ChatGPT into language learning for special education students. Teacher 1 sees ChatGPT as a helpful supplement to classroom instruction but should not replace one-on-one instruction and individualized support. However, Teacher 1 suggests that ChatGPT may not be suitable for students with specific learning challenges and may not offer the same level of cultural context as a human teacher. Teacher 2 believes that the effectiveness of ChatGPT depends on how it is integrated into the classroom, and it is essential to set clear goals, provide support and resources, and assess its impact on language learning outcomes regularly. According to Teacher 3, ChatGPT can provide personalized learning experiences for special education students, but it should be used in conjunction with other teaching methods. Teacher 4 emphasizes that the quality and relevance of the content determine the effectiveness of ChatGPT in improving language skills. Finally, Teacher 5 highlights the importance of using a variety of teaching methods and regularly assessing the effectiveness of ChatGPT to ensure that it meets the students' needs.

3. What challenges have you encountered when integrating ChatGPT into language instruction for special education students, and how did you overcome them?

Integrating ChatGPT into language instruction for special education students poses challenges for EFL teachers. Teacher 1 addresses this by providing ChatGPT with appropriate vocabulary and structures, aligning language generated with learning goals. Teacher 2 works with a speech therapist to ensure ChatGPT accurately understands and responds to speech patterns. Teacher 3 incorporates ChatGPT into small-group instruction and provides individualized support. Teacher 4 uses ChatGPT in a variety of activities and ensures opportunities for peer interaction and teacher-led instruction. Despite challenges, EFL teachers have found ways to provide effective language instruction using ChatGPT.

ChatGPT can be a valuable tool for language instruction, but it may not be able to provide the same level of emotional support and nonverbal cues that a human teacher can offer. According to Teacher 5, the lack of emotional connection and support may be a significant barrier to learning for some special education students. Additionally, Teacher 5 notes that the use of ChatGPT may limit opportunities for students to practice their speaking and listening skills, which are critical for language proficiency.

4. How do you ensure that ChatGPT is used in an inclusive way that meets the diverse needs of special education students in your classroom?

These teachers prioritize inclusive integration of ChatGPT into language learning for special education students, using different strategies. Teacher 1 ensures accessibility for all learners with diverse needs. Teacher 2

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emphasizes ongoing training and support. Teacher 3 collaborates with colleagues and evaluates effectiveness. Teacher 4 supplements ChatGPT with other strategies, considering student interests. Teacher 5 incorporates student feedback and cultural and linguistic diversity. All teachers recognize ChatGPT's importance in effective and accessible language learning for special education students, regularly evaluating its impact.

5. In what ways have you modified your teaching approach when using ChatGPT to better support special education students' language learning?

Teacher 1 mentioned that she modified her teaching approach when using ChatGPT to better support special education students' language learning by breaking down the language into smaller, more manageable parts. This helped students to better understand the language and use ChatGPT to improve their language skills. Additionally, according to Teacher 2, "I scaffold the use of ChatGPT by first modeling its use and gradually releasing responsibility to students. This approach helps students to develop the skills needed to use ChatGPT independently.". Teacher 3 also stated that she provides ample opportunities for practice and reinforcement using ChatGPT, which helps students to internalize and apply what they have learned. Furthermore, Teacher 4 mentioned that she focuses on building students' confidence in using ChatGPT by providing positive feedback and celebrating their successes. Lastly, Teacher 5 emphasized the importance of regularly assessing student progress and adjusting her teaching approach as needed to ensure that students are making meaningful gains in their language learning. By modifying their teaching approaches, these teachers have been able to effectively incorporate ChatGPT into their language instruction and support their student's language learning needs. ChatGPT can play a significant role in language instruction, improving language skills, particularly in areas such as vocabulary and grammar. According to Teacher 3, ChatGPT offers an engaging and interactive learning experience that adapts to the student's individual needs. Similarly, Teacher 4 notes that ChatGPT provides personalized feedback and adapts to the student's learning style, pace, and needs. However, Teacher 1 notes that the use of ChatGPT may reinforce certain biases and stereotypes that exist in language and culture.

4. DISCUSSION

The findings of this study directly address the first research question, demonstrating that ChatGPT holds significant implications for language learning. The participants' positive attitudes provide compelling justifications for the potential value of ChatGPT in facilitating communication, enhancing language learning outcomes, and even potentially replacing traditional teaching methods. These results align with previous research highlighting the effectiveness and benefits of employing artificial intelligence and natural language processing technologies in language education (Artiles *et al.*, 2021; Mohamed, 2023). Thus, the study's findings strongly support the notion that ChatGPT can be a valuable tool in language instruction, fulfilling its intended purpose.

The high mean scores for statements related to communication facilitation and technology replacing traditional teaching methods indicate educators' recognition of ChatGPT's potential. The participants' familiarity with ChatGPT and desire for training highlight the importance of teacher support and professional development in utilizing ChatGPT effectively. However, some statements received lower levels of agreement,

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emphasizing the need for ongoing support and addressing user concerns. These findings resonate with previous research on the importance of support and addressing challenges in technology integration.

Regarding the second research question, the study findings indicate a range of attitudes and concerns surrounding the effectiveness and barriers of utilizing ChatGPT in language instruction. While there is a certain level of confidence in its effectiveness, the presence of concerns related to suitability, time consumption, integration, and accessibility suggests a more nuanced perspective. The moderate overall interpretation of the results signifies a balanced assessment of the potential benefits and challenges associated with ChatGPT. To address these concerns, future research should delve deeper into specific barriers and explore strategies to mitigate them, ultimately informing the development of guidelines and support systems. By addressing these concerns, the study highlights the potential for improving language learning outcomes and fostering acceptance of AI-based language learning technology. This aligns with previous research by Adiguzel *et al.* (2023) and Mohamed (2023), further emphasizing the significance of addressing these concerns for the successful integration of ChatGPT in language instruction.

Regarding the third research question, the findings reveal positive attitudes towards the future use of ChatGPT in language instruction, particularly for EFL special education students. Participants express intentions to use ChatGPT extensively, believe in its future capabilities to meet individual learning needs and plan to continue incorporating it into their instruction. These results indicate a high level of enthusiasm and optimism for utilizing ChatGPT in the future.

The significance of these findings lies in their potential implications for the integration of ChatGPT in EFL special education language instruction in Saudi Arabia. The moderate level of willingness to use ChatGPT for language learning suggests that this tool may be a viable option for supporting language instruction in the special education context. However, the variability in agreement levels among the different items indicates the need to carefully consider the specific applications of ChatGPT in language learning and tailor them to the needs and preferences of the learners (Florian, & Linklater, 2010; Mohamed, 2023; Qasem *et al.*, 2023).

The results of the study on the fourth research question showed no significant gender differences in EFL special education teachers' attitudes toward ChatGPT, its effectiveness, and barriers, consistent with previous studies (Florian, & Linklater, 2010; Mohamed, 2023; Qasem *et al.*, 2023). However, female teachers expressed a higher inclination to incorporate ChatGPT into their language instruction, highlighting the importance of promoting gender equality in technology adoption and ensuring equal access for all teachers. The study's results underscore the need to consider gender differences in teachers' attitudes towards technology and call for further research to explore the underlying factors influencing these differences and strategies that enhance technology integration while fostering inclusivity (Tomczyk *et al.*, 2023).

EFL special education teachers shared valuable insights on using ChatGPT in language teaching, including strategies, effectiveness, challenges, and inclusivity. Effective strategies identified by the teachers include scaffolding, differentiation, individualized instruction, modeling, guidance, and collaboration, which were found to facilitate language learning outcomes. Teachers suggested using ChatGPT to provide personalized and adaptive learning experiences, peer-to-peer interactions, and promote social and emotional growth, aligning with research on collaborative learning's effectiveness for special education students (Mohamed, 2023; Qasem *et al.*, 2023).

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The effectiveness of ChatGPT in enhancing language learning outcomes was found to depend on several factors, including integration, content quality, and student engagement, consistent with previous research (Bingimlas, 2009; Edwards, & Cheok, 2018; Şimşek, & Ateş, 2022). Technology can supplement traditional teaching methods but should not replace one-on-one instruction and individualized support. However, teachers also identified challenges with ChatGPT use, such as appropriate language levels, speech pattern recognition, providing additional support, and avoiding overreliance on technology. While technology integration in special education can aid learning and offer access to materials, concerns about reduced social and emotional interaction and the need for appropriate support and guidance have been raised (Cagiltay *et al*., 2019; Cheng, & Lai, 2020).

To ensure inclusive use of ChatGPT in special education language learning, teachers suggested ongoing training and support, varied instructional approaches, collaboration, and regular evaluation. These strategies align with previous research emphasizing inclusive and effective technology integration in classrooms, regardless of learning styles and abilities, through continuous training and support (Alcorn *et al*., 2019; García Aguilera, & Aguilar Cuenca, 2022; Hopcan *et al*., 2022; Paju *et al*., 2016). Addtionally, the importance of thoughtful integration and evaluation of ChatGPT in special education language instruction is highlighted by teachers' responses and supported by previous studies (Cheng, & Lai, 2020; Miranda *et al*., 2019; Pedró *et al*., 2019), emphasizing the need to consider special education students' unique needs in incorporating educational technologies.

The interview findings provided valuable insights into the use of ChatGPT in special education classrooms, and identified successful practices and strategies that can be shared with other teachers. The interviews also helped to understand how teachers evaluate the impact of ChatGPT on their students' learning, and how they adapt their practices to enhance learning outcomes. Finally, the interviews highlighted the need for effective support mechanisms for special education teachers using ChatGPT in their classrooms.

In conclusion, the study has addressed various research questions on the advantages and drawbacks of AI-powered educational technologies for students with disabilities, including their effectiveness, challenges, and the potential of ChatGPT. The findings offer valuable insights into the potential benefits and challenges of integrating AI-powered educational technologies in special education, promoting the development of more equitable and inclusive learning environments.

5. CONCLUSIONS

This study provides insights into EFL special education teachers' attitudes toward using ChatGPT for language learning in Saudi Arabia. The participants had moderate attitudes and perceived ChatGPT as moderately effective, with moderate barriers to its use. Female teachers demonstrated a greater willingness to use it. The results have important implications for ChatGPT's implementation and development as a language learning tool for EFL special education students. Educators need training in using AI effectively, and policymakers and education leaders must invest in AI technologies and resources. The study contributes to the growing literature on AI in special education, with significant implications for teaching approaches and AI technology design for students with disabilities.

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5.1. Limitations and recommendations

While this study provided valuable insights from EFL special education teachers on ChatGPT, it has limitations. The small sample size may restrict generalizability. Future research should include a larger, diverse participant group. Additionally, perspectives of students and families were not considered, limiting understanding of ChatGPT's impact. The study focused on English language instruction and may not apply to other languages.

To effectively implement ChatGPT in EFL special education, teachers need adequate training and support. Ethical concerns, such as data privacy, must be addressed, and adherence to ethical and legal standards is important. Further research is needed to assess long-term effects on language learning outcomes and support for students with diverse disabilities. More studies should explore ChatGPT's potential in different educational contexts and for diverse populations. Addressing these limitations and recommendations will optimize ChatGPT's implementation in EFL special education instruction.

5.2. Pedagogical Implications

The investigation's outcomes have important implications for AI use in special education settings. Firstly, special education instructors hold a favorable view of AI integration in language teaching, particularly for enhancing student engagement and motivation. Policymakers and educators can explore AI tool integration to create a dynamic and engaging learning environment for special needs students. Secondly, professional development opportunities are crucial for teachers to effectively use AI technologies. Training sessions can provide skills to select appropriate AI tools, design lesson plans, and assess outcomes. Thirdly, special education teachers need support in their use of AI technologies, such as technical support, online resources, and peer networks. In general, AI integration in special education settings can improve language instruction and cater to specific learning requirements. However, this requires careful analysis of educational consequences and suitable support systems to enable successful AI integration.

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Acceptance and Use of Cloud-Based Virtual Platforms by Higher Education Vocational School Students: Application of the UTAUT Model with a PLS-SEM Approach

Aceptación y uso de plataformas virtuales basada en la nube por estudiantes de educación superior de escuelas profesionales: aplicación del modelo UTAUT con enfoque PLS-SEM

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ABSTRACT

Cloud-based virtual platforms emerged as a new way of tracking lectures as mobile, reliable, and productive. Especially due to the COVID-19 breakdown, they became popular because checking the students' effort, performance, social interaction among each other, and the condition of vocational schools was easy to track during and after the online classes. The research aims to analyze the behavioral intention to adopt cloud-based virtual platforms such as Blackboard, Microsoft, Zoom, Edmodo, Sakai and Moodle during COVID-19. 14 questions were asked to 313 students from higher education vocational schools in the district of Izmir, Turkey via Google Forms. PLS-SEM analyses were made by SmartPLS 4.0 software and by proposing the Unified theory of acceptance and use of technology (UTAUT) theory. The results showed that the variance of effort expectancy, behavioral intention, and facilitating conditions explained 76.00% of the proposed model. The research contributes to understanding the students' behavior toward the acceptance of cloud-based virtual platforms in case of new variants or other epidemic diseases emerged in the future.

KEYWORDS Cloud-based virtual platforms; PLS-SEM; UTAUT theory; COVID-19; Higher education vocational students.

RESUMEN

Las plataformas de aprendizaje basadas en la nube surgieron como una nueva forma portable, confiable y productiva de hacer un seguimiento a clases y conferencias. Particularmente debido al impacto del COVID-19, se convirtieron en herramientas populares debido a su facilidad para monitorear el esfuerzo de los estudiantes, su rendimiento, así como su interacción social durante y después de las clases. La investigación tiene como objetivo analizar la intención de comportamiento de adoptar plataformas virtuales basadas en la nube como Blackboard, Microsoft, Zoom, Edmodo, Sakai y Moodle durante COVID-19. Se hicieron 14 preguntas a 313 estudiantes de escuelas vocacionales de educación superior en el distrito de Izmir, Turquía a través de Google Forms. Análisis PLS-SEM se realizaron mediante el software SmartPLS 4.0 proponiendo la teoría unificada de aceptación y uso de tecnología (UTAUT). Los resultados mostraron que la varianza de la expectativa de esfuerzo, la intención de comportamiento, y las condiciones facilitadoras explicaron el 75,40% del modelo propuesto. La investigación permite comprender el comportamiento de los estudiantes hacia la aceptación de plataformas de aprendizaje basadas en la nube en caso de que surjan nuevas variantes u otras enfermedades epidémicas en el futuro.

PALABRAS CLAVE Plataformas virtuales basadas en la nube; PLS-SEM; teoria UTAUT; COVID-19; Estudiantes de formación profesional de educación superior.

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1. INTRODUCTION

The COVID-19 lockdown has temporarily switched the education system from face-to-face to virtual instruction (Torrás, 2021; Vásquez *et al*., 2023). The first occurrence was reported in Wuhan, China, on February 22nd, 2020, and the first case was discovered in Turkey on March 11th, 2020 (Republic of Turkey Ministry of Health, 2020). The Turkish government has implemented stringent regulations in relation to higher education, with peak instances beginning in the middle of 2021. For safety reasons, the spring 2019–2020 term and the fall 2020–2021 term were launched online (Bautista *et al*., 2022). According to the council of higher education (2021), the institutions had the authority to choose whether students would receive their education remotely, virtually, or in person, depending on whether the region was under threat. The requirement of the vaccine for students, academics, and administrative personnel also shaped the educational atmosphere (the council of higher education, 2021). Since the COVID-19 epidemic began to spread in July 2022, it was necessary to make research to determine how cloud-based learning platforms would be used effectively if students were online away from college.

The UTAUT is a significant theory for examining people's intentions regarding the acceptance and use of technology (Venkatesh *et al*., 2003). Several studies have successfully used UTAUT in understanding the technology acceptance and use across various technologies, containing AL integrated CRM systems (Chatterjee *et al*., 2021), document management systems (Ayaz, & Yanartas, 2020), eWallet (Bommer *et al*, 2022), accounting information systems (Lutfi, 2022), online technology (Chayomchai *et al*, 2020), e-commerce (Chan *et al*., 2021), open online courses (Li, & Zhao, 2021), internet banking services (Al-Fahim *et al*., 2021), smart city (Popova, & Zagulova, 2022), digital technology (Akinnuwesi *et al*., 2022), online knowledge paying behavior (Yu *et al*., 2021), mobile payments (Ariffin *et al*., 2020; Namahoot & Jantasri, 2022; Nur, & Gosal, 2021), mobile health or ehealth applications (Magsamen-Conrad *et al*., 2019; Semiz, & Semiz, 2021), ERP systems (Thottoli, & Thomas, 2022), e-government (Zeebaree *et al*., 2022), streaming media (Limna *et al*., 2022) and online learning (Ahmed *et al*., 2022; Alvi, 2021; Alwahaishi, 2021; Jameel *et al*., 2022; Marandu *et al*., 2022; Sabayleh *et al*., 2020; Şimşek, & Ateş, 2022; Sukarya *et al*., 2020; Tussardi *et al*., 2021), m-learning (Alyoussef, 2021; Ikhsan *et al*., 2021). However, the COVID-19 period has seen a limited number of studies on behavioral intentions to use cloud-based learning platforms, and the majority of the extant research has focused on a four-year higher education (Adanir & Cinar, 2011; Batucan *et al*., 2022; Serttas, & Kasabali, 2020). The dearth of research in the literature today makes it even more important to examine the influences of effort expectancy, behavioral intentions, and facilitating conditions on the adoption of cloud-based learning platforms during the COVID-19 period in the two-year higher education program context.

In light of this, it is intended to study students' behavioral intentions with regard to using cloud-based learning platforms during COVID-19 from vocational school and comprehend what are hurdles of cloud-based learning platforms adoption usage using UTAUT theory. The following are covered under the research questions: What are the factors that influence vocational school students' intentions to use cloud-based virtual platforms? How did performance expectations and social influence affect their behavioral intentions? How did effort expectations, behavioral intentions, and performance expectations interact with one another?

This study will contribute to the educational institutions taking the required actions and creating user-friendly features to make preferable virtual learning platforms and guide their students in using

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cloud-based virtual platforms during COVID-19. The details of materials and methods to address the aim of this study are given in the next section.

2. MATERIAL AND METHOD

The research primarily proposes a UTAUT theory to understand how cloud-based virtual platforms are used and accepted, which are Blackboard, Microsoft, Zoom, Edmodo, Sakai and Moodle. In order to compre-hend the behavioral intentions of higher education students at vocational schools, the quantitative study methodology was used. Table 1 displays the five demographic questions that were developed to profile the universities' cloud based virtual platform usage of for higher education.

TABLE 1. Descriptive statistics for the participants.

GENDER	FREQUENCIES	RATIOS
Male	136	43.5
Female	177	56.5
AGE INTERVAL		
18-19	90	28.8
20-21	99	31.6
22-23	32	10.2
24-25	21	6.7
25 and above	71	22.7
COURSE		
Graphic design	29	9.3
Civil Technology	24	7.7
Occupational health and safety	30	9.6
Civil air transportation and management	71	22.7
Medical documentation and secretarial	36	11.5
Applied English and translation	25	8.0
Landscape Architecture	98	31.2
CLOUD-BASED LEARNING PLATFORMS USE		
Once a month	25	8.0
Twice a month	28	8.9
Several times a day	115	36.7
Once a week	119	38.0
Never	26	8.4
CLOUD-BASED LEARNING PLATFORMS TOOL USE		
Blackboard	116	37.1
Microsoft	47	15.0
Zoom	72	23.0
Edmodo	21	6.7
Sakai	31	9.9
Moodle	26	8.3

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2.1. Design and data collection

The UTAUT investigates people's effort, performance, social influence, facilitating conditions regarding behavioral intention, and the user behavior of technologies. This model was used because this was the only mixture theory of combined psychological and sociological studies, measuring acceptance and use of disruptive technologies and including the combined technology acceptance model (TAM) for social cognitive theory (SCT) towards cloud-based virtual platforms acceptance and use during COVID-19. The unique feature of the UTAUT theory discovered was that it was successful in explaining students' spontaneous and instantaneous actions toward cloud-based virtual platforms during COVID-19 by measuring the impact of effort expectancy directly on technology adoption and use. In this study, the UTAUT was applied by obtaining Effort expectancy (EE), Performance expectancy (PE), Social influence (SI), Facilitating condition (FC), Behavioural intention (BI), and Use behavior (UB), as the hypothesis illustrated in Fig 1. EE (H1) served to examine perceived ease of use and complexity. PE and SI were applied to analyze perceived usefulness and subjective norms, respectively, as H2a and H2b. FC (H3) was also examined to seek perceived behavioral control and compatibility.

FIGURE 1. The Research Model.
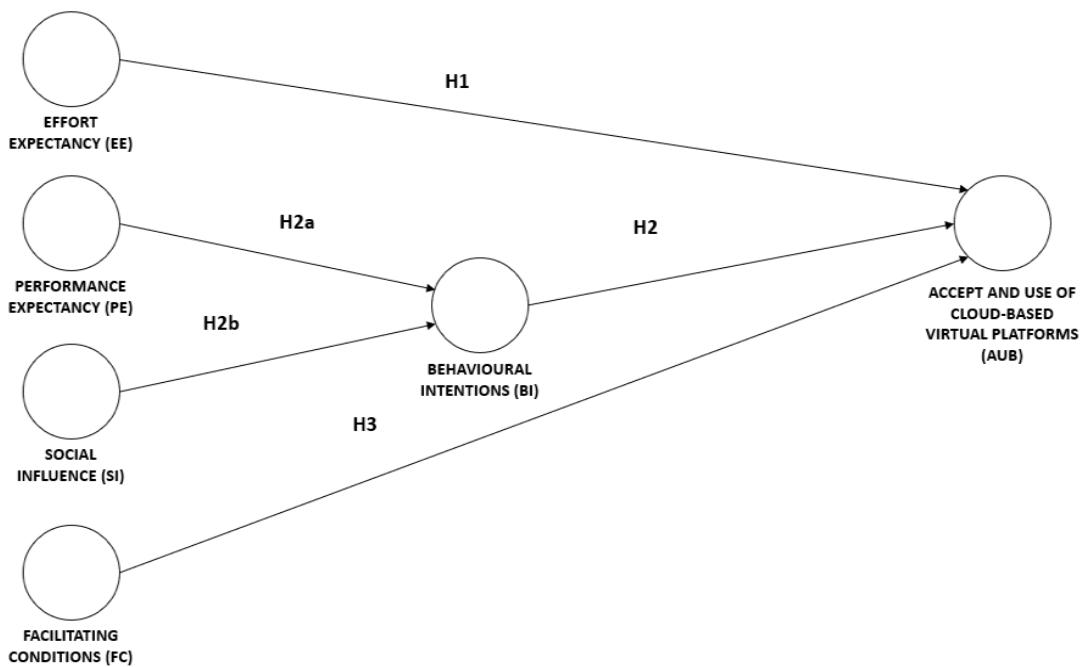
2.2. Participants

In the present study, an online survey was administered to 313 vocational higher education students in the spring of 2021/between mid-March and mid-April 2021, during the partial lockdown, and lockdown.

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2.3. Instrument and hypothesis

The students' use and acceptance intention to adopt cloud-based virtual platforms were evaluated using a 5-point Likert scale from 1 (totally disagree) to 5 (totally agree). Six constructs and fifteen items were used in the structural model, and accept and use of cloud-based virtual platforms were used and accepted as a dependent variable, which had 2 items. There are 5 independent variables: Effort expectancy (EE), Performance expectancy (PE), Social influence (SI), Facilitating condition (FC), and Behavioural intention (BI), each of which has 4, 3, 2, and 3 items, respectively. Assessments were made in accordance with the hypothesis put forth as the study's starting premise after the results were elicited.

H1. Effort expectancy (EE) has a positive impact on the acceptance and use (AUB) of cloud-based virtual platforms.

H2. Behavioral intention (BI) has a positive impact on the acceptance and use (AUB) of cloud-based virtual platforms.

H2a. Performance expectancy (PE) has a positive impact on behavioral intention (BI) to adopt cloud-based virtual platforms.

H2b. Social influence (SI) has a positive impact on behavioral intention (BI) to adopt cloud-based virtual platforms.

H3. Facilitating conditions (FC) has a positive impact on the acceptance and use (AUB) of cloud-based virtual platforms.

2.4. Data analysis procedures and techniques

To create a structural model for the research domains, 15 questions were applied to SmartPLS 4.0 for six factors. The structural model was examined using confirmatory factor analysis (CFA). To test the theory, structural equation modeling (SEM) was applied. Standard Loadings, Cronbach's Alpha, Composite reliability (CR), Average variances extracted (AVE), and Variance inflation factor (VIF) were acquired to check the validity and reliability of data items. The Fornell-Larcker criterion and cross loadings analysis were formed to check the discriminant validity among constructs. After ensuring the reliability and validity, the structural model assessment was exhibited to assess the model's effect, explanatory and predictive power. The structural model was formed, deriving from the UTAUT theory to test the hypothesis.

3. RESULTS

Six constructs were used to create the UTAUT theory: EE, PE, SI, FC, BI, and AUB. The Items were also illustrated in Appendix 1. The section was divided into two subsections: Reliability and Validity, and Model Evaluation.

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3.1. Reliability and Validity

SRMR value for the structural model was 0.080, which MacCallum *et al.* (1996) noted was a significant fit for the range of 0.08 to 0.10. Nunnally and Bernstein (1994) stated that all Cronbach's Alpha values of the EE, PE, SI, FC, BI, and AUB ranging from 0.635 to 0.956, which is more than 0.6, were considered fit. According to Hair *et al.* (2017), all AVE values should be more than 0.5 and were all valid. According to Hair *et al.* (2010), the threshold of value was 0.7, and all CR values were fit. Table 2 shows that EE has four components, with a CR of 0.925, and an AVE of 0.755. PE consists of three items with a CR of 0.944, and an AVE of 0.849. SI has 2 items with a CR of 0.845, and AVE of 0.732. FC has two items holding with a CR of 0.854, and an AVE of 0.745. BI has three elements, with factor loadings ranging from 0.950 to 0.967, a CR of 0.971, and an AVE of 0.919. AUB has 2 components with a CR of 0.893, and an AVE of 0.807. According to Hair (1995), the VIF value, which was below 10, was acceptable. It was shown in Table 2 that all items have no multicollinearity issues.

TABLE 2. Items, Cronbach's Alpha, Composite reliability (CR),
Average variances extracted (AVE) and Variance Inflation Factors (VIF).

UTAUT Variables	Indicators	Cronbach's Alpha	CR	AVE	VIF
EE (Item 1-3)	EE1				2.804
	EE2	0.891	0.925	0.755	1.761
	EE3				3.532
	EE4				3.211
PE (Item 4-6)	PE1				2.749
	PE2	0.911	0.944	0.849	4.245
	PE3				3.144
SI (Item 7-8)	SI1				1.277
	SI2	0.635	0.845	0.732	1.277
FC (Item 9-10)	FC1				1.319
	FC2	0.659	0.854	0.745	1.319
BI (Item 11-13)	BI1				5.939
	BI2	0.956	0.971	0.919	6.898
	BI3				4.821
AUB (Item 14-15)	AUB1	0.762	0.893	0.807	1.608
Model Fit SRMR Value (0.080)	AUB2				1.608

The distinctness and uniqueness of the construct were evaluated using the Forner-Lacker criterion, as proposed by Hair *et al.* (2017), in this work. Every latent variable should have an AVE square root that is higher than other latent variable correlation coefficients (Fornell, & Lacker, 1981). In Table 3, EE, PE, SI, FC, BI, and AUB consist of four, three, two, two, three, two components, with standardized factor loadings, ranging from 0.771 to 0.910, 0.902 to 0.913, 0.838 to 0.873, 0.841 to 0.885, 0.950 to 0.967, and 0.888 to 0.909, respectively. According to Hair *et al.* (2010), all factor loadings should be more than 0.7, which all were satisfied. Additionally, it was observed that the cross-loadings for each construct are low, indicating strong discriminant validity. The discriminant validity assessments' valid Fornell-Larcker criterion and cross-loading results

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were shown in Table 3. The structural model was assessed in the next section when it was determined that the construct measurements were accurate and valid.

TABLE 3. Discriminant Validity Measurement through Fornell-Larcker Criterion and Cross-loadings.

UTAUT Constructs	EE	PE	SI	FC	BI	AUB	Discriminant Validity
Fornell-Larcker Criterion							
EE	**0.867**						Valid
PE	0.753	**0.921**					Valid
SI	0.689	0.646	**0.856**				Valid
FC	0.677	0.632	0.702	**0.863**			Valid
BI	0.572	0.600	0.632	0.680	**0.959**		Valid
AUB	0.718	0.679	0.709	0.750	0.798	**0.896**	Valid
Cross-Loadings							
EE1	**0.887**	0.663	0.585	0.610	0.421	0.590	Valid
EE2	**0.771**	0.602	0.644	0.544	0.324	0.538	Valid
EE3	**0.910**	0.676	0.562	0.591	0.561	0.674	Valid
EE4	**0.900**	0.681	0.641	0.639	0.602	0.696	Valid
PE1	0.741	**0.902**	0.567	0.578	0.542	0.622	Valid
PE2	0.681	**0.948**	0.588	0.613	0.573	0.625	Valid
PE3	0.667	**0.913**	0.632	0.572	0.543	0.645	Valid
SI1	0.726	0.599	**0.838**	0.689	0.509	0.714	Valid
SI2	0.481	0.513	**0.873**	0.548	0.570	0.523	Valid
FC1	0.533	0.512	0.524	**0.841**	0.627	0.605	Valid
FC2	0.646	0.586	0.703	**0.885**	0.543	0.702	Valid
BI1	0.515	0.551	0.609	0.650	**0.958**	0.739	Valid
BI2	0.549	0.603	0.616	0.658	**0.967**	0.761	Valid
BI3	0.547	0.572	0.592	0.627	**0.950**	0.757	Valid
AUB1	0.711	0.633	0.674	0.693	0.579	**0.888**	Valid
AUB2	0.597	0.598	0.615	0.674	0.819	**0.909**	Valid

3.2. Model Evaluation

The model was assessed by obtaining f2 (effect size of the model), Q2 (predictive relevance), and R2 (coefficient of determination), path coefficients, and T-values.

As Table 4 illustrated, The effect size (f square) of the model was defined as large, which was above 0.35, medium, which was above 0.15, and small was above 0.02. (Cohen, 1988). Every hypothesis has separate values: the effect of BI on AUB (H2) was 0.436 (large); the effect of EE on AUB (H1) was 0.191 (medium); the effect of SI on BI (H2b) was 0.190 (medium); the effect of PE on BI (H2a) was 0.118 (small). The predictive relevance (Q square) of the model was described as 0.02, 0.15, 0.32 for weak moderate, and strong (Hair *et al*.,

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2010). The influence of both EE on AUB (H1) and PE on BI (H2a) hypotheses were strong with 0.670, and 0.450, respectively.

TABLE 4. Structural model's effect, explanatory, and results.

Hypothesises	f²	Q²	T-Values	Results	p Value
H1: EE->AUB	0.191	0.670	5.302	**SUPPORTED**	0.000 (***)
H2: BI ->AUB	0.436		7.510	**SUPPORTED**	0.000 (***)
H2a: PE->BI	0.118	0.450	4.404	**SUPPORTED**	0.000 (***)
H2b: SI->BI	0.190		8.559	**SUPPORTED**	0.000 (***)
H3: FC->AUB	0.110		5.723	**SUPPORTED**	0.000 (***)

As shown in Figure 1, path coefficients of effort expectancy and acceptance and use of cloud-based virtual platforms (H1), behavioral intention and acceptance and use of cloud-based virtual platforms (H2), performance expectancy and behavioral intention (H2a), social influence and behavioral intention (H2b), and facilitating conditions and accept and use of cloud-based virtual platforms (H3) were 0.272, 0.437, 0.329, 0.419, and 0.284 with the T-value of 4.916, 8.096, 4.891, 6.024, and 4.662, respectively. The hypotheses were supported as T-value exceeds 1.96 (Hair *et al.*, 2010). As understood from explained variable as variance (R square), the variance of PE and SI explained 46.30% of BI of cloud-based learning platforms. The results exhibited that the variance of EE, BI, and FC explained 76.00% of the variance of AUB.

FIGURE 2. The structural model with Path Coefficients, T- values and R square.

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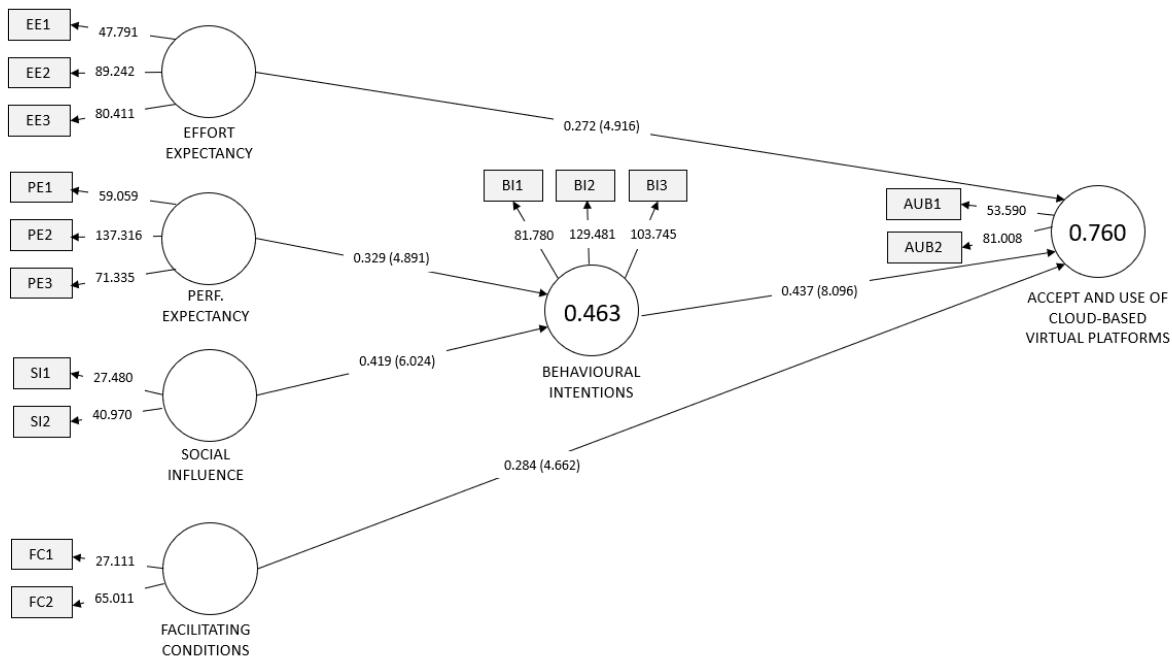
4. DISCUSSION

By utilizing cloud-based learning platforms like Blackboard, Microsoft, Zoom, Edmodo, and Sakai, education has transitioned from traditional classroom instruction to online instruction. According to Kacan and Gelen (2020), 50% of institutions have chosen to adopt Moodle as a platform for conducting business. Blackboard is the platform of choice in Turkish higher education, according to Ozbay (2015). Additionally, the UZEM platform was extensively used for history and e-MBA programs, according to Kirkan and Kalelioglu (2017). According to Kacan and Gelen (2020), 15% of Turkish universities have created their software. Izmir Katip Celebi University, Ataturk University, Bilecik Seyh Edebali University, and Dokuz Eylul University, respectively, produced the software known as Canvas, ALU, SOFRA, and DEOYS. This demonstrated how the research and development division became creative to sustain education.

The council of higher education (2021) emphasized that the entire class will continue to engage in hysbrid learning based on COVID-19 commission regulations and COVID-19 cases. By using the council of higher education's guide, the government has continued to specify the standardized learning ecosystem policy for instruction using cloud-based learning platforms. (1) It protects students' rights by allowing university registration to be frozen, according to the council of higher education's instructions. (2) The flexibility of the online and in-person absence policies for students has encouraged them to pursue excellent education continuity. (3) To prevent confusion in class, the syllabus and course material should be made known to the students in advance. As a result, the council of higher education has sponsored both traditional and online higher education in Turkey.

Later, from March 2020 till today, understanding the actual use of cloud-based learning platforms has become significant. It can be inferred that effort expectancy (EE) was not correlated with behavioral intention but was correlated with the acceptance and use (AUB) of cloud-based learning platforms, as the online classes emerged swiftly, the ease of use of online learning during the COVID19 outbreak was not as important as the system usefulness at the first stage.

From effort expectancy —the acceptance and use (AUB) hypothesis (H1), as the students from the vocational school have applied classes, white blackboard extensions by Rahmadi (2021) and discussion forums by El Said (2021) were required with the file sharing and access feature for involving lab classes as two-way communications (Cavus, & Zabadi, 2014). It led the vocational school students to increase the perceived ease of use and decrease the complexity of accepting and using cloud-based learning platforms. From facilitating condition —the acceptance and use (AUB) hypothesis (H3), microlearning mentioned by Sozmen *et al.* (2021) was established for lecturers and students from vocational schools to share their experiences and keep track of students' behavior for finding an effective human-friendly interface. Based on the feedback, the systems were upgraded by the IT help desk (van Houwelingen *et al.*, 2018). It caused the vocational school students to increase their perceived behavioral control and the compatibility for accepting and using of system. From performance expectancy (PE) —the behavioral intention (BI) hypothesis (H2a), learning centers and the IT help desk worked collaboratively for contacting students and lecturers There is an urgent contact for students' critical issues such as missing attending midterm and final exams on time. They also accompany lecturers to conduct online classes, video services, and real-time chatting declared by Karadag *et al.* (2021) for increasing productivity during and after classes. It induced the vocational school students to increase the efficiency

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of students' behavioral intentions to adopt cloud-based learning platforms. From the social influence(SI)-behavioral intention (BI) hypothesis (H2b) lecturers conducted demo quizzes and virtual gamification classes by Sukarya *et al*. (2020) for students to acknowledge the systems' use. It led the vocational school students to increase their awareness of students for behavioral intentions to adopt cloud-based learning platforms. From behavioral intention —the acceptance and use (AUB) hypothesis (H2) Most students have experienced using distance learning previously. Bozkurt (2017) stated that Anadolu University started open university education in 1993, Fırat University began remote certified programs in 1995, and Bilkent University held a video conference system education portal for lecturing from the US. They led the vocational school students to understand the subjective norms of accepting and using cloud-based learning platforms.

This research aims to investigate the behavioral intention of the acceptance and use of cloud-based learning platforms in the COVID-19 period to increase the quality of two-year higher education programs for vocational school students and build them ease of use and usability system by applying the UTAUT model. The indicators of UTAUT are performance expectancy and social influence which explained 46.3% of the variance of the behavioral intention of cloud-based learning platforms. Hence, this UTAUT model was constructed to indicate that effort expectancy, behavioral intentions and social influences are three important critical constructs for the actual acceptance and use of cloud-based learning platforms, which explained 75.4% of actual acceptance and use of cloud-based learning platforms. In this section, the results obtained will not be shown again, but the most outstanding ones will be highlighted based on citations from similar studies that complement those obtained.

5. CONCLUSIONS

Education was changed drastically in the spring term of 2020 during the pandemic by using cloud-based learning platforms. From that time to two years, as the new variants appeared, knowing the use and acceptance of cloud-based learning platforms from the perception of vocational school students is significant to preserving the education standards.

The study monitored the acceptance and use of cloud-based learning platforms tools by using a UTAUT theory, which was Effort expectancy (EE), Performance expectancy (PE), Social influence (SI), Facilitating condition (FC), Behavioural intention (BI), Use behavior (UB). The model provides vocational school students' intentions for educational policymakers. Universities should especially create a communal learning platform manual for sharing their obstacles and hindrances over cloud-based learning platforms. Virtual learning centers for universities should also create student-oriented procedures for preparing manuals of the applied lectures. In addition, IT helpdesks should follow students' behaviors by examining the system's ease of user feedback for the classes and informing the board of universities' executives to reduce the troubles. Lecturers should be taken as feedback to answer students' instant requests to pervert the sufferer.

The research contributes to universities' cloud-based learning platform providers by adopting the UTAUT model to how students have a perceived acceptance and use of cloud-based learning platforms. This will aid the students in avoiding unprecedented system issues in future pandemics.

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5.1. Limitations and future lines of research

Despite the fact that the suggested approach has significant consequences for both students and higher education institutions, some drawbacks were discovered. First, different results will be obtained when the study is implemented in other places and time periods. The second step is to include students taking diverse courses in vocational schools, such as applied English translation, architectural restoration, foreign trade and tourism, and hotel management, to obtain the various samples. Third, the UTAUT model may be used in conjunction with other theories to create HOT-fit models that help us understand the technological, organizational, and human factors that influence the adoption of cloud based learning management adoption.

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APPENDIX 1. QUESTIONNAIRE DESIGN

EE1: I have a clear and intelligible engagement with the cloud-based virtual platforms offered by my university.

EE2: I find it simple to learn how to use the cloud-based virtual platforms that my university offers.

EE3: I find using the cloud-based virtual platforms offered by my university to be simple.

EE4: I find it simple to understand how to use the cloud-based virtual platforms my university offers.

PE1: My institution's cloud-based virtual platforms are helpful for my education, in my opinion.

PE2: My productivity increases when I use the cloud-based virtual platforms offered by my university.

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PE3: My institution's cloud-based virtual platforms improve my chances of receiving a high grade.

SI1: My institution's professors have been helpful in utilizing the cloud-based virtual platforms that they offer.

SI2: My institution's cloud-based virtual platforms are recommended by people who matter to me.

FC1: I possess the tools required to utilize cloud-based virtual platforms.

FC2: Help in using cloud-based virtual platforms is available from a particular person or group.

BI1: I'm planning to use the offered cloud-based virtual platforms in the upcoming semester.

BI2: I anticipate use the offered cloud-based virtual platforms over the upcoming semester.

BI3: I intend to make use of the offered cloud-based virtual platforms throughout the upcoming semester.

AUB1: When I'm learning in class, I use cloud-based virtual platforms.

AUB2: I access my personal materials through cloud-based virtual platform tools.

PE1: I find cloud-based virtual platforms provided by my institution useful to my study.

PE2: Using cloud-based virtual platforms provided by my institution increases my productivity.

PE3: Using cloud-based learning platforms provided by my institution increases my chances of getting a good grade.

EE1: My interaction with cloud-based learning platforms available in my institution is clear and understandable.

EE2: It is easy for me to become skillful at using the cloud-based virtual platforms' provided by my institution.

EE3: I find it easy to use cloud-based learning platforms provided by my institution.

EE4: Learning to operate cloud-based learning platforms provided by my institution is easy for me.

Examination of Student Satisfaction with e-courses by Clustering Analysis

Examen de la satisfacción de los estudiantes con los cursos digitales mediante análisis de agrupaciones

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ABSTRACT

Student satisfaction is one of the foremost factors for e-courses to continue efficiently and achieve their goals. The present research aims to analyze the clustering tendencies of e-course students' satisfaction with e-courses according to the variables of "gender, class, computer ownership, computer and internet literacy, duration of internet use, the connection type to the internet, and the tools utilized by the students in the learning management system" through clustering algorithms, one of the data mining techniques. The survey model was employed. A 35-item satisfaction scale devised for students taking e-courses was used for data collection. A total of 522 students taking online courses at a university participated in the study. Descriptive statistics and cluster analysis were employed to analyze and interpret the data. As a result of the analyses through K-Means cluster analysis, four different clusters were obtained. Those clusters were defined in accordance with the variables they included as follows: Cluster 1 (the group with the highest rate of computer ownership and the highest computer literacy); Cluster 2 (the group with the lowest rate of computer ownership and the lowest computer literacy); Cluster 3 (students have low computer literacy and low duration of Internet use), and Cluster 4 (the group with the highest rate of females, first graders, and those who use the Internet at "good" and "very good" levels). According to the research results, the mean student satisfaction levels regarding e-courses were determined to be low in general. As per the clustering analysis, it was observed that the students in Cluster 1 and Cluster 4 had the highest mean values of satisfaction with e-courses and a "good" level of satisfaction compared to the other groups, while Cluster 2 had the lowest mean value. Cluster 3, on the other hand, was the one with a "medium" level of satisfaction.

KEYWORDS e-courses; students' satisfaction; clustering analysis; online learning environment.

RESUMEN

La satisfacción de los alumnos es uno de los factores más importantes para que los cursos electrónicos sigan impartiéndose con eficacia y alcancen sus objetivos. El objetivo de la presente investigación es analizar las tendencias de agrupación de la satisfacción de los estudiantes con los cursos electrónicos en función de las variables de "género, clase, propiedad de ordenadores, conocimientos informáticos y de Internet, duración del uso de Internet, tipo de conexión a Internet y herramientas utilizadas por los estudiantes en el sistema de gestión del aprendizaje" mediante algoritmos

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de agrupación, una de las técnicas de minería de datos. Se empleó el modelo de encuesta. Para la recogida de datos se utilizó una escala de satisfacción de 35 ítems concebida para los estudiantes que siguen cursos electrónicos. Participaron en el estudio un total de 522 estudiantes que seguían cursos en línea en una universidad. Para analizar e interpretar los datos se utilizaron estadísticas descriptivas y análisis de conglomerados. Como resultado de los análisis mediante el análisis de conglomerados de K-Means, se obtuvieron cuatro conglomerados diferentes. Dichos conglomerados se definieron de acuerdo con las variables que incluían de la siguiente manera: Conglomerado 1 (el grupo con la tasa más alta de posesión de ordenadores y el nivel más alto de conocimientos informáticos); Conglomerado 2 (el grupo con la tasa más baja de posesión de ordenadores y el nivel más bajo de conocimientos informáticos); Conglomerado 3 (los estudiantes tienen un nivel bajo de conocimientos informáticos y una duración baja de uso de Internet), y Conglomerado 4 (el grupo con la tasa más alta de mujeres, estudiantes de primer curso y los que usan Internet a niveles "bueno" y "muy bueno"). Según los resultados de la investigación, se determinó que los niveles medios de satisfacción de los estudiantes con respecto a los cursos electrónicos eran bajos en general. Según el análisis por grupos, se observó que los estudiantes de los grupos 1 y 4 tenían los valores medios más altos de satisfacción con los cursos electrónicos y un nivel de satisfacción "bueno" en comparación con los demás grupos, mientras que el grupo 2 tenía el valor medio más bajo. El grupo 3, por su parte, tenía un nivel de satisfacción "medio".

PALABRAS CLAVE Cursos digitales; satisfacción de los estudiantes; análisis de conglomerados; entorno de aprendizaje en línea.

1. INTRODUCTION

With the developing technology, information-and-communication technologies-oriented e-learning practices have increased in education institutions. E-courses, one of the e-learning applications, are becoming increasingly widespread as a complement and alternative to formal education. Due to the pandemic that emerged in the world and in Turkey in 2019 and the subsequent transition to distance education by suspending face-to-face education, awareness and prevalence of e-courses have grown even more. During the confinement period resulting from the COVID-19 virus, distance, isolation, and uncertainty were inevitable among the general population (Bautista *et al*., 2022; Vásquez *et al*., 2023). In the e-learning environment, courses take place synchronously and asynchronously (Yildirim, 2020). While synchronous courses are conducted in an interactive online learning environment, allowing students and teachers in separate places to meet simultaneously, asynchronous ones are delivered at separate times and in separate locations. Student satisfaction, which provides feedback to make e-courses effective, efficient, and attractive, is one of the primary factors in ensuring the sustainability of these courses (Bolliger *et al*., 2010; Moore & Moore, 2005). High levels of satisfaction may be associated with a higher likelihood of success in the learning process, and students with high levels of satisfaction are likely to exhibit better academic performance (Chen *et al*., 2008; Martín *et al*., 2015).

Student satisfaction can be expressed as the "perceived value" of the education they receive (Bollinger, & Erichsen, 2013; Ilgaz, 2008). When the literature is reviewed, it is observed that the factors affecting students' satisfaction levels regarding the e-learning environment are evaluated from different perspectives. Chua and Montalbo (2014) address these factors as learner interface, learning community,

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content, and usefulness. Gülbahar (2012) discussed learner satisfaction in four dimensions: teaching process, interaction with the teaching content, delivery and usefulness, and evaluation. Kolburan and Deveci (2015) analyzed the factors affecting students' satisfaction levels in five dimensions. These dimensions are the materials and communication tools used in the online environment, design, attitude towards the e-course, course content, teacher-student interaction, and teaching process. A sustainable system of higher quality can be achieved by examining the factors that affect the students' satisfaction levels in the e-learning environment, making arrangements for a more effective and efficient teaching process (Donavant, 2009; Gülbahar, 2012; Martín *et al*., 2015). Today, the continuous increase in the number of online courses and student demands indicates the requirement for further relevant research. Determining the clustering trends of the satisfaction variables of students taking e-courses can contribute to the elimination of the deficiency in the literature.

In today's world, where data have been multiplying rapidly, the searching process for correlations that allow accessing information from large-scale data, that is, making projections about the future from large piles of data through software, denotes data mining (Terzi *et al*., 2011). Data mining (DM), which is employed in every field from education to finance, from health to business, is the extraction of implicit, not-so-clear, previously unknown yet potentially useful information from the available data. Having its basis in statistical methods, DM is used in the analysis of structured and unstructured data. Among the data mining models, clustering analysis is a multivariate method that classifies grouped data based on similarities and differences. This classification allows for an easier understanding of data stacks and more efficient use of information (Çetintürk, & Gençtürk, 2020). In the literature, there are numerous studies using cluster analysis, but it has not been used sufficiently in education. Antonenko *et al*. (2012) stated that cluster analysis could function as a data mining technique in educational technology research, yet the clustering algorithm should be chosen carefully, and cluster validation analysis was essential for obtaining valid and reliable results. Satisfaction-related studies conducted with cluster analysis in the literature are as follows:

In their study investigating the social dimensions of distance education in high schools, Lidegran *et al*. (2021) identified three clusters: urban upper-middle-class, immigrant working-class, and rural working-class.

Agyapong (2021) divided students into three clusters, which were highly, moderately, and least satisfied based on preferences (price, quality, packaging, and social bonding) that influenced their distance education program choices. Students in the highly satisfied cluster were driven by the education program's service quality and competitive fee structure.

In their study, Çakir *et al*. (2018) determined the motivation levels of distance learners using cluster analysis and obtained three clusters as low, medium, and high levels. They reported that the reason for the dissatisfied group with low motivation was the lack of interaction, negative perceptions, and dependence on traditional education, while the students with high motivation had high satisfaction due to reasons such as being independent of time and space, investigation-suitable, effective, and contemporary learning.

Unsihuay and Blanco (2021) aimed to characterise students taking a basic statistics course in the first cycle of virtual classes and to determine which variables affect their academic performance. They identified

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three clusters of students who differed according to age, anxiety and stress scores, academic background and depression. They also found that the most influential attributes in predicting academic performance were the weighted semester average of the previous semester, the course they were enrolled in, age, the number of credits enrolled, stress and anxiety.

Kaya (2022), using Ward's minimum variance clustering method, classified the differences in attitudes toward the use of distance education environment into three clusters: effectiveness and satisfaction, motivation, and dissatisfaction.

1.1. The aim of the research

The present research aimed to analyze the satisfaction levels of undergraduates for e-courses by K-Means cluster analysis with reference to different variables. In this context, the researchers determined the following questions:

1. What is the satisfaction level of the students regarding e-courses?

2. Do the clustering tendencies of students differ with respect to their satisfaction with e-courses, gender, class, computer ownership, computer and internet literacy, internet usage duration, way of connecting to the internet, and the tools students use in the learning management system?

2. MATERIAL AND METHOD

This research was conducted with a descriptive approach and using a correlational research model. The correlational research is a research method that aims to determine the presence and/or co-variation between two or more variables (Karasar, 2006). The research took place on a voluntary basis with 530 students studying in different faculties of a state university during the spring semester of 2021-2022. Due to missing data in the questionnaires of some students, the number of attendees whose data were processed was 522. Ethics committee approval was obtained before starting the study. Among the students participating in the study, 1st graders received at least four courses via distance education, 2nd graders received at least two semesters, and 3rd and 4th graders received at least three semesters of all courses via distance education. Descriptive statistics on the demographic characteristics of the students are given in Table 1.

TABLE 1. Demographic details of the students.

GENDER	N	F(%)
Female	401	76.4
Male	124	23.6
GRADE	**N**	**F(%)**
1. grade	156	29.7
2. grade	112	21.3
3. grade	152	29
4. grade	105	20
HAVE A COMPUTER	**N**	**F(%)**
Yes	414	80.1
No	111	19.9
COMPUTER USİNG SKİLLS	**N**	**F(%)**
Low	10	11.1
Medium	107	46.2
Good	223	30.9
Very good	118	11.8
INTERNET USİNG SKİLLS	**N**	**F(%)**
Low	12	2.3
Medium	121	23.4
Good	250	48.3
Very good	135	26.1
TOTAL	**522**	

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2.1. Data Collection Tools

The research data were collected through the Satisfaction Scale for E-Courses developed by Kolburan and (2015). It is a 5-point Likert scale and comprises 35 items and 5 sub-dimensions. Materials and communication tools utilized (8 items), Attitude towards e-course (6 items), Environment design (8 items), Teacher-student interaction (4 items), and Course content and teaching process (9 items) make up the sub-dimensions. The data were first analyzed for reliability, and Cronbach's alpha (α) was found to be =0.923, indicating a "good" level of reliability.

2.2. Data Analysis

The data were analyzed using the SPSS 21 software. Mean, standard deviation, and clustering analysis were used in data analysis. The significance level was taken as 0.05. The range of arithmetic means for the E-Courses Satisfaction Scale was interpreted as: 1.00-1.79 (strongly disagree), 1.80-2.59 (disagree), 2.60-3.39 (somewhat agree), 3.40-4.19 (agree), 4.20-5.00 (completely agree). K-means clustering, one of the data mining techniques, divides a data set consisting of n data objects into K clusters given as input parameters. Partitioning mainly aims to group the units, based on their characteristics, in a way to have the highest level of intra-cluster similarity and the lowest level of inter-cluster similarity. This grouping renders the data into useful summative information that is convenient to research.

3. RESULTS

The descriptive statistics of the Satisfaction Scale for E-Courses used in the research and its sub-dimensions are depicted in Table 2. According to this table, the students' mean satisfaction score in "Environment Design", one of the sub-dimensions of the satisfaction scale, was found to be at a good level (Agree), while it was determined to be at a moderate level (Somewhat agree) in the overall scale and in other sub-dimensions. This finding indicates that student satisfaction with distance education is low across the whole scale.

TABLE 2. Perception levels of students regarding their satisfaction with e-courses.

SCALE AND SUB DIMENSIONS	N	Min	Max	$\overline{X}$	S.d.	Skewness	Kurtosis
Materials and communication tools utilized	522	1.00	5.00	2.87	.866	.012	-.345
Teacher-student interaction	522	1.00	5.00	3.32	.943	-.304	-.310
Environment design	522	1.00	5.00	3.50	.809	-.205	-.066
Attitude towards e-course	522	1.00	5.00	3.00	.899	.188	-.514
Course content and teaching process	522	1.11	5.00	3.22	.656	.128	.178
TOTAL	**522**	**1.26**	**4.80**	**3.18**	**.621**	**.070**	**.167**

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The findings of the analysis performed with K-Means to reveal the satisfaction of students taking on-line courses in e-learning environments are presented below. In the study, the findings with regard to the variables of "gender, grade, computer ownership, computer and internet literacy, internet usage duration, connection way to the internet, and the tools used in e-learning environments" are as follows. Table 3 depicts the inter-cluster distances found as a result of the analysis. When this table is examined, it is observed that Cluster 3 (the group with low computer literacy and internet usage durations) and Cluster 4 (the group with the highest number of females, first graders, and the ones with the "good" and "very good" internet literacy levels) are the closest clusters (0.574), while Cluster 1 (the group with the highest computer ownership rate and the highest computer literacy) and Cluster 2 (the group with the lowest computer ownership rate and the lowest computer literacy) are the most distant clusters (2.021). Accordingly, students in Clusters 3 and 4 indicate far more similarity, while those in Clusters 1 and 2 are the least similar.

TABLE 3. Distances between final cluster centers.

CLUSTER	C1	C2	C3	C4
C1		2.021	1.340	.766
C2	2.021		.682	1.256
C3	1.340	.682		.574
C4	.766	1.256	.574	

Table 4 gives the ANOVA test results indicating the difference between the clusters created based on K-Means clustering. The value obtained from the Bonferroni test, one of the post hoc techniques of the ANOVA test, reveals that all clusters differ significantly from each other (F=1375.2; p<.001).

TABLE 4. ANOVA test results demonstrating the difference between clusters in terms of E-course satisfaction.

	Sum of Squares	df	Mean Square	F	p
Between Groups	178.311	3	59.437		
Within Groups	22.388	518	.043	1375.223	.000
TOTAL	200.699	521			

Table 5, which depicts the clusters the students belong to and the demographic characteristics of the students in the clusters, reveals that there are 4 clusters, and Cluster 3 has the highest number of students (196) while Cluster 1 has the lowest number of students (64). The Final Cluster Centers column in the table reflects the mean values of the students attending e-courses in 4 clusters. Accordingly, it is evident that the mean value of the students in Cluster 1 is the highest while the mean value of those in Cluster 2 is the lowest.

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TABLE 5. Clusters formed as a result of K-Means analysis with respect to the learning environment satisfaction levels of the students attending e-courses.

SATISFACTION		C1	C2	C3	C4	Total
	N	64	82	196	180	522
Final Cluster Centers		4.26	2.24	2.92	3.50	
Gender	Female	48 (75%)	63 (76.8%)	145 (74%)	145 (80.6%)	401(76.8%)
	Male	16 (25%)	19 (23.2%)	51 (26%)	35 (19.4%)	121(23.2%)
Grade	1.Grade	15 (23.4%)	18 (22%)	62 (31.6%)	61 (33.9%)	156(29.9%)
	2.Grade	18 (28.1%)	18 (22%)	33 (16.8%)	43 (23.9%)	112(21.5%)
	3.Grade	23 (35.9%)	28 (34.1%)	54 (27.6%)	47 (26.1%)	152(29.1%)
	4.Grade	8 (12.5%)	18 (22%)	47 (24%)	29 (16.1%)	102(19.5%)
Have a Computer		58 (90.6%)	59 (72%)	150 (76.5%)	151 (83.9%)	418 (80.1%)
Those Who Use The İnternet Connection of Their Place of Residence		41(64.1%)	65(79.3%)	143(73%)	137(76.1%)	386(73.9%)
Those Who Have Their Own İnternet Package On Their Phone		42(65.6%)	56(68.3%)	125(63.8%)	124(68.9%)	347(66.5%)
Those Who Have An İnternet Package Connected With Their Own Cable / Wireless Modem		23(35.9%)	24(29.3%)	56(28.6%)	60(33.3%)	163(31.2%)
Those Who Use The Faculty's İnternet Connection		15(23.4%)	36(43.9%)	75(38.3%)	78(43.3%)	204(39.1%)
Computer Using Skills	Low	1 (1.6%)	16 (19.5%)	25 (12.8%)	11 (6.1%)	53(10.2%)
	Medium	26 (40.6%)	37 (45.1%)	91 (46.4%)	91 (50.6%)	245(46.9%)
	Good	25 (39.1%)	24 (29.3%)	54 (27.6%)	61 (33.9%)	164(31.4%)
	Very Good	12 (18.8%)	5 (6.1%)	26 (13.3%)	17 (9.4%)	60(11.5%)
Internet Using Skills	Low	1 (1.6%)	2 (2.4%)	5 (2.6%)	3 (1.7%)	11(2.1%)
	Medium	15 (23.4%)	23 (28%)	47 (24%)	37 (20.6%)	122(23.4%)
	Good	30 (46.9%)	37 (45.1%)	83 (42.3%)	103 (57.2%)	253(48.5%)
	Very Good	18 (28.1%)	20 (24.4%)	61 (31.1%)	37 (20.6%)	136(26.1%)
Internet Using Time Per Day	1-5 Hour	30 (46.9%)	33 (40.2%)	90 (45.9%)	63 (35%)	216(41.4%)
	6-10 Hour	23 (35.9%)	32 (39%)	69 (35.2%)	74 (41.1%)	198(37.9%)
	11-15 Hour	6 (9.4%)	9 (11%)	20 (10.2%)	27 (15%)	62(11.9%)
	> 15 Hour	5 (7.8%)	8 (9.8%)	17 (8.7%)	16 (8.9%)	46(8.8%)

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When Tables 5 and 6 are analyzed together, it is noted that Cluster 1 has the highest mean (4.26), and their satisfaction is at the "good" level. It is the group with the highest rate of computer ownership (90.6%) and the highest computer literacy (57.9% at a good - very good level). The duration of using the internet within the cluster along with Cluster 3 is lower than other clusters (46.9% between 1-5 hours). This group makes the least use of the faculty's internet connection service (23.4%), and they usually have their own internet packages. It is the Cluster 1 that watches lecture recordings (73.4%), animations (14.1%), and videos (40.6%) the most, does homework the most (62.5%), and uses questionnaires the most (21.9%).

TABLE 6. Learning Management System (LMS) tools used by students in clusters generated by the k-means method.

	C1	C2	C3	C4	TOTAL
N	64	82	196	180	522
Synchron Courses	55 (85.9%)	74 (90.2%)	167 (85.2%)	150 (83.3%)	446 (85.4%)
Forums	9 (14.1%)	9 (11%)	27 (13.8%)	21 (11.7%)	66 (12.6%)
Word Processor Document	11 (17.2%)	9 (11%)	36 (18.4%)	39 (21.7%)	95 (18.2%)
Web Pages	20 (31.3%)	13 (15.9%)	64 (32.7%)	64 (35.6%)	161 (30.8%)
Pdf Documents	47 (73.4%)	59 (72%)	151 (77%)	142 (78.9%)	399 (76.4%)
Exam	37 (57.8%)	32 (39%)	98 (50%)	102 (56.7%)	269 (51.5%)
Course Records	47 (73.4%)	44 (53.7%)	87 (44.4%)	92 (51.1%)	270 (51.7%)
Graphic And Picture	16 (25%)	13 (15.9%)	46 (23.5%)	45 (25%)	120 (23%)
Chat	9 (14.1%)	11 (13.4%)	50 (25.5%)	57 (31.7%)	127 (24.3%)
Homework	40 (62.5%)	37 (45.1%)	100 (51%)	105 (58.3%)	282 (54%)
Survey	14 (21.9%)	14 (17.1%)	23 (11.7%)	33 (18.3%)	84 (16.1%)
Dictionary	3 (4.7%)	1 (1.2%)	8 (4.1%)	10 (5.6%)	22 (4.2%)
Animation	9 (14.1%)	5 (6.1%)	16 (8.2%)	17 (9.4%)	47 (9%)
Video	26 (40.6%)	19 (23.2%)	75 (38.3%)	87 (48.3%)	207 (39.7%)
E Mail	15 (23.4%)	8 (9.8%)	39 (19.9%)	41 (22.8%)	103 (19.7%)

The satisfaction level within the 2nd cluster, which has the lowest mean (2.24), is low. This group has the lowest rate of computer ownership (72%) and the lowest computer literacy (good - very good level 35.4%). Their internet usage durations are higher than other clusters. Moreover, this group takes the longest time for synchronous courses (90.2%), while spending the least time on word processing documents (11%), web pages (15.9%), exams (39%), graphics and pictures (15.9%), homework (45.1%), animations (6.1%), videos (23.2%), and emails (9.8%). Thus, one can infer that this group follows the course just to ensure the course attendance requirement.

Cluster 3, having a moderate satisfaction rate (2.92), is the second-most populous cluster. The students in this cluster have low computer literacy (59.2%) and internet usage duration (45.9%), while the 1st graders'

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rate is higher than the other grades, and they mostly use their own internet packages. The group spends the least time watching the course records (44.4%) and uses the questionnaires the least (11.7%).

Cluster 4, with a "good" satisfaction level (3.5), is the most populated one. This cluster has the highest rate of females (80.6%), 1st graders (33.9%), and those with internet literacy at good and very good levels (77.8%). This cluster ranks second in terms of computer ownership (83.9%) and computer literacy (good - very good 43.3%). At the same time, the group has the longest time staying connected to on the internet (over 5 hours by 65%). It is the group that follows synchronous courses the least (83.3%) and uses the chat tool (31.7%), videos (48,3%), word processing documents (21.7%), and web pages (35.6%) the most.

4. DISCUSSION AND CONCLUSIONS

In this study where it was aimed to analyze the satisfaction levels of undergraduate students attending distance education courses during the pandemic by using cluster analysis with respect to different variables, it was found that student satisfaction with distance education was at a moderate level. Upon the review of relevant studies in the literature, it is observed that there exist different levels of satisfaction. Kaya (2022) identified that university students adapted to distance education during the COVID-19 period, and the satisfaction rate was high. Harsasi and Sutawijaya, (2018) reported that the influencing factors on students' satisfaction levels are the course structure, flexibility of online education, and quality of technology; they also noted that more attention should be paid to the online education quality, particularly in terms of image quality, ease of use, and teacher-student interaction. Zhou (2022), on the other hand, stated that inadequate learning environments and poor student-teacher interaction are the foremost factors that prevent student satisfaction.

According to the results of the K-Means cluster analysis, 4 separate clusters were specified. Among these clusters, the students in Clusters 3 and 4 were revealed to be more similar to each other, while those in Clusters 1 and 2 were the least similar to each other.

It was observed that the students in Cluster 1 had the highest satisfaction level (agree - good), while those in Cluster 2 had the lowest satisfaction (disagree). Regarding the characteristics of the students in the obtained clusters, the students in Cluster 1 have the highest computer ownership rate and the highest level of computer literacy, and along with cluster 3, the shortest internet usage duration, compared to the other clusters. This group uses the Faculty's internet connection service the least, and they usually have their own internet packages. Also, this cluster watched lecture recordings, animations, and videos the most, did the homework assignments the most, and used the questionnaires the most. The fact that the students in this group frequently use the resources relevant to the course content and have a high level of satisfaction in personalizing the education they receive indicates that they feel extremely interested in the course content when using this system with distance education. According to the literature, student-content interaction is the strongest predictor of satisfaction level (Kuo *et al*., 2014). Karabatak *et al*. (2020) stated that the homework-supported-distance-education process enhances academic success more, students' academic satisfaction and attitudes are positively affected, distance education alone is not enough, and it should be supported with diverse techniques and methods to increase its effectiveness.

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Having the lowest mean scores, Cluster 2 is the group with the lowest computer ownership and the lowest level of computer literacy. Their internet usage durations are higher than other clusters. It is the cluster where the highest number of synchronous courses are taken, yet the least time is spent on word processing documents, web pages, exams, graphics and pictures, homework, animations, videos, and e-mails. Thus, one can infer that this group follows the course just to ensure the course attendance requirement.

Cluster 3, which has a moderate level of satisfaction, is the second-most populated cluster. The students in this cluster have low computer literacy and short internet usage duration. Among the cluster members, the rate of 1st graders is higher than other grades, and they mostly use their own internet package. Apart from these, this cluster watched the course records the least, and they used the questionnaires the least.

Being the most populated and having a "good" level of satisfaction, Cluster 4 is the one with the highest rate of females, 1st graders, and those whose internet literacy is at a "good" or "very good" level. It ranks second in terms of computer ownership and computer literacy. At the same time, it is the group with the longest duration staying connected to the internet. Within the same group, synchronous courses are followed the least, while chat tools, videos, word-processing documents, and web pages are used the most.

Nortvig *et al*. (2018) reported that the educator presence in online environments, student-teacher-content interactions, and intentional connections between online and offline activities were the most prominent factors that affected students' e-learning, online learning, and blended learning experiences in higher education. Likewise, Goh *et al*. (2017) identified three learning experiences as predictors of learning outcomes and satisfaction: course design, interaction with the instructor, and interaction with peer students.

Considering these findings, it can be inferred that computer literacy and using the internet for reasonable periods significantly affect satisfaction, and satisfaction increases once the interactive and individualized learning tools in the environment increase. Several studies on distance education also reveal that experience with technological tools contributes to students' distance education experiences and thus to their satisfaction levels (Kuo *et al*., 2013). Bossman and Agyei (2022) stated that the factors of technology anxiety, instructor, course quality, technology quality, and ease of use significantly affect distance learners' e-learning satisfaction and performance levels.

In future studies, it may be recommended to further expand the dataset through different demographic variables, student performance, and behavioral and psychological variables that might apply to satisfaction with e-courses, and to further improve the clustering performance by using diversified parameter settings.

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Challenges of Social Media in Education. Review and Bibliometric Analysis of Scientific Production to Map Trends and Perspectives

Desafíos de las redes sociales en educación.
Revisión y análisis bibliométrico de la producción científica
para mapear tendencias y perspectiva

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ABSTRACT

This paper aims to analyse the trends in the articles included in the Journal Citation Report on the implications of social networks in the educational sphere during the period 2011-2020 and, in this way, to synthesise the knowledge base on their use in formal, non-formal and informal educational environments. Regarding methodology, various variables were analysed in the 157 selected articles, and exploratory and descriptive bibliometric research was carried out. The PRISMA protocol's indications have been followed for the whole process. The results show a considerable increase in production in the first quartiles of impact journals. Most of the papers were written by occasional authors from the USA. The most common theme was using social networks as a vehicle for creating virtual environments, with qualitative methodology standing out. It has been revealed that challenges remain to be addressed from an educational science perspective, such as non-formal learning, ethical dilemmas, and addictions. Collaboration and the establishment of peer-to-peer publication networks show areas for improvement.

KEYWORDS Social media; virtual environments; scientific literature; bibliometric analysis; research trends.

RESUMEN

El presente trabajo tiene como objetivo analizar las tendencias de los artículos recogidos en la base *Journal Citation Report* sobre las implicaciones de las redes sociales en el ámbito educativo durante el periodo 2011-2020 y, de este modo, sintetizar la base de conocimiento sobre su uso en entornos educativos formales, no formales e informales. En cuanto a la metodología, se han analizado diversas variables en los 157 artículos seleccionados y se ha realizado una investigación exploratoria y descriptiva con carácter bibliométrico. Para todo el proceso, se han seguido las indicaciones del protocolo PRISMA. Los resultados muestran un aumento considerable en la producción en los primeros cuartiles de las revistas de impacto. La mayoría de los trabajos fueron realizados por autores ocasionales, procedentes de EE.UU. La temática más

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habitual fue el uso de las redes sociales como elemento vehicular para la creación de entornos virtuales, destacando la metodología cualitativa. Se ha revelado que quedan desafíos por abordar desde la perspectiva de las Ciencias de la Educación, como el aprendizaje no formal, o dilemas éticos y adicciones. La colaboración y el establecimiento de redes de publicación entre pares evidencian aspectos de mejora.

PALABRAS CLAVE Redes sociales; entornos virtuales; literatura científica; análisis bibliométrico; tendencias en investigación.

1. INTRODUCTION

The emergence of social networks has changed how people communicate, relate to one another and learn (Donelan, 2016). This work considers their role in education. In the words of López *et al*. (2018), "interconnections play a fundamental role in how we adapt to changes that could lead to fragmentation and isolation, and they help us understand the world systematically" (p. 235, own translation). Earlier works also showed the need for a fuller overview of research into social networks in different disciplines (Abadal, 2017).

To focus our perspective on the subject we analyse in this work, we follow the angle of authors such as Bruguera *et al*. (2019), Li *et al*. (2017), López-Navarro *et al*. (2015) and Yu-Tang *et al*. (2019), who in their analyses focussed more specifically on three areas: social networks and human behaviour; social networks and professional development; and educational networks. These authors agree that the intensity of their use means it is necessary to identify contexts, characteristics, trends and methodologies. Educational networks and their influence on learning communities in the current digital society is something that should be analysed from a variety of angles and paradigms (Calderón-Garrido, & Gil-Fernández, 2022; Gil-Fernández, & Calderón-Garrido, 2021a). In this sector, networks have provided excellent opportunities for directing and personalising learning, both from the formal and informal perspectives (Chug, & Ruhi, 2018; Gil-Fernández, & Calderón-Garrido, 2021b; Hashim, & Carpenter, 2019; León-Gomez *et al*., 2019; Van Den Beemt *et al*., 2020).

Studies on social networks are multifaceted and they are considered from various disciplines. Li *et al*. (2017) set out to pursue a holistic vision of networks, analysing and systematising a wide range of focuses: motivations for use, management on social media sites, impact on markets and businesses, tourism, communication, managing emergencies, politics and networks in education. Bruguera *et al*. (2019), when analysing the professional use of networks, concluded that the academic literature on networks pays the most attention to the fields of health and educational sciences, both separately and often transversally (Aparicio-Martínez *et al*., 2019; Rhem *et al*., 2019).

Lantz-Anderson *et al*. (2018), focussing on education, affirmed that the nature of professional networks has developed since the start of this century, as digital technologies have become increasingly fundamental to teachers' work. They also emphasised that teachers could access a wide variety of online opportunities for professional development, and that while many of these resources can be used individually and are self-directed, they are still essentially social technologies.

This study belongs to this field and focus, as it uses bibliometric indicators to show information about authors, networks of cooperation between authors, citations, journals, etc. from empirical studies of social networks in different areas and levels of formal and non-formal education. The research is completed with a

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number of aspects typical of systematic reviews as it also seeks to analyse lines of action, policy and research methodologies. In this way, we aim to present structural aspects to enable evaluation of the current state of output relating to social networks in their generic educational use (García-García *et al*., 2023), as well as to foster understanding of changes in trends of a topic in constant change and evolution. A literature review must summarise the state of the question of the relevant research works that contextualise work at an international level, and explain what conclusions by other authors, if there are any, are being questioned or extended. It should include a general overview of the study, its main aim and the methodological design used.

In contemporary society, with its democratic and globalised context, it is not enough to create scientific knowledge; it is also vital to disseminate it, explore the process and methodologies that guide it and consider the criteria to take into account when putting this process of dissemination into practice. It is also necessary to analyse aspects that relate to selection, self-curation and peer assessment (Hernández-González *et al*., 2017). Systematic reviews and literature analyses using qualitative and quantitative methods, guided by objective techniques, make it possible to analyse these studies optimally (Cooper, 2017).

In recent years, there has been an increase in systematic reviews and bibliometric studies that synthesise research based on primary studies. The aim of these reviews is to examine secondary data in order to retrieve, synthesise and evaluate the existing knowledge that exists on a subject in a logical, transparent and analytical way (Martín *et al*., 2020). For their part, bibliometric analyses provide the scientific community with valuable information: not just about where research in a given field comes from, but also identifying, focussing and channelling future trends. In the same way, they provide evidence to guarantee a solid foundation for further research. Systematic reviews and bibliometric analyses usually are —and should be— a way in and a starting point for new researchers to find their bearings in their disciplines (Maggio *et al*., 2020) thus acting as a route map for academics. Bibliometric analysis techniques and tools provide information about the lines of research that act as guidelines for each discipline: the ones researchers follow —whether individually or in the field of collective work environments— and their impact on the scientific community (Martín-Martín *et al*., 2016).

The aim of this work is to use bibliometric techniques to analyse and quantify the research trends present in JCR relating to the implications of social networks in the field of education, to be able to identify which practices, guiding principles and goals convey the scientific output relating to the matter in hand.

2. MATERIAL AND METHOD

2.1. Research questions and specific objectives of the study

To achieve the aim of the work, the following research questions have been set:

R.Q.1 What has been the development of scientific output on the implications of social networks in the field of education through the 2011–2020 period?

R.Q.2 What relationships can be established between authors, output, working networks, journals and impact of articles on this topic?

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R.Q.3 What thematic lines of research have been developed in relation to the educational use of networks, what methodologies have been used and what trends are they following?

R.Q.4 What are the principal needs and challenges that should guide future studies on the use of social networks?

To do this, we set the following specific objectives

S.O.1 To analyse the evolution of the scientific output on JCR related to the educational use of social networks through the 2011–2020 period.

S.O.2 To establish what relationships exist between authors, output, working networks, journals and impact of articles on the chosen topic.

S.O.3 To determine what thematic lines of research have been developed in regards to the educational use of networks, what methodologies are used and what new paths are being taken.

S.O.4 To establish what the principal needs and challenges are that should guide future studies into the educational use of social networks.

2.2. Research focus, design and instruments

This research is exploratory, descriptive and bibliometric. It sets out to summarise the knowledge base regarding the use of social networks in formal, non-formal and informal educational settings, to identify the principal research trends and the variables that have shaped them. Therefore, to do so, we performed a documentary analysis of the articles published in journals indexed in the Web of Science platform, in the Core Collection database, and we selected those included in the JCR index published during the 2011-2020 period.

The process we used to select the works was based on the specifications of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Hutton *et al*., 2016). For García-Peñalvo (2022), use of this protocol is highly recommended as it is one of the most widely used and referenced ones for systematic reviews and meta-analyses, it is applicable to all of the branches of knowledge and it represents an important help for authors to undertake critical evaluation of works and presentation of data.

This study uses as its framework the database of academic literature that is most highly rated by researchers and academic institutions: Journal Citation Report (JCR). This database comprises two indexes: the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI). It is part of the Core Collection of Web of Science (WoS). It is internationally recognised as a source that provides high-quality information in science and technology, as the rigorous evaluation of the journals indexed in it involves a high level of scientific demand. The type of data it supplies in relation to the publications in many cases guides scientific policies (Pereira, 2018).

We used the keywords "Social networks" AND "Teacher" OR "Social media" AND "Teacher" in the "Topic" section. In this way, we searched in both in the title and the abstract for the keywords in each article

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indexed in JCR. For the choice of keywords, we performed a preliminary search of the most common ones in the academic articles from the discipline studied to determine the results.

Firstly, we consulted various combinations of keywords with different synonyms and related words in the relevant publications from 2020. This search was done by two researchers who subsequently specified the chosen keywords. All of the access was done using the web portal of the Fundación Española para la Ciencia y la Tecnología (FECYT–Spanish Foundation for Science and Technology). The whole of the process followed was based on the indications of the protocol set out in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Hutton *et al*., 2016).

To analyse the data, we first carried out data cleansing through the platform itself by including the keywords "Social networks" AND "Teacher" OR "Social media" AND "Teacher" in the subject. The following inclusion and exclusion criteria were applied:

TABLE 1. Inclusion and exclusion criteria.

INCLUSION CRITERIA	EXCLUSION CRITERIA
IC1. Included in JCR	
IC1. Years 2011-2020	
IC2. Language: English or Spanish	
IC3. Areas of knowledge, type of source, type of document, country, type of access: All	
	CE3. No access to work
CI5.Formal, non-formal and informal education. Role of actors and level of education: all	CE5.Works that do not correspond to the subject matter. Research whose sample has not been collected in educational settings or which does not have an educational purpose.

Once the protocol had been designed, we asked two external experts to validate it. To apply the exclusion criteria, the two authors of this work analysed each article. In the event of disagreements, a third opinion was obtained, although this only was only needed on six occasions. All the articles selected were reviewed individually in order to extract each of the results shown.

A total of 1027 works were published in the 2011–2020 period, that matched the keywords "Social networks" AND "Teacher" OR "Social media" and "Teacher" included in the main collection of Web of Science (SCI, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S y ESCI). Of these, 371 are in the JCR database (SCI and SSCI), and 345 of them belong to the "article" category. We reviewed all of the articles and found that the content of 188 did not correspond with the keywords used in the research because, despite appearing as part of the topic of the article, they were in all cases articles from the fields of sociology, communication or health sciences that mentioned the educational level of the subjects involved in the research, but they did not match the study object. Consequently, the final sample comprised 157 articles. Figure 1 shows the selection made.

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FIGURE 1. Flowchart of the selection of items carried out.
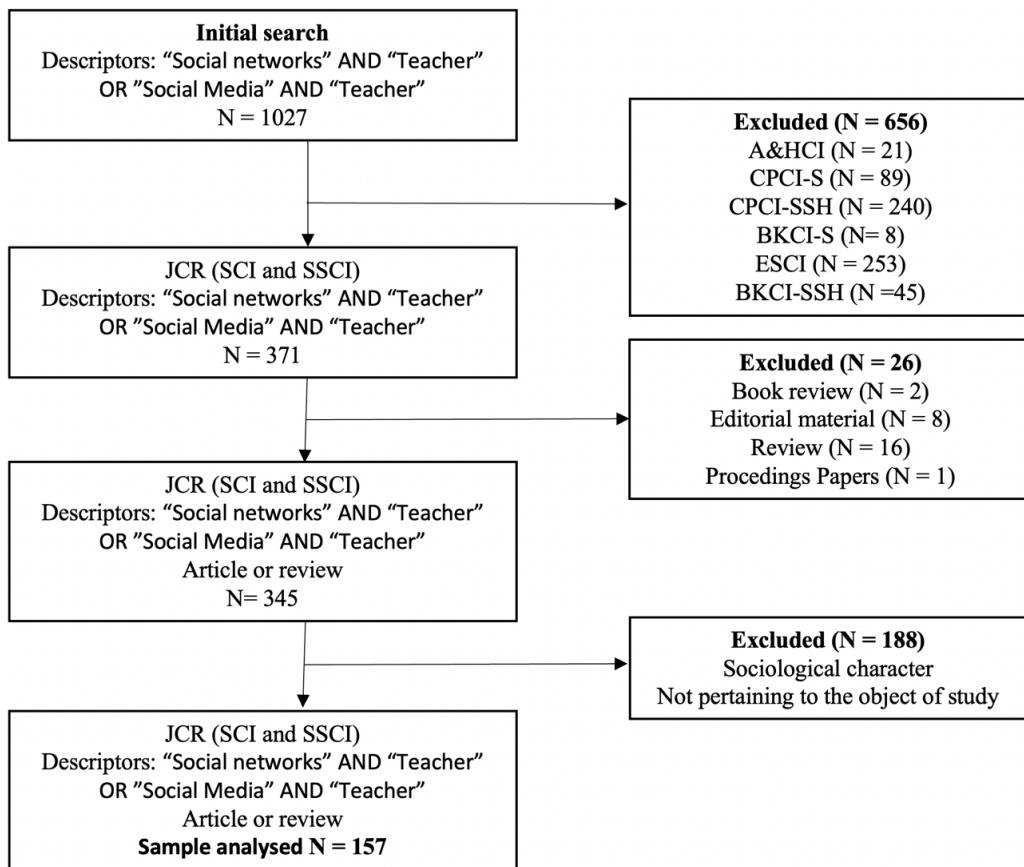
The authorship of each article was then checked through the institutional *profiles* of each researcher or their presence in academic social networks such as Google Scholar, ResearchGate or Academia.edu. This way, we were able to verify and establish the gender and name of each author and any variance in the names they used.

Next, we classified articles into five topics using their keywords and abstracts. To do so, each article was analysed by both authors, with the involvement of a third expert in the case of disagreement. To guarantee quality in all of this review process, (Wright *et al*., 2007), we calculated Cohen's kappa (k = 0.92). The choice of topics was based on previous systematic reviews centred on the use of social networks in educational settings.

Finally, we coded all of the data and analysed them using the Statistical Package for Social Science (SPSS) version 21.0. quantitative analysis software. The variables analysed were: year of publication of each article; percentage increase in output; authorship; gender of authors; frequency of publication by each author; number of citations received; country of authors; country of each journal; journal impact index; language used; accessibility relating to whether each article is open access; and the subject matter of each article. As well as the descriptive count, we carried out comparisons of groups, using Student's t test and analysis of variance, as well as the Kolmogorov–Smirnov normality test, the Shapiro-Wilk test and Levene's test depending on each case.

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3. RESULTS AND DISCUSSION

3.1. Analysis of the development of scientific output

Figure 2 shows the evolution in publications with the keywords marked in all of the WoS databases, the total works indexed in JCR, the articles indexed in JCR and the articles indexed in JCR filtered by topic. Considerable growth in the number of works and articles is apparent, especially from 2016. If we compare the first year studied (2011) with the last (2020), publication of this type of article grew by 2050%.

**FIGURE 2.** Total number of papers and articles in WOS.
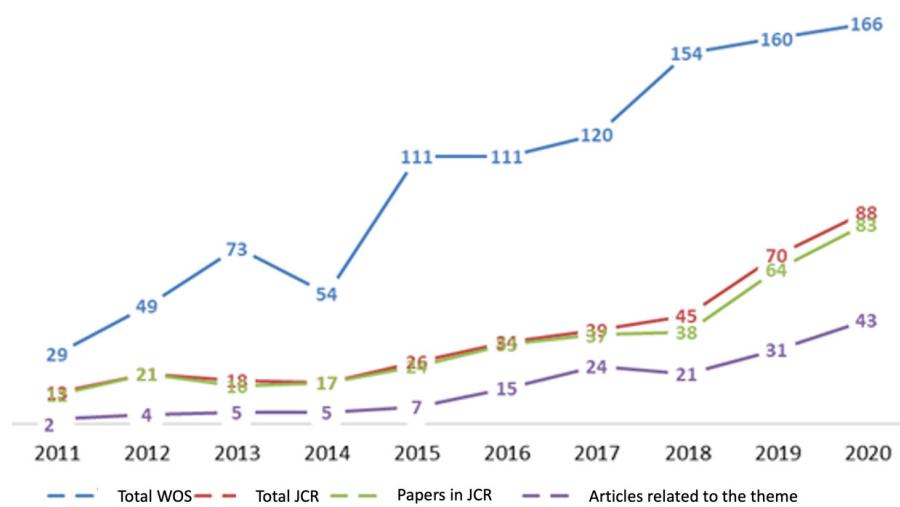
Earlier generic studies on networks already reflected an increase from 2010 following a slight slow-down over the previous two years (Li *et al*., 2017). Another interesting piece of information is that the number of pages per article tended to decrease. Bruguera *et al*. (2019), this growth in scientific literature about networks in education can be explained by teachers' interest in integrating them as an educational resource or establishing networks among professionals. As shown *below*, these are in fact the two topics most often covered in the articles from the sample. However, unlike the data set out here, when analysing the professional use of networks in various settings these authors detected a stagnation in 2016, followed by a notable increase in 2017.

3.2. Relationships between authors, output, working networks, journals and impact of articles

A total of 346 names are used in the articles analysed, representing 340 different researchers. It should be noted that some authors use a variety of names. Carpenter, for example, sometimes used a single forename and sometimes included a middle name. In any case, the mean number of authors is 2.02 per article. This issue in bibliometric research has already been noted by some authors such as González and Osca (2015) or Calderón-Garrido and Gustems-Carnicer (2018).

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With regards to scientific output, the great majority of the authors ($n = 310$, 91.18%) are occasional authors, in other words, they published a single article during the period studied; 26 authors (7.65%) are "intermediate" producers, as they authored two or three articles each, and only 4 (1.17%) are "major" producers who were authors of four or more articles. The author with the most articles published was Carpenter with 11. Figure 3 shows the interactions between the authors (only major and intermediate producers are included). These data, referring to the earliest years analysed, could be interpreted negatively, as they reflect a lack of continuity by authors of this type of analysis in relevant settings. Nevertheless, the occasional authors included in recent years could be a symptom of the incorporation of "new researchers" (Yu-Tang *et al*., 2019) who join academic output as it increases.

FIGURE 3. Networking among authors.
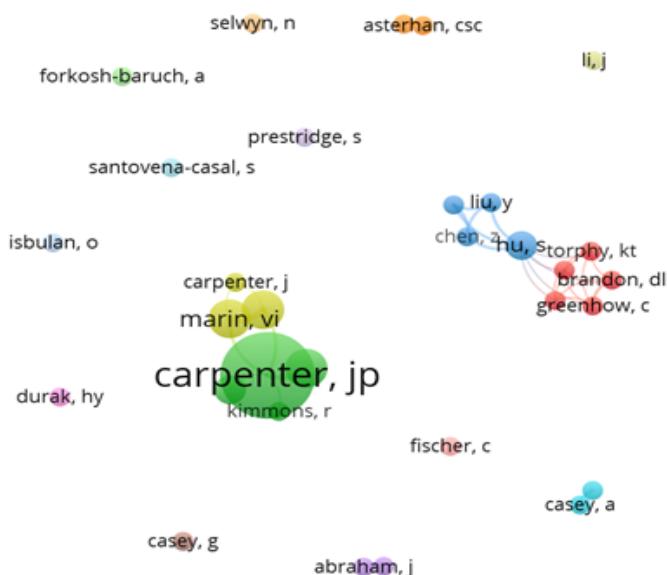
With regards to co-authoring, authors generally publish individually or in small groups. Figure 4 shows the distribution of articles by number of authors.

FIGURE 4. Number of authors of articles published during the period 2011-2020.

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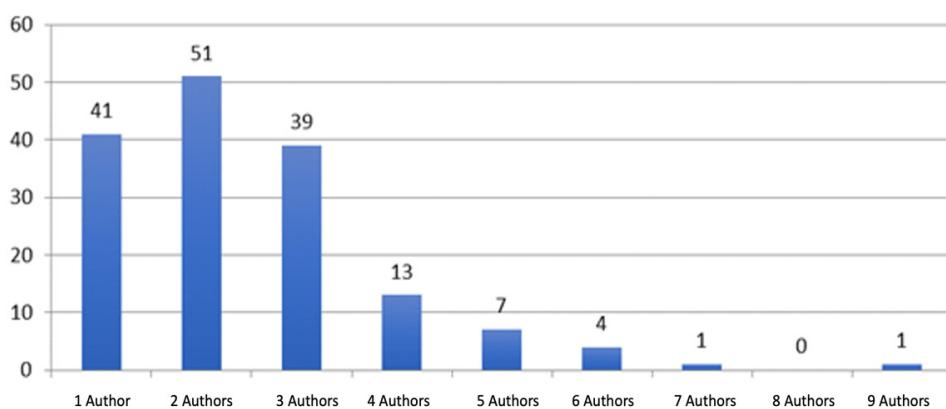
When analysing the question of authorship and co-authorship, we found that more than half of the articles were written by two authors, followed by those written by just one and those written by three researchers. The practice of working with a large number of authors was used a small number of times. In fact, only one article each had seven and nine authors. Networks of interpersonal collaboration, including institutional, have a weak matrix, as Figure 3 shows. This contrasts with the results of studies on generic use of social networks, such as that by Li *et al*. (2017), which observed strong networks of collaboration, or Aparicio-Martínez *et al*. (2019) on networks in the field of youth and health, which found intense contacts. Rhem *et al*. (2019) detected an identical trend, and even found that social networks are a common ground between disciplines given the intensity and variety of the networks of authorship.

When analysing output of articles by gender, it is apparent that there is a greater presence of women (M = 1.27; SD = 1.1) than men (M = 1.19; SD = 1.01) in the articles. Women represent 51.6% (N = 81) of lead authors. Accordingly, considering the gender of the authors, this study finds a slight dominance of women in the total count of authors. The order of authors displays the same trend, with women being lead authors more often. This finding contrasts with previous research such as that by Morales *et al*. (2017) in the field of music education —which found a greater presence of male authors— or studies in the field of psychology such as that of Barrios *et al*. (2013) or that by Malouff *et al*. (2010), which showed the same trend.

Regarding the number of citations, and taking into account the fact that the WoS database only shows citations made in works that are listed in the database, the articles analysed were cited a total of 1531 times, including 172 self-citations. The h-index is 22. It is notable that 23.6% had no citations. The mean is 9.75 citations (SD = 15.2) with a range of 0 to 85 citations. The number of citations does not correlate with the number of authors (r = 0.029; p = 0.716) but it does correlate negatively with year of publication (r = -0.500; p < 0.01). However, when observing the number of citations per year in relation to the articles published, no clear trend is apparent. Azer and Azer (2019) reflect on the fact that research institutions have used the number of citations to measure results, assuming that the greater the number of citations, the higher the possibility of being cited. But they note that this might not necessarily be true, because there is a body of evidence that shows that there are other important factors such as the position held by the authors or their prestige.

FIGURE 5. Number of articles, citations, and citation ratio per article.

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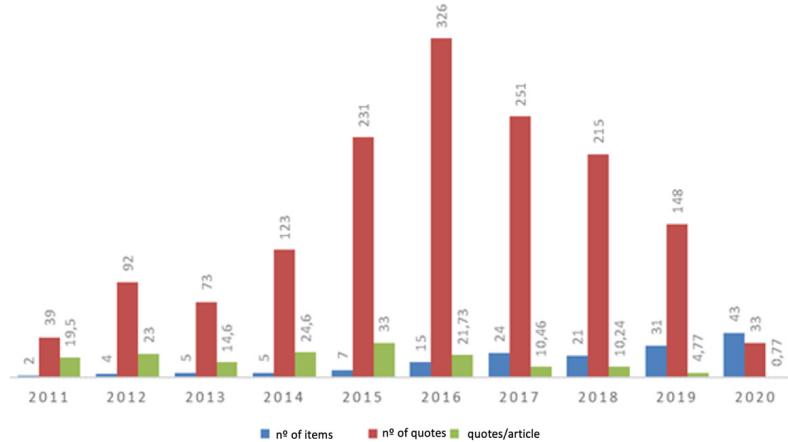
Similarly, and with regards to citations, differences were apparent between articles published in open-access journals and ones that are not, with the former being cited more. There does not seem to be a correlation between the number of citations and the number of authors listed on the articles. This might partly be because the number of self-citations is not very high, since, as Pandita and Singh (2017) noted in a study that covered various disciplines, a significant part of the citations that an article receives come from its own authors. Furthermore, authors who collaborate tend to work on similar concepts, which means that they frequently cite one another (Kapoor *et al.*, 2018). Hence, taking into account the fact that, as we have already seen, authors in the sample analysed tend to work alone or in small groups, the potential for citations by one of them is reduced. On the other hand, and as most of them are occasional authors, we could also argue that as they do not focus on the subject matter, they do not have the chance to cite their own works. Although social networks belong to the digital sphere, which is characterised by rapid changes and transformations, the oldest works continue to arouse interest, unlike in other fields such as medicine (Villar *et al.*, 2007). Hancock and Price (2016), in a work on music education, observed that articles in their discipline took longer to be cited than ones from psychology.

Nonetheless, the open-access variable did not display any statistically significant differences with regards to the number of citations ($t155 = 0.740$; $p = 0.460$). Table 2 shows these differences.

TABLE 2. Differences between quotes in open access and non-open access journals.

	Open access	Non-open access
Number of publications	21	136
Number of quotes received	228	1303
Average number of quotes per paper	10,86	9,58

With regards to the country of affiliation of the authors, the USA was most productive with 53 articles (33.76%), followed by Spain (N = 19; 12.10%), Australia and Turkey with 15 articles each (9.55%) and the United Kingdom (N = 11; 7%). There was also a series of countries with fewer than 10 works, giving a total of 38 countries. Works in open access publications were cited only slightly more often, as Table 1 shows. Although being published in journals that can be consulted for free might result in greater dissemination and therefore more citations, this fact is explained by the small number of this type of works in JCR. Only 13.37% of the works in this study were published in this way. This percentage is notably lower than the one observed by Abadal (2017), who found that in the field of social sciences, 30% of journals were open access.

Regarding the language of the articles, almost all of them (N = 154, 98.01%) were written in English. There was one work each in Portuguese, Spanish and Turkish (0.64% each). Various studies, such as that by López-Navarro *et al.* (2015), show that using English as the vehicular language for scientific output improves the impact of works. Indeed, some systematic review works on the subject matter in question only include articles published in English (Rhem *et al.*, 2019) in their selection.

The provenance of output was varied, as the 157 works came from a total of 38 countries. The leading ones in order were the USA, Spain, Australia and Turkey. If we compare this with the information about articles published in JCR on education in general in the 2011–2020 period —without defining the specific

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area— the countries with the most articles published were the USA, the UK, Australia and Spain. In the work by Yu-Tang *et al.* (2019), which used another keyword and referred to the period between 2010 and 2018, the USA was still the leading producer but it was followed by the United Kingdom, Spain and Australia, with Turkey outside the top four. Therefore, in the study of networks and their educational use, Spain had a more significant position than in studies on education in general while the United Kingdom had a lower output than Turkey. We should note that the output of the United Kingdom displayed a downward trend, already apparent in this analysis for the years 2019 and 2020. In the work by Li *et al.* (2017), who completed their analysis of networks in general in 2014, Spain was outside their focus, something which, even though this work refers to the educational field, could be a reflection of a "lift off" in the scientific literature of this country. In any case, it is striking how this trend does not correspond with the population of each country. For example, if we compare the USA, Spain and Australia by number of inhabitants, we can see that Spain published 2.86 times more articles than the USA and Australia 3.72 times more than the USA.

In regard to journals, the articles studied were published in a total of 79 journals. Analysis of these data shows that only seven journals published five or more articles. These journals contain 31.21% of the total number of articles.

TABLE 3. Journals that have published the most articles, areas and impact factor.

JOURNAL	N	Impact factor*	Research areas	JCR categories	Quartile in category**
Teaching and Teacher Education	11	2,686	Education and Educational Research	Education and Educational Research	Q1
Computers Education	10	5,296	Education and Educational Research; Computer Science	Education and Educational Research; Computer Science	Q1
Education and Information Technologies	6	1,912	Education and Educational Research	Education and Educational Research	Q2
International Review of Research in Open and Distributed Learning	6	2,297	Education and Educational Research	Education and Educational Research	Q1
Technology Pedagogy and Education	6	1,481	Education and Educational Research	Education and Educational Research	Q3
Interactive Learning Environments	5	1,938	Education and Educational Research	Education and Educational Research	Q2
Teachers College Record	5	0,970	Education and Educational Research	Education and Educational Research	Q4

* JIF (*Journal Impact Factor*) referring to 2019

** Quartile in 2020

Seven of them published between 5 and 11 works on the reference topic. Of these, three are indexed in Q1 and two in Q2. This analysis shows that the journals with the greatest influence in this field and topic, both by number of publications and by position (Q1) were *Teacher and Teaching Education* and *Computer Education*, which only differed by one publication, *International Review of Research in Open and Distributed Learning* and *Education and Information Technologies*, all of which are in JCR's "education and educational research" category and domain. *Computer Education* had the highest impact factor. This study essentially matches the details set out in the work by Yu-Tang *et al.* (2019), which also found this to be the journal with the highest impact among those studied and the one that published the most articles. It is also notable that in the study by Bruguera *et al.* (2019), *Teacher and Teaching Education* was the journal with the second most works published, despite the journal's specificity contrasting with the generic analysis of the general professional use of networks that the authors performed.

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3.3. Thematic lines

Regarding the subject matter, five major lines of research were found. The most common of these relates to social networks as an element that provides a vehicle for the creation of virtual settings and educational communities (n = 51; 32.5%). In this sense, it can be seen that the subject matter does not affect the number of citations ($F_{(4,152)}$ = 1.375; p = 0.245) nor does the number of participating authors ($F_{(4,152)}$ = 0.701; p = 0.592). Table 4 shows the differences in citation and authors depending on the topic.

TABLE 4. Distribution of quotes and authors according to the subject matter of the articles.

THEMES	N %	Quotes Mean SD	Authors Mean SD
Social networks as a vehicle for the creation of virtual environments and educational communities	51 32,5%	6,90 9,454	2,61 1,343
The teaching-learning process mediated by social networks as a didactic resource	47 29,9%	13,17 17,897	2,51 1,545
Digital competence and teaching digital competence. Implementation and motivational aspects	31 19,7%	10,32 18,284	2,39 1,383
Problems, ethical dilemmas and addictions derived from the use of social networks: their treatment in the classroom	21 13,4%	10,29 16,496	2,38 1,322
Social movements and demands in the field of education through social networking sites	7 4,5%	3,43 4,685	1,71 0,488

Of the articles, 62.4% tackled the first two aspects. The first line of research considered networks as a vector and factor for environments and communities. The works in this group cover how they are produced between the different agents in the educational process —teachers, learners and educational community— and how they relate to one another by configuring educational settings and networks of social capital. The most cited and disseminated works in this category were those by Rehm and Notten (2016) and Sarapin and Morris (2015). The second topic comprises analysis of networks as an educational resource for learning, and the authors consider all educational levels, with a particular interest in the university level (Barry *et al.*, 2016; Goodyear *et al.*, 2014). Digital competence and educators' digital competence in their aspects of implementation and motivational aspects represented 19.7%, as in the case of the works by Carpenter and Krutka (2015) and Matzat (2013). The fourth topic —problems, ethical dilemmas and addictions deriving from the use of social networks and their treatment in class— represented 13.4% of the total (Cam, & Isbulan, 2012). Finally, the analysis of social movements and demands in the educational sphere through networks is the topic that received the least attention (4.5%) (Ajayi, 2015). There is no clear correlation with regards to topic, number of authors that decided to choose it and the number of citations received.

Social networks, in general, as stated above, have been covered from a variety of disciplines and perspectives. Kapoor *et al.* (2018) found that up to 2011, the principal concern of researchers was to consider content created by users as an innovative form of online production. Their interest then shifted towards other more diverse aspects, especially behavioural aspects and the creation and management of online communities and social capital.

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Li *et al*. (2017) found 221 thematic categories defined by 20 principal topics. López *et al*. (2018), in their systematic review established that in the last 20 years, the most interesting topics on educational networks were reforms to educational policies, leadership, learning communities, initial teacher training and collaboration between agents in the educational process. Hâncean *et al*. (2016) classified this collaborative work according to the level of analysis: node, dyad or network.

Other authors such as Yu-Tang *et al*. (2019) simplified the thematic lines into three: personal relations in networks; networks for learning; and network-based methodologies. These authors also found no correlation between these lines of study and the number of citations. It is worth noting that, in fields other than education, the use of networks that connect the non-formal and informal realms in different disciplines such as STEM, music, social work, and engineering, has been an abundant source of studies (Bruguera *et al*., 2019), while in the field of education it has been addressed, albeit with less intensity.

With regards to the methodology used, empirical studies stand out, as some review studies on social networks show (Van Den Beemt *et al*., 2020). The main techniques used in this selection were qualitative —almost half— and methods were used that include case studies, interviews, ethnographic data and analysis of accounts. These are followed by mixed methods and quantitative methods and, to a lesser extent, techniques for the systematic review of scientific literature. This matches the sample of Yu-Tang *et al*. (2019), where half of the most-cited articles used qualitative techniques. There is a discrepancy in the more general sphere of the use of networks for professional purposes as quantitative methods were used more, especially analysis of questionnaires (Bruguera *et al*., 2019; Kapoor *et al*., 2018). This is also the case in works on educational uses of specific networks (Chug, & Ruhi, 2017).

3.4. Needs and challenges detected

Certain shortcomings can be seen in the studies, suggesting that there is interesting potential for future works. While there are some topics related to social networks that are in "good health", others, such as non-formal learning or problems, ethical dilemmas and addictions, have been covered by other areas thanks to their interest, but have been considered to a lesser extent by educational sciences, or at least have not made their way into high-impact journals. Limited collaboration and the establishment of networks of publication between peers are also matters that have not been considered in sufficient depth.

4. CONCLUSIONS, LIMITATIONS AND FUTURE POSSIBILITIES

In the case of the how production of academic works development of output of academic works on the educational use of social networks in journals indexed in JCR has evolved, we found a noticeable increase in number in the period between 2011 and 2020, which accelerated from 2016. This is because researchers considered two educational needs, which from that moment became crucial: the incorporation of social networks as an educational resource and the use of them to establish professional and academic networks.

With regards to authorship, this study shows something of an imbalance between the number of names used and the total number of producers. Among other reasons this is because some authors sometimes use their middle name when publishing and sometimes do not, as in the case of a "major" producer like Carpenter.

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As for the frequency of authorship, a large majority of researchers only published one article on social networks in education in JCR in the period analysed. A minority can be considered to be "intermediate" and, as shown *above*, only four authors can be described as "major" producers. Observing the earliest years of the analysis, this information about authorship, which is so polarised, could be interpreted as authors losing interest in the subject, but if we shift the focus to more recent years, we find that new researchers emerge who cover educational needs arising from the digitalisation of society. Women make up the majority of the authors and they are more often the lead authors.

The 157 works came from a total of 38 countries. The leading ones in order were the USA, Spain, Australia and Turkey. The articles are distributed across a large number of journals, with only 7 having published 5 or more articles on this topic.

Among the research questions, they set out to determine what thematic lines of research have been pursued, what methodologies have been used and the directions in which they are evolving. The distribution of themes in the articles shows that the topics that have inspired researchers' interest predominantly relate to social networks as an element that provides a vehicle for the creation of virtual environments and educational communities and also to the teaching-learning process mediated by social networks as a teaching resource. The literature gathers and analyses practices implemented through networks that guarantee innovation. These are followed by works on digital competence and educators' digital competence, frequently related to motivational aspects, good practices, creation of communities and network-mediated virtual environments. The literature has also addressed addictions and negative aspects of networks in education, as well as legal and ethical questions. To a lesser extent, there are also works that can be subsumed in the analysis of social movements and demands in the field of education using networks as an instrument.

The limitations of this work relate to the choice of databases. It has enabled us to establish what trends exist among high-ranking literature, but there is bias, as the results are always positive. Furthermore, the quality of the articles is more homogeneous. Using other broader databases, such as ERIC or Google Scholar and the addition of grey literature would offer a more "realistic" and complete vision. The choice of a bibliometric methodology limits the focus of the research questions to very specific aspects. Future works could consider nuances that are more specific and which cover the content and results of the works.

In short, the use of networks in education is experiencing a high point in academic literature, which has confirmed the benefits and effectiveness of the practices implemented using them. This work has found that authors tend to work independently or in small groups, and that they establish limited networks of collaboration. Taking into account the sociological aspect that is characteristic of social networks, one interesting future possibility would be to establish collaborations between institutions and carry out comparative studies across different countries. Bearing in mind that there are more qualitative or mixed-method studies, one possibility would be to carry out studies using quantitative methodologies, which are much more numerous in other fields. The intersection between formal, non-formal and informal settings is especially relevant owing to the intrinsic characteristics of social networks and should be analysed in greater depth.

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Bibliometric Analysis of Technology-Supported Language Learning: LMOOC Trend in China

Análisis bibliométrico del aprendizaje de lenguas con apoyo tecnológico: Tendencia de LMOOC en China

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ABSTRACT

Interest in LMOOCs (Language Massive Open Online Courses) has increased in terms of research and number of courses offered, due to their potential for developing training processes and for working on these contents with technologies. Situating the interest in the publications made on LMOOC in China, this study aims to bibliometrically analyze said scientific production in Scopus. The final sample was made up of 134 publications, which were analyzed using different bibliometric techniques (bibliographic coupling, co-citation, co-occurrence). The results indicate a stabilized scientific production since its inception in 2014, with further development in the years of the COVID-19 pandemic. Indexing predominates in the areas of computer science and social sciences. Contributions to conferences and articles predominate. The most cited publications focus on systematic reviews, student autonomy and active methodologies combined with LMOOC. Other influential publications focus on defining the quality criteria to carry out an LMOOC and the emotional factor involved in the development of these courses. Among the potential future courses of action, highlight the adoption of more personalized formats such as the SPOC or the inclusion of methodologies such as the flipped classroom. It is concluded that this study on scientific production will allow the development of new avenues of research on LMOOCs from what already exists.

KEYWORDS LMOOC; Language learning; Research methods; Information and Communication Technologies (ICT).

RESUMEN

El interés por los LMOOC (*Language Massive Open Online Courses)* ha aumentado en términos de investigación y número de cursos ofrecidos, por su potencial para el desarrollo de los procesos formativos y para trabajar estos contenidos con tecnologías. Situando el interés en las publicaciones realizadas sobre LMOOC en China, este estudio pretende analizar

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bibliométricamente dicha producción científica en Scopus. La muestra final quedó conformada por 134 publicaciones, siendo analizados con diferentes técnicas bibliométricas (acoplamiento bibliográfico, co-citación, co-ocurrencia). Los resultados señalan una producción científica estabilizada desde sus inicios en 2014, con un mayor desarrollo en los años de la pandemia COVID-19. Predomina la indexación en las áreas de ciencias de la computación y sociales. Predominan las contribuciones a congresos y los artículos. Las publicaciones más citadas se centran en revisiones sistemáticas, autonomía del alumnado y metodologías activas combinados con LMOOC. Otras publicaciones influyentes ponen el foco en definir los criterios de calidad para realizar un LMOOC y el factor emocional en el desarrollo de estos cursos. Entre las potenciales futuras líneas, destacar la adopción de formatos más personalizados como los SPOC o la inclusión de metodologías como el aula invertida. Se concluye que este estudio sobre la producción científica permitirá desarrollar nuevas líneas de investigación sobre los LMOOC a partir de lo existente.

PALABRAS CLAVE LMOOC; Aprendizaje de lenguas; Métodos de investigación; Tecnologías de la Información y la Comunicación (TIC).

1. INTRODUCTION

Thanks to the advances in Information and Communication Technologies (ICT) and Internet access in the last two decades, the use of open educational resources has seen a proliferation in teaching and learning processes (Bethencourt-Aguilar *et al.*, 2021; Comas-Quinn, & Borthwick, 2015), especially in language teaching (Martín-Monje, & Borthwick, 2021) where MOOCs (Massive Open Online Courses) for foreign language learning (LMOOCs) represent one of the key elements.

LMOOCs are defined as massive open online courses specifically designed to teach languages (Hsu, 2021). In particular, this can be understood as "dedicated web-based online courses for second languages with unrestricted access and potentially unlimited participation" (Bárcena, & Martín-Monje, 2014, p. 1). LMOOCs have flourished since 2013, providing foreign language learners with a wide range of learning resources, increasing their linguistic input and connecting students from different countries and regions with diverse language exchange opportunities (Jitpaisarnwattana *et al.*, 2021; Sallam *et al.*, 2022). Typically, these courses are available online and are either free (Luo, & Ye, 2021) or have a basic free option with paid options for additional content or certificates (Caro-Barek, 2022). LMOOCs offer a wide variety of languages and are usually designed to provide students with skills in reading, writing, listening, and speaking in the selected language (Lebedeva, 2021).

LMOOCs often use online learning platforms that offer videos, interactive exercises or even exams (Gharawi *et al.*, 2020; Ruiz-Palmero *et al.*, 2021). Some of these courses also feature real-time interactions, such as live chat sessions with instructors or tutors (Cinganotto, & Cuccurullo, 2019). Moreover, these types of courses can go beyond formal instruction. As stated by Vázquez-Cano *et al.* (2018, p. 179) these courses can be "interesting formative modalities to develop in this polychromatic plurality of formal and informal educational contexts. In this context, Gil (2021) states that LMOOCs help all those individuals who want to carry out non-formal education or even those who find themselves in vulnerable situations such as professional and social exclusion. With this, it would be possible to meet the linguistic needs of any type of student body (Negre *et al.*, 2018).

In China, where this study is contextualized, the use of MOOCs or in our case, LMOOCs has been generally welcomed by the educational community as a revolution which can help democratize education and

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promote educational equality among students (Peng, & Jiang, 2022), especially with the rapid development of internet usage and low-cost mobile technologies (Law *et al.*, 2019). Within this context and bearing in mind the exponential number of LMOOCS existing today, this need has arisen to conduct a critical, systemic and detailed review of existing recent research which will help facilitate a deeper understanding and knowledge about this type of courses in China. With this new analysis it will be possible to identify gaps in the scientific literature on LMOOCS in China and suggest new directions and challenges. This review paper aims to contribute to this research.

Taking all of the above into consideration, the focus will be on those publications on LMOOCs in which some of the researchers have their professional affiliation in a Chinese research institution. The aim of this study was to analyze bibliometrically the scientific production on LMOOCs in China in the international Scopus database.

In relation to this, different research questions were established:

1. How has the scientific production of LMOOCs in China evolved with respect to the variables known as year of publication, areas of knowledge, type of document, institutional affiliation and relevance of publications?
2. What are the most influential publications in the topic of study?
3. What are the main lines of research related to LMOOCs in China?

2. MATERIAL AND METHOD

The reality of LMOOC research in China was analyzed through a bibliometric study. As a research methodology, it is a meta-analysis technique that explores scientific production with respect to the object of study (González *et al.*, 2020). During its application, criteria are established to analyze the progress and development of publications from a qualitative and quantitative perspective in a thematic area, considering different variables. This technique is supported by multiple studies that have developed and implemented it in recent times (Colomo *et al.*, 2022; 2023; Marín *et al.*, 2021; Mielgo *et al.*, 2022).

The selection of documents was made in the Scopus database. Scopus was chosen because it has a large, rigorous and high-quality scientific production, including multiple areas of knowledge within the academic field (Cívico *et al.*, 2022). The keywords and Booleans used to choose the sample (search command) were "MOOC" OR "MOOC's" OR "LMOOC" OR "LMOOC'S" AND "Language". The command was applied within the title, keywords and abstracts. The search returned 890 documents as of August 1, 2023, including all types of documents (articles, book chapters or papers, among others).

Screening criteria were applied to the sample of 890 documents (Figure 1), linked to the purpose of the study, using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement as a model. The first action was to restrict the results by country (China), so that any of the authors of the paper that investigated MOOCs and their application to language learning had their affiliation in an institution in that country. This brought down the sample size to 139 papers. Following this, research whose object of study was not directly related to LMOOCs was purged, eliminating another five papers. The final sample,

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after applying the above limitations, consisted of 134 documents (132 in English, one in Chinese and one in Spanish). This sample, after being exported from Scopus in .csv format (comma separated values), was analyzed bibliometrically.

FIGURE 1. Flowchart of the study selection process based on the PRISMA statement.

Note (above): not affiliated with China or no affiliation with China
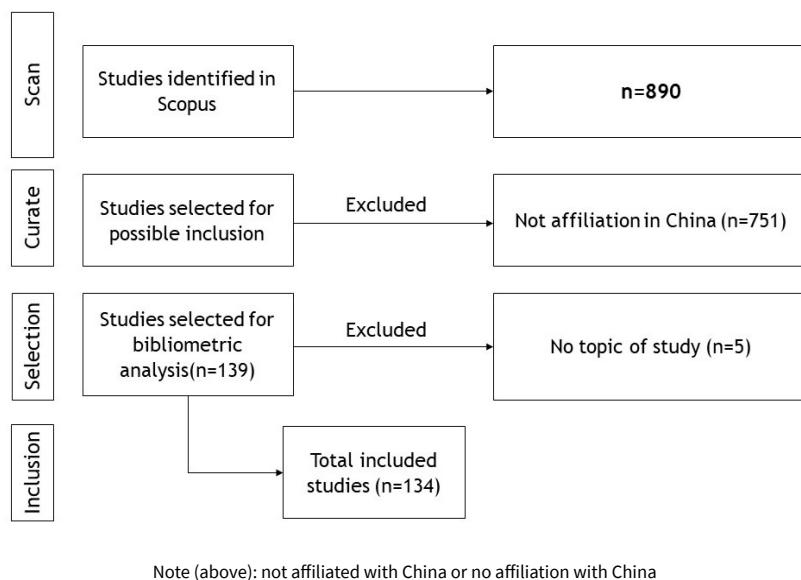
To examine the sample, several bibliometric techniques were used: a) an analysis of the scientific production, evaluating how the publications have evolved considering certain variables; b) a bibliographic linkage, which allows us to know the references in common between publications, being able to determine the influence of the most relevant sources; c) a co-citation analysis, which allows us to know the number of times different articles are cited together; d) a word set analysis, where the most frequent descriptors/key words indicate the main topics that have been worked on in the publications. The exploration of the relationships and links developed between publications was assessed using the VOSviewer software. This program allows visual representation of the relational nodes generated in each factor considered.

The variables that were considered in the analysis of the scientific production should be noted, as well as whether any inclusion/exclusion criteria were used to examine them. These criteria arise from the need to choose only those elements that are most representative, and not to reproduce all 134 documents in all the variables. Thus, in some variables, only the most frequent descriptors are selected because they are more relevant to the variable under study.

- Year of publication. This variable indicates the temporal distribution of the publications. As an inclusion criterion, publications from the last 10 years (2014-2023) were considered.
- Subject area. This allows us to know to which field of knowledge the publications belong. The subject areas considered are those that at least registered 10 publications.
- Type of publication. This variable indicates which format of publications were those that inquired into the object of study. In this variable there was no exclusion criterion, including all the documents that make up the sample.

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- Institutional affiliation. This variable noted the main research centers in China that have addressed the object of study. Institutions with at least three publications were considered.
- Most relevant publications. Taking citations as a factor of relevance of the publication and its impact on the subject of study, those that obtained the most citations in total were chosen. In this case, the inclusion criterion was publications with at least 17 citations.

3. RESULTS

The results section is structured on the basis of the bibliometric techniques used to answer the research questions. We begin with the analysis of scientific production, followed by the analysis of bibliographic linkage, co-citation and co-occurrence.

3.1. Analysis of scientific production

The 134 documents were analyzed considering the different variables that were stipulated.

3.1.1. Year of publication

Based on the criterion of including studies from the last 10 years (2014-2023), the final sample (after applying the different filters) also had no publications prior to this. The results reveal an upward progression from the first-time tranche (2014-2016) to the second tranche (2017-2020), with the exception of 2019 which only recorded eight publications. Within the last tranche (2021-2023), we have results that follow the line of the second time tranche (11 publications in 2023) and a potential growth in the two years recording publications around the COVID-19 phenomenon, where technology-mediated learning (resources, methodologies, etc.), were the focus of interest of researchers due to the demands caused by periods of isolation during the pandemic.

FIGURE 2. Documents published per year.

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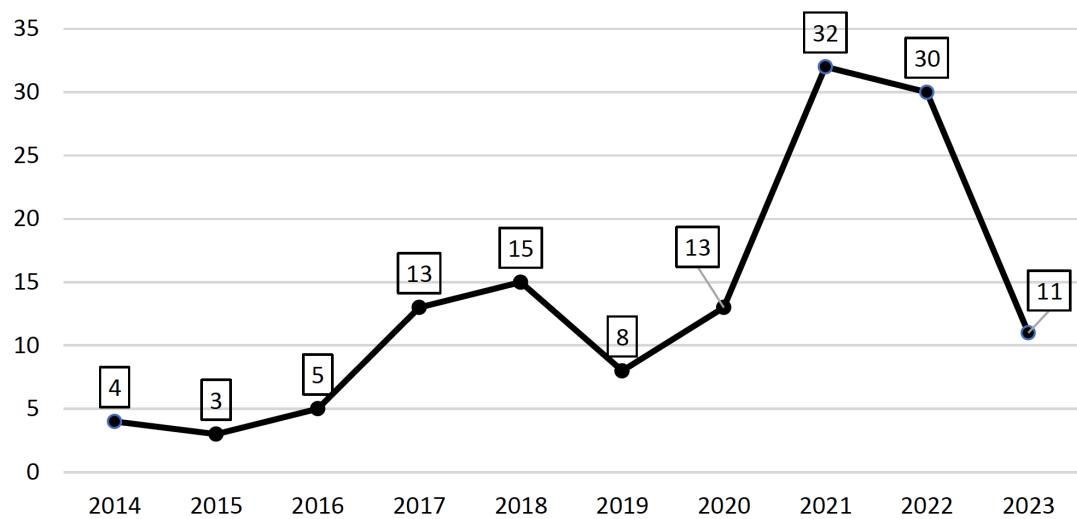
3.1.2. Subject area

Only areas with at least 10 publications were considered in this variable. In addition, it should be borne in mind that the assignment of a publication to an area in Scopus is multi-classification. This means that the same publication can be associated with more than one subject area, so that the number of publications associated with areas will always be greater than the number of publications in the sample. This is reflected in Table 1, where the sum of only the areas that meet the criterion is greater than the 134 publications in the sample.

TABLE 1. Subject area.

Area	Number of publications
Computer Science	98
Social Sciences	51
Engineering	41
Mathematics	26
Decision Sciences	18
Arts and Humanities	11

TABLE 2. Type of publication.

Type of documents	Type of publications
Conference Paper	77
Article	54
Book Chapter	2
Review	1

Computer sciences was the subject area with the most publications (98), with social sciences in second position, with about half of the records (51). The variety of areas is noteworthy, due in part to the technological component. This is due to the fact that LMOOCs are designed and created from this area, with a high weight of engineering (41). However, the role of the area of mathematics stands out, as it is transversal to the technological component and is not the focus topic of the MOOCs, having a high presence in spite of this.

3.1.3. Type of publication

Another important aspect was to know what type of publications had dealt with the subject of the study. Based on the 134 documents in the sample and without applying any exclusion criteria, Table 2 shows the results.

Contributions to conferences were in the majority, with more than half of the documents published (57.5%), followed closely by articles (40.3%). Book chapters (1.5%) and reviews (0.7%) had an anecdotal presence.

3.1.4. Institutional affiliation

For this variable, only those institutions with at least three publications on the topic of study were considered. Although the sample reached 14 documents, the most prolific institutions were Huazhong Normal University and Tsinghua University, both with five publications. Peking University had one less (four), while several institutions had three publications: Northeast Normal University, Guangdong University of Foreign Studies, Beihang University, Harbin Institute of Technology, Beijing Normal University, National University of Defense Technology China and Hangzhou Normal University.

3.1.5. Most relevant publications

The criterion for selecting the most relevant publications was based on the total number of citations achieved. In this case, publications that achieved 17 total citations or more were considered (Table 3).

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TABLE 3. Most relevant publications.

AUTOR	AÑO	TITLE	MAGAZINE	QUOTES	QUOTES PER YEAR
Wang, An, & Wright	2018	Enhancing beginner learners' oral proficiency in a flipped Chinese foreign language classroom	Computer Assisted Language Learning, 31(5-6), 490-521	57	9.5
Sallam, Martín, & Li	2022	Research trends in language MOOC studies: a systematic review of the published literature (2012-2018)	Computer Assisted Language Learning, 35(4), 764-791	34	17
Ding, & Shen	2022	Delving into learner autonomy in an EFL MOOC in China: a case study	Computer Assisted Language Learning, 35(3), 247-269	18	9
Fang, Hwang, & Chang	2022	Advancement and the foci of investigation of MOOCs and open online courses for language learning: a review of journal publications from 2009 to 2018	Interactive Learning Environments, 30(7), 1351-1369	17	8.5

Although the paper by Wang *et al*. (2018) is the most cited paper, it does not have the best average number of citations per year. This rate of citations per year is headed by the paper by Sallam *et al*. (2022), being the second with the most citations in total. It should be noted that only the first work is prior to 2022, since the other three that make up this variable of most relevant publications are from that year, having good citation rates per year that may cause them to change their position in future years within the classification by total citations. Regarding topics, there are two papers focused on systematic reviews (Fang *et al*., 2022; Sallam *et al*., 2022), another focused on the student body (Ding, & Shen, 2022) and another on the impact of the use of an active methodology in LMOOCs (Wang *et al*., 2018). Regarding systematic reviews, the most relevant (by citations) is that of Sallam *et al*. (2022), where research published from 2012 to 2018 on massive open online language courses (LMOOCs) is analyzed. The results highlight that Spain is the most prolific country, with the "Universidad Nacional de Educación a Distancia" leading the way. The main findings include the advantages that the didactic use of LMOOCs can bring to learning due to their suitability or the motivation they achieve in students. The review by Fang *et al*. (2022), covering 10 years of studies (2009-2018), focuses on reviewing the research on open online language learning. Among their conclusions, it should be noted that most of the studies were empirical, predominantly on reading and writing, with self-directed and blended learning processes, especially analyzing factors such as motivation, interest and satisfaction in LMOOC learners. The work of Ding and Shen (2022) places learner autonomy in LMOOC as the main focus, using interviews as a research instrument. It should be noted that learner autonomy was contingent on factors such as metacognitive strategies, motivational control and emotional control to regulate learning. Regarding the impact of active methodologies in LMOOCs, Wang *et al*. (2018), analyzed whether the MOOC-based Flipped Classroom improved the development of oral proficiency and learner progress. Using a control group and an experimental group, the results indicated that the students who took the LMOOC with the Flipped Classroom methodology had a 25% faster progress rate. In addition, these students significantly improved their oral proficiency, especially in speech fluency but less so in language complexity and accuracy.

3.2. Bibliographic coupling

Bibliographic linkage allows highlighting the influence of a publication within the scientific production analyzed, due to its similarity with other documents. To do so, we considered the number of references in common

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among the documents in the sample, applying a backward citation chaining. With this we were able to find the referent publications, within the subject of LMOOCs in China. The bibliographic linkage analysis was developed with the documents as the unit of analysis, setting as inclusion criteria that the document had been cited a minimum of four times. The relationship nodes generated with the 10 items that met the criterion are shown in Figure 3. 4 sets of documents were formed by the coupling relationship between them.

It is worth highlighting the higher linkage intensity (total link strength 21) among the documents grouped around the blue cluster (Fang *et al*., 2022; Sallam *et al*., 2022), being the third and first documents with the most citations. It should be noted that both studies were systematic reviews of LMOOC research. The yellow cluster has a lower intensity (total link strength 9), although by citations between both papers (Ding, & Shen, 2022; Luo, & Ye, 2021) it would be in second position. Learner autonomy in language courses through MOOCs in China was the topic researched by Ding and Shen (2022). Luo and Ye (2022), who, on the other hand, worked on defining criteria from a learning perspective to ensure the quality of MOOCs for second language learning. Within the red cluster, the work of Zeng *et al*. (2022), on the analysis of collective attention in LMOOCs, with higher link intensity (total link strength 7) and 10 citations, stands out. Additionally, in the green cluster, the work of Peng and Jiang (2022), on the impressions and feelings of Chinese LMOOC students through forums, with medium levels of intensity (total link strength 6) and citations (4), should be highlighted.

FIGURE 3. Bibliographic linkage with "documents" as unit of analysis.
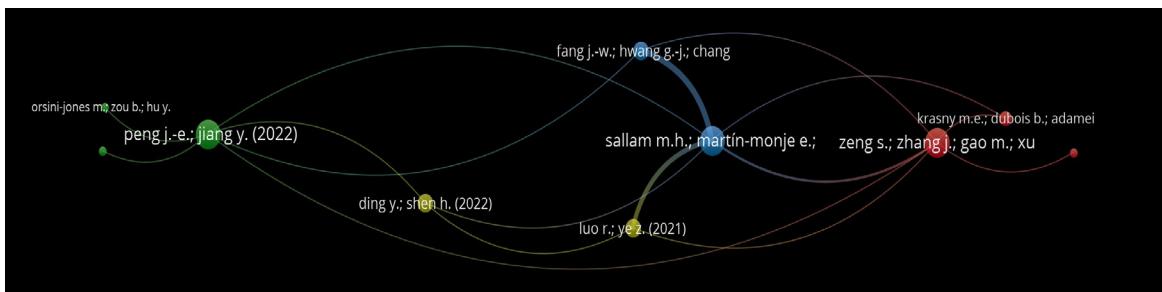
3.3. Co-citation and co-occurrence analysis

By applying a co-citation analysis, we know the frequency in which different publications are cited together. This allows us to know the main topics within the object of study. If we add the analysis of co-occurrence of keywords, we can know the main descriptors with respect to the content of the sample of publications. Co-occurrence allows us to connect the frequency of occurrence of keywords with a conceptual link between them. These two analyses complement each other to answer the question about the main lines of research related to LMOOCs in China.

Regarding co-citation, it was established as a criterion to have a minimum of 15 citations, with 16 items fulfilling it (Figure 4). Three sets of co-citations were generated, according to the authors who appear co-cited. The levels of co-citation intensity are diverse. Martin (total link strength 286), Li, C. (total link strength 227) Perun (total link strength 196) and Barcena (total link strength 192) are the most outstanding.

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FIGURE 4. Co-citation with "authors" as unit of analysis.
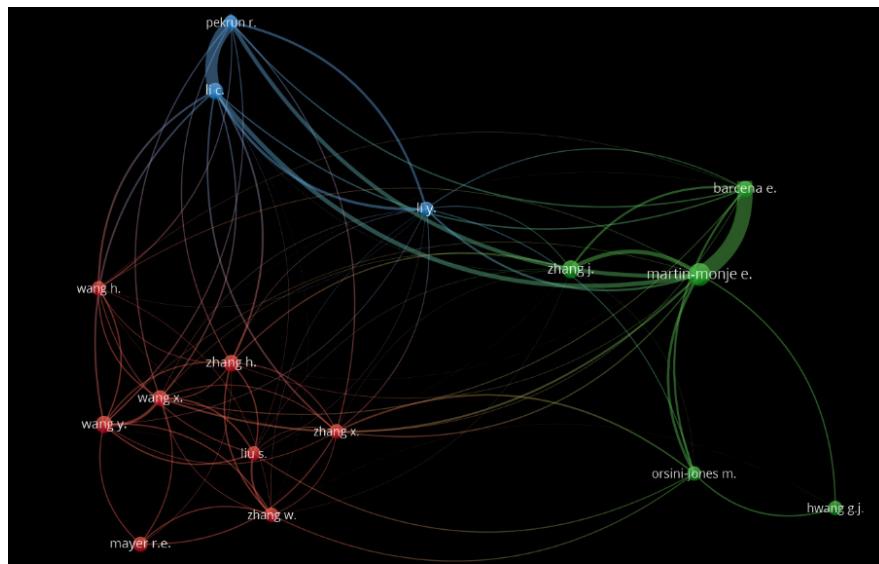
Regarding the co-occurrence of keywords, of the 134 documents in the sample analyzed, the authors proposed 382 keywords and the documents were indexed with 678 keywords, reaching a total of 1060. Among them, 49 keywords coexisted more than five times in the analyzed documents (Figure 5). Five co-occurrence clusters were established, as a result of the linkage between descriptors that usually appear together as keywords.

FIGURE 5. Concurrence of keywords in scientific production.

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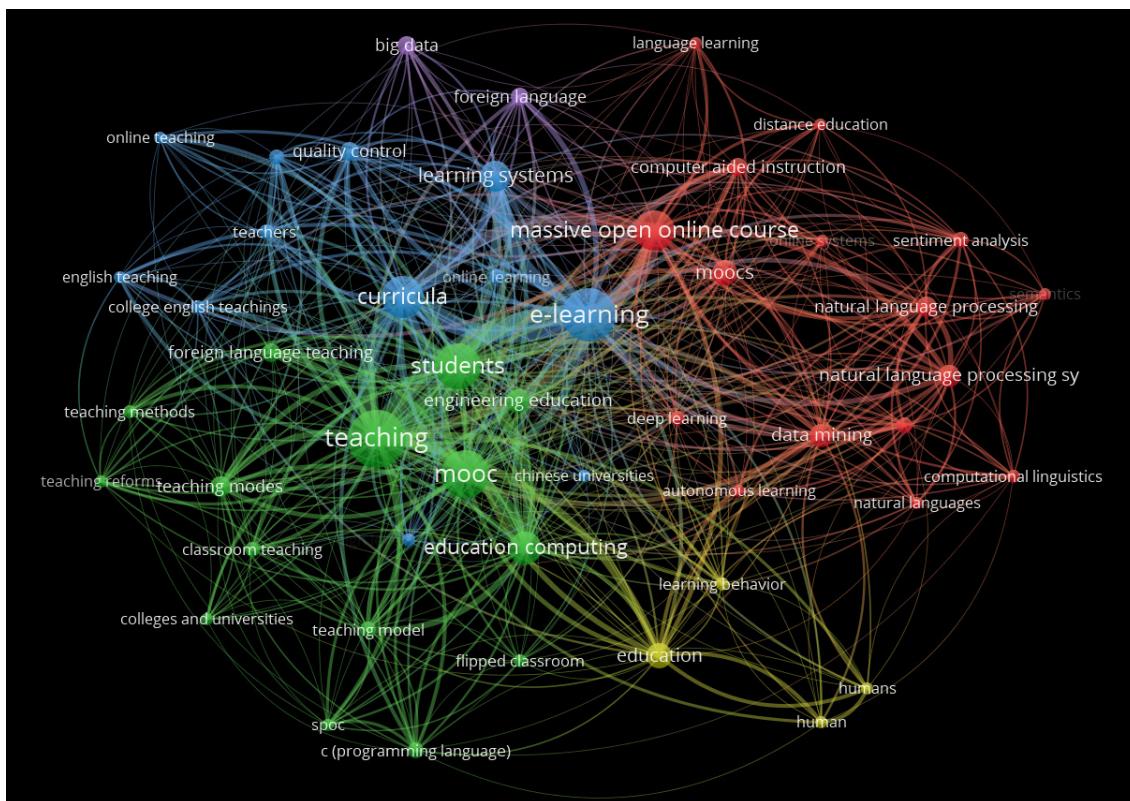
Among the descriptors with the greatest presence, and in respect of the Booleans used, MOOC and Massive Open Online Course together reach 89 appearances, while "Language" as such has no presence, although there is mention of "natural language processing" (22), "foreign language" (19), "English teaching" (5), "natural languages" (5), "high level languages" (6) and "language learning" (5). Other terms such as "e-learning" (49) should be highlighted, thus underlining the relationship between online learning and MOOCs as a resource for such processes. Other terms, such as "social networking" (8), "learning behavior" (6), "flipped classroom" (6) and "SPOC" (5) offer an insight into tools, contents and methodologies implemented in LMOOCs that can be further explored in future studies.

4. DISCUSSION

Due to the worldwide development of LMOOCs, in China it has become a relevant field of applied linguistics, which is increasingly attracting attention (Chen, 2022). With adapted MOOC pedagogy, better platforms, easier access to technology, and a general increase in digital literacy, students from different backgrounds can enjoy learning through LMOOCs in line with their own needs and learning pace (Li *et al.*, 2022a). In addition, since language teaching and learning differ from other disciplines, it is essential to pay attention to the technical and management aspects of LMOOC courses (Ye, & Luo, 2021).

Going deeper into the research questions, regarding the evolution of scientific production, we can state that although the number of publications has increased since 2014, they have tended to stabilize around 13-15 publications per year, except as an isolated fact over the two years in which publications increased due to COVID-19. In the sample, technological publications (computer science and engineering) predominate, as they are the basis for the design and development of LMOOCs, followed by social sciences. Regarding the type of documents, contributions to conferences (77) and articles (54) make up the bulk of the sample (978.8%). In terms of affiliation, the most prolific institutions registered five publications (Huazhong Normal University and Tsinghua University), followed by Peking University with four. The most relevant publications, according to the number of citations received, are focused on systematic reviews on LMOOCs spanning from 2009 to 2018 (Fang *et al*, 2022; Sallam *et al*., 2022), on the analysis of students' autonomy to perform LMOOCs and the factors that influence (emotional or motivation, for example) their development (Ding, & Shen, 2022), and on how the implementation of the Flipped Classroom as a methodology in an LMOOC affects the development of students' communicative competence (Wang *et al*., 2018).

Regarding the most influential publications on LMOOC in China, the publications by Ding and Shen (2022), Fang *et al*. (2022) and Sallam *et al*. (2022) should be highlighted, having already appeared in the most relevant publications (by citations), with the only exception the work by Wang *et al*. (2018). Thus, systematic reviews on LMOOCs and learner autonomy when using these platforms are references for researchers interested in this topic. Along with these, it is worth highlighting the interest in defining what quality criteria an LMOOC should have for its implementation in learning (Luo, & Ye, 2022), the importance of collective attention when taking this type of second language course (Zeng *et al*., 2022), as well as the study in forums of the emotional component of taking an LMOOC on the part of the students (Peng, & Jiang, 2022). Thus, the references are recent publications (less than two years old) that focus on learning more about LMOOCs and the students who take them.

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Regarding the main lines of research related to LMOOCs in China, it is worth mentioning the combination of MOOCs with different mentions of language learning, such as the work of Jin (2020) for "natural language processing"; He (2022), Liang and Pang (2019) and Wang (2019) for "English teaching"; or Pan *et al*. (2022) for "foreign learning". In addition, there are several interesting avenues to explore, such as the use of SPOCs as an evolution of MOOCs (Zhang *et al*., 2021) or the influence of emotions on student behavior when learning with these methods (Li *et al*., 2022b). Special mention should be made of the studies in which active methodologies are implemented, such as the flipped classroom, to improve MOOCs in second language learning. Studies were found in respect of the perception of teachers when implementing a MOOC for learning a second language through Flipped Classroom (Orsini, & Zou, 2019); the influence of learning with computers and ICT through MOOCs and Flipped Classroom (Deng, 2021); or a comparison between the possibilities of MOOCs and this methodology for learning a foreign language by analyzing variables such as anxiety, student attitudes or motivation (Pan *et al*., 2022).

5. CONCLUSIONS

The acquisition of a second language is key in an increasingly global and borderless world. In this technological era, there are many resources, materials and programs available to develop this formative learning. In this situation, LMOOCs become a relevant resource due to their universal and massive access (Martín, & Bárcena, 2014), being a learning opportunity with ever-increasing possibilities (Jitpaisarnwattana *et al*, 2021).

In the Chinese context, within the focus of this study, these have been positively accepted by all the agents involved in educational processes (Han, 2019), hence the interest in knowing the evolution of scientific production in this field. From the bibliometric analysis we can conclude that publications increased since the emergence of LMOOCs in 2013 until stabilizing, undergoing a temporary growth during the COVID-19 pandemic. Systematic reviews are notably frequent in this field and are amongst the most cited publications. This is related to their short conceptual trajectory, which is useful for other researchers to situate the theoretical basis of their study proposals. The incorporation of active methodologies into LMOOCs has also had an impact, highlighting the Flipped Classroom as a didactic strategy to be implemented, or as a counterpoint to MOOCs for language learning. In both cases, it is a methodology that arouses interest among researchers and that can continue to be analyzed in the future. The other most common component has to do with the students participating in LMOOCs, analyzing aspects such as their motivation, their autonomy during the learning process or their emotional responses when they make use of this resource. In this sense, it would be interesting to develop specific technologies to improve student interaction and offer them more channels and opportunities for participation in view of the few studies that have analyzed this phenomenon. Moreover, based on the results, if we want to gain a more complete view of the pedagogical impact of LMOOCs, there are other focuses that should be addressed, such as the teaching staff and the quality of the platforms.

5.1. Limitations and foresight

The main limitation of a bibliometric study is not incorporating publications from other international databases such as Web of Science, Eric or Scielo. The main factor is related to the duplication of publications,

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due to the fact that journals tend to be indexed simultaneously in several databases. In addition, we acknowledge that the criteria established by Scopus for indexing in its database are of sufficient quality for the sample found to be representative of the phenomenon under study.

Among the future lines of research, if we modify the inclusion criteria, it would be interesting to analyze the impact of LMOOCs on scientific production worldwide, which would provide us with information on the most prolific countries and institutions, together with the main research groups and lines of work on this topic. As a result of this and of the detailed analysis of the most relevant research worldwide (systematic review as a working methodology), the strengths and weaknesses of LMOOCs could be outlined, and constructive suggestions could be made for the future design of technology-assisted language learning.

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Análisis de la producción científica en WOS sobre realidad aumentada y educación infantil

Analysis of Scientific Production in WOS on Augmented Reality and Early Childhood Education

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RESUMEN

En los últimos años, la realidad aumentada ha ganado terreno en el ámbito educativo. En particular, en educación infantil ofrece grandes oportunidades para enriquecer los procesos de enseñanza-aprendizaje, sin embargo, las investigaciones sobre su uso didáctico se encuentran en estado incipiente. Ante esta situación, cobra relevancia conocer el estado actual de la producción científica sobre realidad aumentada en educación infantil. Con este fin surge el presente estudio, en el que se realiza una revisión sistemática exploratoria de la producción científica sobre la temática en Web Of Science (WOS). Los resultados obtenidos muestran una evolución favorable de la producción científica en los últimos años, la relevancia que desde España se está dando al tema de estudio y la necesidad de seguir investigando para favorecer una aplicación adecuada de esta tecnología en educación. Tras el estudio, se concluye que es importante formar a los docentes para aplicar la realidad aumentada en contextos formativos y promover la producción científica sobre el tema. En concreto, se destaca la necesidad de concretar elementos de diseño que se tienen que tener presente, pasos a seguir para lograr resultados óptimos y herramientas útiles para desarrollar experiencias educativas utilizando esta tecnología.

PALABRAS CLAVE Realidad aumentada; educación infantil; revisión sistemática; base de datos.

ABSTRACT

In recent years, augmented reality has gained ground in the educational field. In particular, in early childhood education it offers great opportunities to enrich the teaching-learning processes, however, research on its didactic use is in its infancy. Given this situation, it is important to know the current state of scientific production on augmented reality in early childhood education. To this end, the present study arises, in which a systematic review of the scientific production on the subject in Web Of Science (WOS) is carried out. The results obtained show a favorable evolution of scientific production in recent years, the relevance that Spain is giving to the subject of study and the need to continue researching to favor an adequate application of this technology in education. After the study, it is concluded that it is important to train teachers

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to apply augmented reality in training contexts and promote scientific production on the subject. Specifically, the need to specify design elements that must be taken into account, steps to follow to achieve optimal results and useful tools to develop educational experiences using this technology is highlighted.

KEYWORDS Augmented reality; early childhood education; systematic review; database.

1. INTRODUCCIÓN

La realidad aumentada (RA) es una tecnología que está en auge en el terreno educativo, gracias a las oportunidades que brinda para enriquecer los procesos de enseñanza-aprendizaje. Dicha importancia queda reflejada en informes Horizon (Johnson, 2013; Johnson *et al.*, 2016), en reportes edutrends elaborados por el observatorio de innovación educativa del Instituto Tecnológico de Monterrey (Edutrends 2015 y 2016) y en el hiperciclo de Gartner del 2017. La importancia de esta tecnología queda reflejada también en proyectos como Rafodiun, en el cual se fomenta la formación sobre RA en niveles universitarios y se crea una comunidad virtual en Google+ para compartir e intercambiar conocimientos sobre esta tecnología en educación (Marín *et al.*, 2020).

Esta tecnología se caracteriza por superponer información digital sobre entornos reales a partir de dispositivos como los móviles (Bower *et al.*, 2014; Huertas-Abril *et al.*, 2019), permitiendo interaccionar con objetos reales y virtuales en tiempo real (Madanipour, & Cohrssen, 2019; Martínez, & Fernández, 2018). Sus características distintivas facilitan la visualización de conceptos abstractos y la interacción con el contenido (Alkhattabi, 2017).

La posibilidad de visualizar el contenido desde diferentes perspectivas y bajo diversos soportes, permite trabajar temas abstractos disminuyendo posibles riesgos, y enriquecer habilidades espacio-temporales y cognitivas (Martínez, & Pérez, 2018). En esta línea, Gómez *et al.* (2022) reflejan las oportunidades que ofrece para mejorar habilidades espaciales y el rendimiento del alumnado.

Las cualidades que la caracterizan ofrecen grandes oportunidades a la educación infantil, permitiendo aprender jugando y por medio de la interacción (Yilmaz, 2016). Tal y como destacan Lee *et al.* (2019) y Han *et al.* (2015), el uso de esta tecnología favorece la experiencia de aprendizaje de forma atractiva e interactiva. Además, su utilización mejora la motivación, el aprendizaje y las relaciones socioafectivas (Redondo *et al.*, 2020).

Como indican Neira-Piñero *et al.* (2019), la RA proporciona una estimulación multisensorial y aprendizaje inmersivo, incentivando de esta forma todas las inteligencias. A lo señalado, añadir que su uso mejora la participación activa, la autonomía, la actitud, la motivación, el interés, la atención, el aprendizaje colaborativo y constructivista (López *et al.*, 2019; Sáez *et al.*, 2018).

Por consiguiente, su uso potencia el nivel de participación y enriquece las experiencias de aprendizaje para resolver problemas e incentivar el aprendizaje por descubrimiento (George, 2020). Aspecto que ha sido demostrado por autores como George (2020) o Huertas-Abril *et al.* (2021), reflejando en sus experiencias un aumento en la participación y motivación hacia el aprendizaje.

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La RA se visualiza como una tecnología para mejorar la comunicación, la interacción social y asimilar contenidos abstractos en personas con Trastorno de Espectro Autista (Láinez *et al*., 2018).

Teniendo en cuenta que en educación infantil cobra relevancia la participación activa y la interacción del alumnado con el contenido (Méndez, 2021), su aplicación es útil en diversas áreas de aprendizaje como: el aprendizaje de idiomas (Chen, & Chan, 2019; Redondo *et al*., 2020), la educación artística (Huang *et al*., 2016), el aprendizaje del cuerpo humano (Marín, & Muñoz, 2018) y el conocimiento del entorno (Marín *et al*., 2016).

Los beneficios destacados y la posibilidad de trabajar de forma interactiva diversas áreas de aprendizaje, ha provocado que distintas instituciones educativas den prioridad a la formación de los docentes y futuros profesionales de la educación sobre el uso de esta tecnología (Martínez, 2020; Martínez, & Pérez, 2018; Neira-Piñero *et al*., 2019; Rodríguez *et al*., 2019; Roig-Vila *et al*., 2019; Villalustre, 2020; Villalustre, & Del Moral, 2020). De esta forma, autores como Martínez (2020), Martínez y Pérez (2018), Neira-Piñero *et al*. (2019), Rodríguez *et al*. (2019) o Villalustre (2020) desarrollan experiencias formativas con futuros docentes de educación infantil para favorecer el diseño de recursos didácticos enriquecidos con RA y su aplicación efectiva en contextos educativos. Las experiencias desarrolladas por estos autores muestran el alto grado de aceptación que han tenido los futuros docentes sobre esta tecnología.

Dicha formación alcanza importancia, debido a la necesidad que encuentran los docentes de esta etapa educativa para incorporar las TIC en el proceso de enseñanza-aprendizaje (Ruíz, & Hernández, 2018). Autores como Ruíz y Hernández (2018), llaman la atención a la falta de estudios existentes sobre las TIC en los primeros años de vida, destacando la importancia de promover investigaciones que ayuden a incluirlas en esta etapa educativa, puesto que es el momento en el que se desarrolla más rápidamente la inteligencia, el comportamiento social y la personalidad.

Centrando la atención en educación infantil y en lo señalado por autores como Madanipour y Cohrssen (2019), los estudios sobre el uso de esta tecnología (RA) en esta etapa educativa son limitados. En particular, los docentes encuentran un vacío formativo sobre el uso didáctico de la RA y pocas experiencias formativas que sirvan de ejemplo (Barroso *et al*., 2019; Martínez, & Fernández, 2018). Así lo han mostrado diversos autores, señalado la baja existencia de investigaciones (Alkhattabi, 2017; Barroso *et al*., 2019; Figueroa *et al*., 2021; Nielsen *et al*., 2016) y modelos conceptuales para su incorporación (Barroso *et al*., 2019; Bower *et al*., 2014; Rasimah *et al*., 2011).

No debemos perder de vista la estrecha relación que existe entre la aceptación de la tecnología y el uso que se hace de la misma en los procesos formativos (Marín-Suelves *et al*., 2022; Martínez, & Fernández, 2018).

Por lo destacado en los párrafos anteriores, cobra importancia analizar la producción científica existente sobre RA y educación infantil, con el fin de situar el estado actual de las investigaciones y poder establecer líneas futuras de actuación.

De la presente necesidad surge el presente estudio, con el que se persigue analizar la producción científica en la base de datos WOS sobre realidad aumentada y educación infantil.

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2. MATERIAL Y MÉTODO

El presente estudio perseguía analizar la producción científica en WOS sobre realidad aumentada y educación infantil. Para tal fin, se concretaron los siguientes objetivos específicos:

— Analizar la evolución anual de artículos sobre realidad aumentada y educación infantil.

— Concretar el número de artículos publicados en acceso abierto.

— Identificar las fuentes en las que se publica más sobre el tema de estudio.

— Determinar los países/regiones más productivas en publicaciones sobre realidad aumentada y educación infantil.

— Identificar los idiomas más utilizados en las publicaciones estudiadas.

— Analizar el contenido de las publicaciones con mayor relevancia.

Para responder a los objetivos, se realiza una revisión sistemática narrativa. El presente método cobra relevancia para el estudio de la realidad aumentada y educación infantil, tal y como reflejaron Rivas *et al.* (2021).

Este tipo de investigación permite conocer el estado de las investigaciones sobre una temática concreta y distinguir los vacíos existentes (Crisol-Moya *et al.*, 2020). Para dotar de objetividad y transparencia, se han tenido en cuenta las recomendaciones PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), orientadas al ámbito educativo (Moher *et al.*, 2009), y su actualización (Page *et al.*, 2020). En la figura 1 se representa el diagrama de flujo seguido en la revisión realizada.

FIGURA 1. Diagrama de flujo del procedimiento de selección de estudios de acuerdo con PRISMA.

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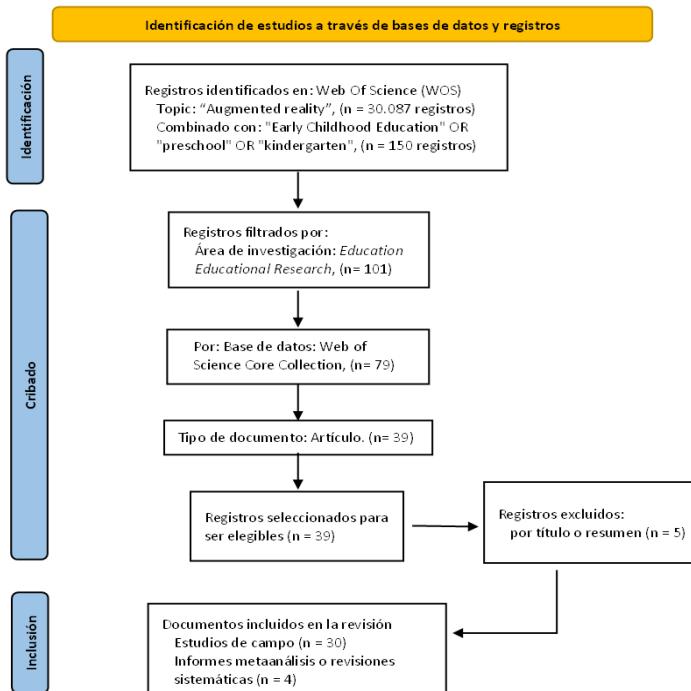
Como se indica en la figura 1, para realizar la investigación se utilizó la base de datos WOS, por estar bien establecida en la investigación educativa, indexar una variedad de materiales gratuitos y ofrecer acceso a literatura de investigación de alta calidad (Madanipour, & Cohrssen, 2019).

El estudio se centró en el análisis de artículos publicados en WOS en el área de investigación de educación. Por lo tanto, la búsqueda se afinó del siguiente modo:

- Topic: "Augmented reality".
- En combinación con los siguientes tópicos: "*Early Childhood Education*" OR "*Preschool*" OR "*kindergarten*".
- Base de datos: Colección Principal de WOS.
- Área de investigación: Education Educational Research.
- Tipo de documentos: Artículos de investigación.

La consulta se realizó en junio de 2022, e inicialmente se recuperaron 150 documentos de los que se seleccionaron 39 tras aplicar los criterios de exclusión. Una vez realizada una lectura detenida de los *títulos* y *abstract* de los registros, se excluyeron 5 por no guardar una relación directa con nuestro centro de interés, es decir: la realidad aumentada y la educación infantil. Sobre todos estos documentos se realizó un análisis bibliométrico de acuerdo con las siguientes dimensiones:

- Bases de datos WOS en las que están indexados los artículos.
- Revistas fuentes de publicación.
- Artículos publicados por año.
- Artículos de acceso abierto.
- Área geográfica de los artículos.
- Idiomas empleados en las publicaciones.
- Artículos más citados por la comunidad científica.

Tras este análisis, se realizó una revisión del contenido de las publicaciones a partir del cual se distinguieron los temas que mayor relevancia alcanzaban en el área de estudio.

3. RESULTADOS

A continuación, se reflejan los resultados en base a las dimensiones analizadas y destacadas en el apartado anterior.

Para comenzar, como ya se ha indicado, todos los artículos formaban parte de la colección principal de WOS, lo que garantiza que han pasado por un proceso riguroso de evaluación de calidad científica, siendo reconocidas como publicaciones confiables. En concreto, se encuentran indexadas en tres de las bases de datos más importantes de dicha colección. Como se recoge en la tabla 1, más de la mitad, se publican en revistas incluidas en el índice de citas Social Sciences Citation Index (SSCI), y el resto en el Emerging Sources Citation Index (ESCI). Se destaca que, de las indexadas en SSCI, cuatro están también en el Science Citation Index Expanded (SCI-EXPANDED).

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TABLA 1. Índices de citas en WOS.

ÍNDICE WOS	Nº ARTÍCULOS
Social Sciences Citation Index (SSCI)	19
Emerging Sources Citation Index (ESCI)	15
Science Citation Index Expanded (SCI-EXPANDED)	4

FIGURA 2. Artículos publicados por año.
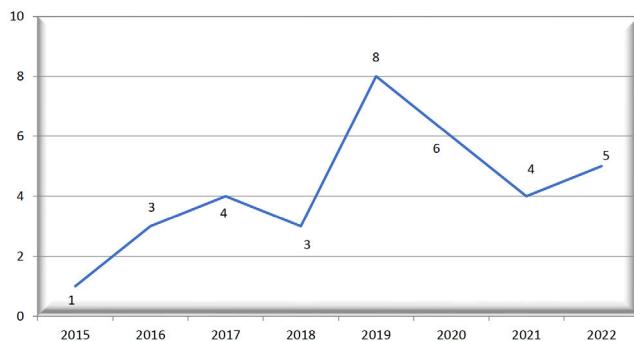
En cuanto al número de artículos por año de publicación, tal y como se refleja en la figura 2, en 2015 se comienzan a publicar artículos focalizados en el estudio y análisis de la realidad aumentada en la etapa de educación infantil, año en el que se localiza un documento, aumentando progresivamente en años siguientes, hasta 2019, año en el que se observa un aumento considerable de interés por la temática al duplicarse el número de artículos publicados. Tras este año, se detecta un descenso en el número, aunque en el 2022 comienza otra vez a subir, ya que, en los primeros seis meses del año, ya se habían publicado 5 artículos.

Las revistas y el número de documentos sobre la temática que se han publicado en cada una de ellas se desglosa en la figura 3. Tal y como se aprecia, la revista *British Journal of Educational Technology* es la que recoge un mayor número, seguida por la revista española, *Pixel. Bit Revista de Medios y Educación*, y la americana, *ETR-D. Educational Technology Research and Development*. En el resto, se publica el mismo número de documentos sobre la temática.

FIGURA 3. Principales fuentes de publicación.

En relación con el tipo de acceso (abierto vs. restringido) al contenido completo de los artículos, en la base de datos WOS se indica que sólo la mitad de los artículos permite acceso abierto. Si bien, en un análisis

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más detallado del resto de documentos catalogados de acceso restringido, hemos observado que uno de ellos no está bien catalogado en la base de datos, ya que se trata de una revista de acceso abierto (revista *Campus Virtuales*) y otros seis documentos sí permiten acceso completo al contenido (cinco de ellos por acceso anticipado). Por tanto, teniendo en cuenta estas cuestiones, podemos indicar que predominan los artículos a los que se puede acceder de forma abierta al contenido. En la figura 4, se presentan los resultados obtenidos.

FIGURA 4. **Número de artículos en Acceso Abierto.**
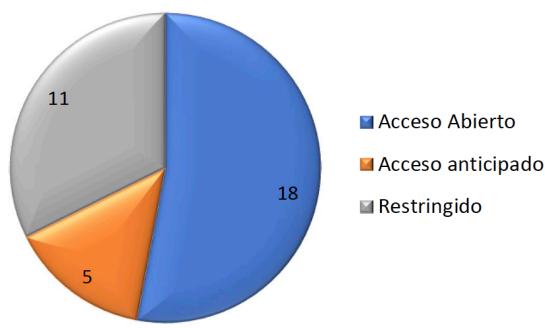
En cuanto al área geográfica, en la tabla 2, se resalta la variedad de países/regiones en los que se ha publicado documentos centrados en nuestra área de estudio. Entre ellos, sobresalen España, Turquía, República popular de China e Italia. En cuanto al número de publicaciones realizadas, se concentran en España el mayor número, muy por delante de Turquía, segundo país de publicación. Estos datos reflejan el interés de España por la temática de estudio.

TABLA 2. **Áreas geográficas de los artículos.**

ASIA	Pueblos R China (5), India (1), Indonesia (1), Kuwait (1), Malasia (1), Corea del sur (1), Taiwan (1)
EUROPA	España (11), Turquía (7), Italia (2), Grecia (1), Luxemburgo (1), Austria (1)
AMÉRICA	Estados Unidos (1)
OCEANÍA	Australia (1)

Los idiomas utilizados en las publicaciones son el inglés (f=28) y español (f=6), existiendo un mayor número de publicaciones en lengua inglesa.

TABLA 3. **Idiomas empleados en las publicaciones.**

IDIOMA	ARTÍCULOS
Inglés	28
Español	6

Por otra parte, como indicador de la relevancia que tienen estos documentos para la comunidad investigadora, se incluye el número de citas recibidas por cada uno de ellos en la tabla 4. En base a estos datos, señalamos que los cinco artículos con mayor relevancia son los documentos publicados en los tres primeros años (de 2015 al 2017). El artículo más referenciado hasta el momento es el de Yilmaz (2016), con más de un centenar de citas. En él, los autores analizaban las percepciones de maestros y niños y niñas de infantil hacia el uso de juguetes mágicos educativos (EMT) desarrollados con tecnología de realidad aumentada. Estudiaron los patrones de comportamiento seguidos por los niños mientras jugaban, su logro cognitivo, y las relaciones que establecían entre ellos mientras lo hacían.

Consideramos que es importante resaltar que, junto a estos documentos, se sitúa en sexto lugar el publicado recientemente por un equipo de autores españoles: Villena-Taranilla *et al*. (2022) con 32 citas. En el cual, los autores desarrollan un metaanálisis en el que se analizan los efectos de la realidad virtual en los resultados del aprendizaje en los 6 primeros años educativos.

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En cuanto a las temáticas de los artículos son de diversa índole, como se refleja en la tabla 4, alcanzando relevancia los estudios centrados en analizar el impacto del uso de realidad aumentada con alumnos de educación infantil (n=21); las experiencias formativas destinadas a docentes/futuros profesionales de la educación sobre el uso didáctico de esta tecnología (n=9) y los metaanálisis y/o revisiones sistemáticas sobre el tema (n=4). En la tabla se observa un menor número de artículos relacionados con el análisis de aplicaciones de realidad aumentada para la educación infantil (n=1).

4. DISCUSIÓN

Los resultados obtenidos muestran el interés creciente por la realidad aumentada en educación. Este aspecto ya ha sido advertido en otros estudios previos y en diferentes niveles educativos (Fombona y Pascual, 2017; Rodríguez, 2021; Vásquez-Carbonell, 2022).

El estudio refleja la importancia que está alcanzando la formación de los docentes de educación infantil en competencias digitales y en el uso de la realidad aumentada, puesto que un gran número de los artículos analizados centra la atención en este tema. Este elemento queda reflejado en experiencias desarrolladas por autores como Barroso y Gallego (2017) y Cózar *et al*. (2015).

La otra temática más tratada en los artículos tiene relación con el análisis del impacto de experiencias educativas desarrolladas con alumnos de educación infantil empleando realidad aumentada. La importancia de esta temática se muestra en palabras de Madanipour y Cohrssen (2019), debido a que llaman la atención a la importancia que tiene conocer si la inclusión de la RA en educación infantil aumenta la calidad pedagógica y enriquece el aprendizaje.

TABLA 4. Número de citas y temática principal de las publicaciones.

Nº CITAS	AUTORES	TEMÁTICA (1)	(2)	(3)	(4)
118	Yilmaz (2016)	x			
50	Han *et al*. (2015)	x			
48	Yilmaz *et al*. (2017)		x		
36	Cheng, & Tsai (2016)	x			
34	Safar *et al*. (2017)	x			
32	Villena-Taranilla *et al*. (2022)			x	
27	Huang *et al*. (2016)	x			
26	Calle-Bustos *et al*. (2017)	x			
20	Mon, & Subaramaniam (2020)	x			
16	Rodriguez-Garcia *et al*. (2019)		x		
14	Redondo *et al*. (2020)	x			
13	Chen, & Chan (2019)	x			
13	Ozdamli, & Karagozlu (2018)		x		
10	Lorusso *et al*. (2018)	x			
9	Belmonte *et al*. (2019)	x			
9	Gecu-Parmaksiz, & Delialioglu (2020)	x			
9	Gecu-Parmaksi, & Delialioglu (2019)	x			
9	Kurniasih *et al*. (2022)		x		
9	Roig-Vila *et al*. (2019)	x			
8	Tuli, & Mantri (2021)	x			
6	Lorusso *et al*. (2020)	x			
5	Marín (2017)		x		
5	Goksu, & Bolat (2021)		x		
5	Madanipour, & Cohrssen (2020)			x	
5	Villalustre, & Del Moral (2020)			x	
4	Pan *et al*. (2021)	x			
1	Aydogdu (2022)	x			
0	Di, & Zheng (2022)		x		
0	Fuentes *et al*. (2021)	x			
0	Haas *et al*. (2022)	x			
0	Lee *et al*. (2019)	x			
0	Martinez, & Perez (2018)		x		
0	Neira-Pineiro, & del-Moral-Perez (2021)		x		
0	Sofianidis (2022)			x	
5	Cadavieco *et al*. (2020)				x
	TOTAL:	**21**	**9**	**4**	**1**

Leyenda: Temática (1): Experiencia educativa con alumnos de Educación Infantil utilizando recursos/juguetes/materiales con realidad aumentada. (2): Experiencia educativa utilizando recursos de realidad aumentada con futuros docentes de educación infantil. (3):Metaanálisis y/o revisiones sobre el tema. (4): Análisis de aplicaciones.

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Coincidimos con Rivas *et al*. (2021) en que España se encuentra entre las zonas de origen de más publicaciones centradas en el estudio de la RA y educación infantil, junto con China y Turquía.

Tanto nuestro estudio como los desarrollados por otros autores (Lorenzo, & Scagliarini, 2018; Rivas *et al*., 2021; Rodríguez, 2021), reflejan la diversidad de países precursores de publicaciones sobre la temática. Entre ellos se encuentra España, que en nuestro caso, se sitúa muy por delante de otros países y zonas geográficas, lo que refleja el interés mostrado en nuestro país sobre realidad aumentada en el terreno educativo.

Respecto al idioma dominante de las publicaciones, encontramos que la mayoría de los artículos se publican en inglés, seguido del español. Dicho aspecto fue también destacado en el análisis realizado por Lorenzo y Scagliarini (2018).

5. CONCLUSIONES

El estudio permite concluir que la realidad aumentada es una tecnología valiosa para la educación infantil. Con esta investigación se ha comprobado el alto nivel de interés que está provocando esta tecnología en el terreno educativo. Especialmente en España queda reflejado este aspecto, puesto que es el país que mayor número de publicaciones cuenta sobre realidad aumentada y educación infantil. Además, el español es el segundo idioma después del inglés que más se emplea en las publicaciones sobre la temática.

El período 2019-2020 es la época en la que se produce un mayor número de artículos sobre realidad aumentada y educación infantil. Respecto a las temáticas tratadas en las publicaciones, señalar que existe un número elevado que refleja el impacto que tiene incluirla en educación infantil y experiencias desarrolladas en la formación docente sobre su aplicación y aceptación. Por lo tanto, a pesar del interés que está provocando, encontramos que existen temas que se pueden abordar en los estudios para que la aplicación de la misma sea efectiva en el proceso de enseñanza-aprendizaje. Por ese motivo, destacamos la necesidad de desarrollar estudios que reflejen: pautas de diseño para su correcta integración en la enseñanza, herramientas útiles para crear recursos didácticos de realidad aumentada, y pasos que hay que seguir para que las experiencias formativas sean útiles y significativas.

No podemos negar la relevancia que alcanza la competencia digital de los docentes para integrar adecuadamente la RA. No solo hacemos alusión a elementos tecnológicos, sino que es imprescindible que el docente tenga capacidad para: analizar las competencias de sus estudiantes y adaptar el diseño de la formación a sus necesidades; seleccionar las herramientas más adecuadas para el fin formativo y destinatarios de la formación; utilizar la tecnología para mejorar la evaluación y aprendizaje; capacitar a los discentes en su uso eficiente y responsable. Por ello, la competencia de los educadores debe ir más allá del uso de tecnologías en la enseñanza.

Estimamos que es importante presentar mayor número de publicaciones en acceso abierto, con el fin de que el lector pueda ampliar sus conocimientos sobre la temática sin barreras. En definitiva, destacamos el alto impacto que está teniendo está tecnología en educación infantil, sin embargo, resaltar el estado embrionario en el que se encuentran las publicaciones y la necesidad de producir publicaciones en acceso abierto que favorezcan su correcta aplicación.

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5.1. Prospectiva

Como futuras líneas de investigación se plantea extender el análisis a otras bases de datos. También se propone la realización de investigaciones que permitan concretar pasos para diseñar una experiencia formativa empleando recursos de realidad aumentada. Igualmente, producir estudios que reflejen principios didácticos a tener en cuenta en el diseño de recursos de realidad aumentada para la educación infantil.

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University Students' Perceived Information overload Mediates Smartphone Immediate Response Syndrome During COVID-19 Outbreak: Taking the Perspective of Personality

La sobrecarga de información percibida por los estudiantes universitarios y su influencia en el síndrome de respuesta inmediata al smartphone durante la pandemia de la COVID-19: Tomando la perspectiva de la personalidad

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ABSTRACT

The COVID-19 pandemic has affected university students' learning and social interaction to a large level, causing different degrees of negative emotions and made them extremely sensitive to smartphone information. However, little is known about the link between personalities, perceived information overload (PIO) and smartphone immediate response syndrome (SIRS) during students' learning process in this specific emergency social context. Therefore, based on the person-environment fit model, this study investigated 482 university students from mainland China during the epidemic by a snowball sampling approach, and analyzed the relationship between their personalities, PIO and SIRS by structural equation modeling. Results indicated that individuals with extraversion and neuroticism formed SIRS from different psychological paths. PIO plays a partial mediating role between neuroticism and SIRS and a fully mediating role between extraversion and SIRS. These findings validate the association among individual personality, PIO and SIRS in the non-conventional environment and highlights the difference exist in cellphone-related psychological path between extraverted and neurotic students. Therefore, it is recommended that PIO should be controlled in a targeted manner for individuals with different personality and guide them using cellphones rationally during the epidemic.

KEYWORDS Personality; perceived information overload; smartphone immediate response syndrome; neuroticism; extraversion.

RESUMEN

La pandemia causada por la COVID-19 ha afectado en gran medida al aprendizaje y a la interacción social de los estudiantes universitarios, provocando emociones negativas de diferentes grados y haciéndoles extremadamente sensibles a la información de los smartphones. Sin embargo, se sabe poco sobre la relación entre la personalidad, la sobrecarga de información percibida (SIP) y el síndrome de respuesta inmediata al smartphone (SIRS) durante el proceso de aprendizaje de los estudiantes en este contexto social de emergencia específico. Por lo tanto, basándose en el modelo de ajuste persona-ambiente, este estudio investigó a 482 estudiantes universitarios de China continental durante la epidemia mediante un enfoque de muestreo de bola de nieve, y analizó la relación entre su personalidad, SIP y SIRS mediante un modelo de ecuaciones estructurales. Los resultados indicaron que los individuos con extraversión y neuroticismo formaron el SIRS a partir de diferentes vías psicológicas. La SIP desempeña un papel mediador parcial entre el neuroticismo y el SIRS y un papel totalmente mediador entre la extraversión y el SIRS. Estos resultados validan la asociación entre la personalidad individual, la SIP y el SIRS en el entorno no convencional y pone de manifiesto la diferencia que existe en la trayectoria psicológica relacionada con el teléfono móvil entre los estudiantes extrovertidos y los neuróticos. Por lo tanto, se recomienda controlar la SIP de forma específica para los individuos con personalidad diferente y guiarlos en el uso racional de los teléfonos móviles durante la epidemia.

PALABRAS CLAVE Personalidad; sobrecarga de información percibida; síndrome de respuesta inmediata al smartphone; neuroticismo; extraversión.

1. INTRODUCTION

The COVID-19 outbreak has disrupted individual's regular lives and also made a huge difference in teaching since late December 2019 (Cantero Téllez *et al.*, 2022; Vásquez *et al.*, 2023). Facing the grim situation of epidemic prevention and control, countries around the world have taken corresponding actions. Public health emergency response and strict traffic control have been implemented in all regions. Students are strictly isolated at home, so home-based online learning took place of the face-to-face schooling during the outbreak (Zhan *et al.*, 2021a). The spread of COVID-19 had brought about changes in learning styles and severely damaged the education and social life of college students and negatively affected students' mental health,

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social isolation, and academic performance (Cao *et al.*, 2020; Elmer *et al.*, 2020; Zhan *et al.*, 2021b). They have to use the Internet to carry out their studies and use cell phones to meet the actual needs (e.g. study from home and work online) (Galván Orozco *et al.*, 2022; Zhan *et al.*, 2021c). Most students responded to the isolation and stress by adopting social media, which to some extent alleviated students' social isolation (Prowse *et al.*, 2021). While people used social media to access information and stay connected with others, the misregulation of these technologies had created an information epidemic that had caused further physical and psychological damage. During the epidemic, there was an overload of information about the epidemic both online and offline, and a flood of rumors and fake news about the epidemic flooded social media, exacerbating public fears about the pandemic (Luu Duc Huynh, 2020). Influenced by the epidemic, people's attention to smartphone messages and instant messages has increased unprecedentedly.

The person-environment fit model (P-E model), proposed by French *et al.* (1982), argued that based on the state of equilibrium between an individual's resource needs (e.g., useful information) and environmental supply, when the balance was broken, negative emotions were likely to arise, leading to stress reaction to counter the adverse social environment (Ragu-Nathan *et al.*, 2008). During the COVID-19 pandemic, numerous epidemic-related false news and rumors flooded social media (Shirish *et al.*, 2021). The massive amount of information exceeded individuals' information processing capacity (Islam *et al.*, 2020). Individuals' demand for information did not match the environmental supply. It was likely to break the equilibrium between individuals and the environment, resulting in the perception of information overload (PIO) and thus stress behaviors such as the smartphone immediate response symptoms (SIRS). What's more, studies showed that personalities are moderately correlated with individual subjective needs and cognitive load, and individuals with different personalities are also affected by cognitive load in different degrees (Gjoreski *et al.*, 2020). Therefore, it is worth studying that individuals with different personalities will have varying degrees of PIO and SIRS in COVID-19 period.

The researchers have defined personalities as the characteristic patterns that influence behavior, thought, and emotion that interact with the environment. Many studies have taken personalities as the main factors affecting smartphone usage (Horwood, & Anglim, 2018; Panda, & Jain, 2018). During the COVID-19 epidemic, students need to use smartphones to study, socialize, and received external information, which undoubtedly increase the time and frequency of using smartphone. This study tried to explore the potential linkage between information overload and smartphone overuse during the epidemic, with an attempt to address the SIRS generated by different psychological mechanisms in students with different personality traits, to mitigate the negative impact caused by the unconscious overuse of smartphones by university students during the COVID-19 epidemic.

2. LITERATURE REVIEW

2.1. Personality

The five-factor model proposed by Costa and McCrae (1992), including openness, conscientiousness, extraversion, affinity, and neuroticism, is one of the most popular descriptive classification methods for personality characteristics, and is widely used to explain various human behavior and prediction of smartphone-related

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activities (Roos, & Kazemi, 2018; Stachl *et al.*, 2017). Among them, extraversion and neuroticism have been proved to be more predictive and regular in explaining individual differences (Eysenck, 1985; Tosun, & Lajunen, 2010).

Neuroticism refers to individuals' tendency to experience pain and the resulting differences in cognitive and behavioral styles (McCrae, & John, 1992). Individuals with higher levels of neuroticism are more likely to experience negative emotions, such as anxiety, depression, vulnerability and anger. They react poorly to stress and often view common situations as threats. Therefore, neurotic individuals are more likely to indulge in their smartphones to relieve their stress and anxiety, leading to smartphones' overuse (Roberts *et al.*, 2015). Extraversion refers to a person's mental energy, interest, and attention directed to the outside, others, or external stimuli. Individuals with this personality are mainly characterized by external things rather than their thoughts and feelings (Gray, 1981). Extroverted individuals usually present as talkative, active and sociable (Komarraju *et al.*, 2009). They use smartphones to receive more information and use social networks to build and improve their relationships (Kuss, & Griffiths, 2011). Some researchers have only looked at two personalities (i.e., extraversion and neuroticism) in studies involving personality, for example, Zhan *et al.* (2021c) study on cellphone addiction and Tan *et al.* (2018) study on smartphone application personality. Therefore, neuroticism and extraversion were selected in this study to investigate their relationship with SIRS and PIO in the context of COVID-19.

2.2. Perceived Information Overload

In the Omnimedia era, the subject, object, communication channel and amount of information are more integrated and complex. The accompanying information overload (IO) of users is becoming increasingly severe (Zhu, 2020). Scholars had attributed the IO effect of mobile social networks to the excessive information flow and the continuous interaction with other users online, and the sense that their responses are perpetually observed and demanded (Vorderer *et al.*, 2017). IO is known as a subjective impression of receiving information too quickly to be processed efficiently. This status is conceptualized as a perception instead of an objective state (Misra, & Stokols, 2011). Studies have shown that users who experience IO are more likely to feel stressed, powerless, confused about developing things, and even experience confusion and self-doubt (Bawden, & Robinson, 2008). Therefore, in this study, we define this factor as PIO.

There are various factors lead to PIO. For example, civil servants who using online information systems may suffer from PIO due to social networking. The amount of information that individuals face when using mobile social networks can lead to overload (Schmitt *et al.*, 2017). During the COVID-19 pandemic, the situation became complex and unpredictability, resulting in an increase in misinformation, and lots of unclear and inaccurate information will cause PIO (Islam *et al.*, 2020), which may trigger adverse effects such as fear of missing out and anxiety (Xiao, & Mou, 2019). Therefore, it is necessary to explore the change of the PIO in the face of unknown COVID-19 development.

2.3. Smartphone Immediate Response Symptoms

According to statistics, by the end of 2019, it is estimated that more than 5 billion have mobile devices, of which more than half are smartphones, which have become an indispensable tool for people to

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communicate (Hou, & Cheng, 2021). Immediate sensory responses may be necessary depending on the application and individual circumstances (Oulasvirta *et al.*, 2011). Kanoh (2017) defined Immediate Response Syndrome referring to the feeling of having to check SNS sites and being is a state of psychological imbalance. Kanoh and Chou (2018) defined Immediate Response Syndrome (IRS) as a psychological tendency of Internet users obsessed with checking their social devices immediately. People's responsiveness to information is closely related to their fear of missing out, worrying about being absent from others' beneficial experiences, and a desire to be constantly connected to their experiences (Przybylski *et al.*, 2013). This study defines SIRS as the behavioral tendency of Internet users obsessed with checking their social devices frequently and responding immediately, which can be regarded as a predictor of cellphone addiction.

From the above discussion, it can be inferred that personal environment and psychological tendency are related to people's SIRS. However, most of the existing studies only focus on smartphone message response and the satisfaction of cellphones for individuals' work needs (e.g., Hwang *et al.*, 2020), ignoring the adverse consequences of students' frequent use and examination of cellphones during the learning process, such as decreased concentration, negative emotions, and low-performance levels, etc., as well as the changes and causes of SIRS during COVID-19-like anomalies. Therefore, during the COVID-19 outbreak, it is useful to explore the trends and influencing factors of SIRS. Appropriate intervention measures can be provided to help students get rid of unnecessary harm caused by SIRS.

3. RESEARCH FRAMEWORK AND HYPOTHESES

3.1. Personality Traits and Perceived Information Overload

From the perspective of cognitive science, IO results from the limited capacity of individual mediated information processing (Lang, 2000). From the perspective of news information, within a full media era, the media fusion would produce more complex information and disseminate a large volume of information and a more diversified main body and object, thus causing the IO in COVID-19. Chen (2003) argued that the extent of information overload is perceived by individuals and depends on personal factors such as personalities, emotions, feelings. Those with strong reservations or emotional characteristics may experience overload, mainly because they lack the skills to process content (Prasitratanaporn, 2010). Studies showed that personalities are significantly correlated with physical demands and objective cognitive load and that personalities tend to be extreme during the epidemic (Gjoreski *et al.*, 2020; Zhan *et al.*, 2021c). According to the P-E model, when personalities change, the physical demands and cognitive load change as well, and individuals may fail to process massive misinformation, breaking the balance with the environment that causes PIO to become more severe. Thus, we can infer a relationship between extraverts and neurotic personality and PIO. Therefore, the following hypotheses were proposed:

- H1: Neuroticism is positively related to PIO.
- H2: Extraversion is positively related to PIO.

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3.2. Perceived Information Overload and Smartphone Immediate Response Syndrome

One of the typical symptoms of cellphone addiction is habitually checking for missing calls or messages (Chen *et al.*, 2017; Lee *et al.*, 2014). This phenomenon is more evident in instant message interactions, such as "Textiety" anxiety over receiving a message and immediately replying to it (De-Sola Gutiérrez *et al.*, 2016). Smartphone users are highly vulnerable to sensory IO when dealing with the latest news's massive social demands (Lang, 2000), information is beyond an individual's ability to process, making it easy for them to miss the information they need, which produced the emotional fear of missing out. This worry drives users to pay closer attention to messages and keep in touch with others (Przybylski *et al.*, 2013). Therefore, responding to smartphone messages may become a habit (Wegmann *et al.*, 2017). After the outbreak of COVID-19, students' offline communication and study transferred to online. In terms of social interaction, instant messaging and different information platforms have become extremely active, and social isolation requires students to respond to messages as quickly as they can, showing the value of their social connections, even when they are studying; in terms of study, the amount of information interspersed with students' study-related messages also place certain demands on students' attention and responsiveness to information. Considering this, we proposed the hypothesis as follow:

- H3: PIO is positively related to SIRS.

3.3. Personality Traits and Smartphone Immediate Response Syndrome

Because impulsivity and trait anxiety lower the threshold of signal detection, it reduces the reaction times of high neurotic individuals so that individuals overreact to threat-related information (Crow, 2019; Mathews, 1990). Fu *et al.* (2020) suggested that the tendency to respond to information is not an external manifestation of stress in daily communication but tends to avoid external pressure and cooperate with others. Moreover, personalities were confirmed to be associated with e-mail, social networks and other Internet services (Kim *et al.*, 2020; Russell, & Woods, 2020). Researchers believed that the trend of instant and immediate response to social network information would negatively affect individuals; for example, the person cannot control the desire to reply SNS messages immediately (Aoki *et al.*, 2017). Therefore, the rapid response triggered by the trait is likely to trigger the SIRS phenomenon in students during cellphone use.

In addition, studies on text dependency suggest that extraversion may foster hyperactivity in maintaining social relationships through frequent use of text messages, while neuroticism may be sensitive to peers' reactions to their messages for fear of rejection (Igarashi *et al.*, 2008). However, some researchers found no significant association between extraversion and reaction time (Crow, 2019). Although there are few academic papers on personalities and smartphone information responsiveness, considering the integration of smartphones and the P-E model, we can infer that personalities are related to SIRS (van Deursen *et al.*, 2015). Therefore, we proposed the following hypotheses:

- H4: Neuroticism is positively related to SIRS.
- H5: Extraversion is positively related to SIRS.
- H6: Neuroticism is positively related to SIRS mediated by PIO.
- H7: Extraversion is positively related to SIRS mediated by PIO.

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3.4. Research model

According to the P-E model, the COVID-19 outbreak leads to changes in the environment, the balance between individual needs and environmental supply is broken. Due to the need for personal safety and social interaction, students are forced to also receive a great deal of information during their studies, but this information often exceeds the threshold of what students can process, PIO occurs as a result, and SIRS may follow. Considering different degrees of epidemic effects on individuals with different personalities, this study included them into the research scope and proposed a research model, as shown in Figure 1.

FIGURE 1. This is a research model.
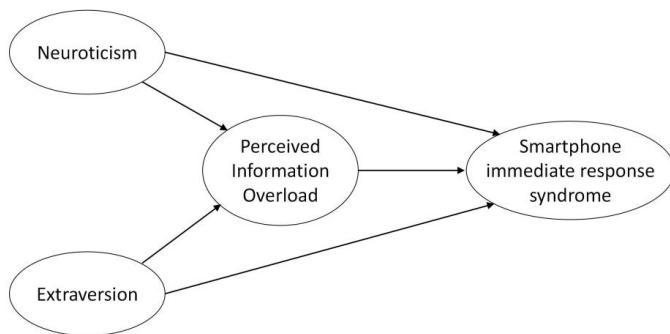
4. METHODOLOGY

4.1. Participants and Procedure

During the COVID-19, this study set up a questionnaire on a professional online questionnaire survey platform and distributed it, adopting the snowball distribution approach. The electronic questionnaire was sent out from WeChat groups to university and graduate students who experienced 14 days or more home isolation. Then they were invited to fill out the questionnaire and further distribute it to their classmates.

A total of 482 students returned their questionnaires to us. After eliminating 57 invalid questionnaires which chose too many single options (e.g., "uncertain"), had obvious contradictory answers, the number of valid questionnaires was finally 425, and the recovery rate of valid questionnaires was thus 88.2%. Among all participants (104 males, 321 females). In terms of the time individuals using smartphone each day, 254 participants (59.8%) used their phone for less than 3 hours, 171 (40.2%) for 4-6 hours.

4.2. Questionnaire

The questionnaire in this study was set up around four dimensions (i.e., Neurotic personality, Extraversion, PIO and SIRS), and the questionnaire items for each variable were designed according to previous researches. Participants were required to choose the most appropriate answer from five different levels, from 1 (strongly disagree) to 5 (strongly agree).

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4.2.1. Neuroticism and Extraversion

For neuroticism and extraversion, the scale was adapted from the self-assessment version of the NEO Five-Factor Personality Trait Questionnaire by Costa and McCrae (1992). In this study, five items were measured extraversion, and four items were measured neuroticism (e.g., "I always ponder for a long time before making decisions" "I take the lead when communicating with people"). We believe that the higher the subject's score in the dimension, the more he conforms to the characteristics described in that dimension.

4.2.2. Perceived Information Overload

In the process of compiling a questionnaire on the PIO dimension, we referred to the questionnaire content of PIO by Hwang *et al.* (2020) Three items were used to explore the degree of participants' perceptual information process in this study (e.g., "I often get too many unwanted messages on my phone." "The volume of messages on my phone causes me to misunderstand some messages.").

4.2.3. Smartphone Immediate Response Symptoms

Kanoh (2016) developed an IRS checklist. This study investigates Smartphone Immediate Response Symptoms, we abbreviate this as SIRS. As a result, we adapted the scale according to the characteristics of using smartphones to explore the participants' SIRS. This study used five items to examine the degree of participants' SIRS (e.g., "If I read a message and don't respond right away, I feel anxious because I missed it." "If I forget to respond to an important message, I get restless.").

4.3 Data analysis

All responses were separated randomly into two sections using SPSS 26, and were subjected to exploratory factor analysis (EFA) with SPSS (N = 212) and confirmatory factor analysis (CFA) with Mplus (N = 213) to determine the questionnaire's structure, reliability, and validity. Finally, based on the hypotheses, this study used Mplus to construct the model, check the model fit, analyze the path, and check the existence of mediating effect.

5. RESULTS

5.1. Exploratory Factor Analyses of Questionnaire

This study used EFA to examine relationships between items and factors and to identify the structure of the questionnaire. The extraction method was Principal Component Analysis, and the rotation method Varimax with Kaiser Normalization, and the eigenvalues with loads less than 0.3 were excluded, after that we obtained the eigenvalues and variance explained for each factor, and the Cronbach's α value for each factor was also validated. As shown in Table 1, the questionnaire's Cronbach's α value was 0.805, verifying the adequacy of the sampling. And for all four variables, the cumulative variance explained was 66.294% means that this structure of 17 items explains 66.294% of the differences in relationship patterns among items. For each factor, the percentages of factors explained by Neuroticism (M = 3.339, SD = 0.746), Extraversion (M = 3.323, SD = 0.664), PIO (M = 3.138, SD = 0.694) and SIRS (M = 3.010, SD = 0.733) were 18.951, 15.136, 12.674 and 19.533%.

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TABLE 1. EFA of the Questionnaire.

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
FACTOR 1: Neuroticism, α = 0.859, M = 3.339, SD = 0.746				
I can't stay calm in a stressful situation	0.692			
I am easily depressed and melancholic	0.771			
I always think long and hard when faced with a decision	0.793			
Sometimes I strain my nerves and suffer from stress	0.774			
I am often distracted by trivial things	0.776			
FACTOR 2: Extraversion, α = 0.804, M = 3.323, SD = 0.664				
I will take the initiative to communicate with people		0.825		
I like to try things I haven't touched before		0.717		
I always keep an optimistic expectation before things happen		0.773		
In public, I often speak first		0.817		
FACTOR 3: Perceived Information Overload, α = 0.796, M = 3.138, SD = 0.694				
The large number of messages on my phone made me send messages with errors			0.796	
The large number of messages on my phone makes me misunderstand some messages			0.840	
A large number of messages or documents exchanged on my phone can cause me to accidentally delete them by mistake			0.817	
FACTOR 4: Smartphone Immediate Response Symptoms, α = 0.868, M = 3.010, SD = 0.733				
If I don't have my phone within easy reach, I get anxious				0.716
If I don't get a response to a message I sent after 15 minutes, I get anxious				0.743
Whenever I see (hear) a message from my cell phone, I will respond immediately, otherwise I will feel uneasy				0.848
When I am ready to go to bed and receive a message from my cell phone (such as a WeChat message), I will respond immediately or I will feel uneasy				0.802
When I put my cell phone in a place where I don't always put it, I feel uneasy				0.811

5.2. Confirmatory Factor Analyses of Questionnaire

CFA and Cronbach's α were used to assess the model's construct validity and reliability. Cronbach's α was used for reliability tests and CFA was used for composite reliability (CR) tests to test internal consistency. Table 2 showed the values of estimated factor loading (FL), average variance extraction (AVE), CR and Cronbach's α. According to Table 2, all Cronbach α values ranged from 0.859 to 0.911, exceeding the threshold value of 0.7 (Taber, 2017). All of CR exceeded 0.7, indicating a high external consistency for each dimension of the model (Peterson, & Kim, 2013).

Cooper and Emory (1995) argued that structural validity consists of convergence validity and discriminant validity. To assess convergent validity, the following criteria were validated: (1) all FL should exceed

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0.6; and (2) the value of AVE associated with each explicit variable should exceed 0.5. The value of FL and AVE in Table 2 both meet the criteria, indicating acceptable convergence (Hair *et al.*, 2014). What's more, the results show that both absolute value of skewness and kurtosis are less than 1, means the data in this study can be normally distributed, which is in line with the premise of structural equation model analysis (Yu, & Richardson, 2015).

TABLE 2. Descriptive statistics and CFA of the Questionnaire.

	M	SD	Skewness	Kurtosis	α	FL	CR	AVE
Suggested value					>0.7	>0.5	>0.7	>0.5
Neuroticism	3.128	0.750	-0.702	0.806	0.874	0.652~0.828	0.879	0.597
Extraversion	3.238	0.692	0.172	0.769	0.859	0.755~0.796	0.860	0.606
PIO	3.130	0.775	0.114	0.427	0.860	0.806~0.830	0.860	0.673
SIRS	2.900	0.815	-0.037	0.398	0.911	0.775~0.846	0.911	0.673

5.3. The goodness-of-fit analysis

Based on Hair *et al.* (2014), this study integrated multiple indicators to check the model's fitness. Among them, the value of x^2/df is required to be lower than 3.0, the value of RMSEA and SRMR should be lower than 0.08, and the value of GFI, CFI and TLI are required to exceed 0.9 (Hu, & Bentler, 1999). It can be seen from Table 3 that the relevant data all meet the above five indicators. Therefore, it can be considered that the model has a high level of fit, that is, means that the model explains better the situation shown by the actual collected data.

TABLE 3. Modification indexes.

Modification index	χ2	df	χ2 / df	GFI	RMSEA	CFI	TLI	SRMR
Threshold value	-	-	<3.0	>0.9	<0.08	>0.9	>0.9	<0.08
Model indicator	172.41	113	1.526	0.919	0.050	0.970	0.964	0.043

5.4. Path analysis

Table 4 shows that neuroticism and extraversion were significantly and positively related to PIO, both of them β >0, p < 0.001, so H1 and H2 hypotheses are supported. H3 is proven to be valid with the standardized regression coefficients (β = 0.369, t = 4.822, p = 0.000) of PIO to SIRS. The result of H4 is valid, it means neuroticism is significantly positively related to SIRS with the result of β = 0.323, t = 4.519, p = 0.000. However, extraversion is not significant correlated with SIRS (β = -0.046, t = -0.611, p = 0.541 > 0.05), H5 is not supported.

In Table 4, the dependent variable's explanatory power (R2) values indicate the strength of the independent variable's explanation of the dependent variable. According to Cohen *et al.* (2000), the value of R^2 greater than 0.15 is called medium explanatory strength. The model explained both PIO and SIRS at medium to high strength. We adjusted the original structure model and verified the research model based on the above results, as shown in Figure 2.

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TABLE 4. Hypotheses test

Hypothesis	Path	t	p-value	R2	β	Hypothesis
H1	Neuroticism → PIO	5.539	0.000***	0.243	0.368	Support
H2	Extraversion→ PIO	4.804	0.000***		0.329	Support
H3	PIO → SIRS	4.822	0.000***		0.369	Support
H4	Neuroticism →SIRS	4.519	0.000***	0.319	0.323	Support
H5	Extraversion→ SIRS	-0.611	0.541		-0.046	Not Support

Note. ***P < 0.001

FIGURE 2. Verification of the research model.
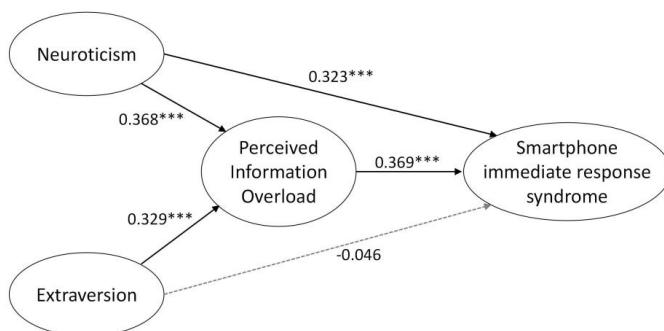
5.5. Indirect Effect Analysis

From Figure 2, we could see that the relationships between variables include a direct effect and an indirect mediating effect. The indirect effects were analyzed by the bootstrap method and the results were shown in Table 5. When the interval formed by the corresponding value of the 95% confidence interval (CI) did not contain zero, indicating that the model exists a mediating effect (Lau, & Cheung, 2010). The results showed that there was a mediating effect between neuroticism and SIRS, and the mediating effect was significant (β = 0.130, p < 0.05; 95% CI, [0.040, 0.239]). In the same way, we found that PIO can mediate the relationship between extraversion and SIRS. The results showed that both H6 and H7 are supported.

TABLA 5. Indirect effects by the bootstrap method.

Point Estimate		Product of Coefficients		Bootstrap 1000 Times 95% CI				
							Percentile	Bias Corrected
		S.E.	Est./S.E.	p-Value	Lower	Upper	Lower	Upper
Neuroticism -PIO-SIRS	0.130	0.052	2.487	0.013*	0.040		0.052	0.266
Extraversion -PIO-SIRS	0.169	0.066	2.567	0.01**	0.057		0.069	0.338

Note. *P < 0.05,**P < 0.01,***P < 0.001

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6. DISCUSSION

Considering the unbalanced social situation during the COVID-19 outbreak, this study examined the relationship between neuroticism, extraversion, PIO and SIRS in students' learning process, and obtained the following findings: (1) neuroticism and extraversion can positively predict PIO; (2) PIO is positively related to SIRS; and (3) PIO plays a partial mediating role between neuroticism and SIRS, and a fully mediating role between extraversion and SIRS.

H1 and H2 are well proven, both neuroticism and extraversion could predict PIO significantly and positively. PIO was positively related to individual factors, information characteristics and other factors (Eppler, & Mengis, 2004). Individuals had higher stress levels during the COVID-19, which might contribute to individuals getting higher scores on neuroticism and extraversion (Liu *et al.*, 2021). After the COVID-19 outbreak, individual's use of new media was significantly associated with more negative emotions, depression, anxiety and stress (Chao *et al.*, 2020). This may because of numerous information directly displayed on smartphones, such as text, voice, video, etc. However, individuals with strong emotional traits who lack the ability to process the content are more likely to experience information overload. The test results of H1 support the judgment of individuals with neurotic personality who like to be alone but hate stress and perceive information overload. The test results of H2 confirmed that individuals with an extraverted personality are also prone to the inference of PIO when traditional social activities are blocked.

H3 is supported in this study, indicating that PIO is positively related to SIRS. During the COVID-19 outbreak, health information related to the epidemic was disseminated through various channels and flooded students' lives (Hong, & Kim, 2020), however, such numerous health information poses challenges for users to effectively locate and process the valuable information they need (Zhang *et al.*, 2016). People had to pay more attention to such news because they were afraid of missing important health-related information to reduce the uncertainty and negative emotions brought by the unknown COVID-19 virus, leading to the generation of SIRS (Kanoh, & Chou, 2018). What's more, in the context of COVID-19, the existence of social media alleviated the loneliness and social distance of home learning caused by the epidemic. Social and learning needs rob students of cognitive resources, and PIO is more likely to occur (Li, & Chan, 2021). However, to prove the importance of friendship, responding to messages quickly and increasing the frequency of smartphone use became one of the response measures of students, which gave rise to SIRS (Kanoh, & Chou, 2018). When faced with smartphone information, individuals usually complete the target information's perception with only the necessary cognitive energy. Faced with massive amounts of information, people are more likely to respond immediately and abundantly than respond in a targeted and quality manner (Kleinmuntz, & Schkade, 1993). As a result, SIRS is inevitably produced when individuals focus on more content and are afraid of missing out on the information they need. In this sense, in the context of COVID-19, PIO significantly affects users' SIRS during students' learning process, which is supported by the results of H3.

H4 receives affirmative support, while H5 does not, indicating that the relationship between neuroticism and SIRS is significantly positive, whereas the relationship between extraversion and SIRS is not significant. Previous studies showed neurotic people tend to use social networks more to compensate for the difficulty of interacting with others and thus spend more time sending text messages (Bianchi, & Phillips, 2005;

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Butt, & Phillips, 2008). Igarashi *et al.* (2008) found neurotic individuals were concerned about text messaging with their peers to avoid isolation and disconnection from their peers. The test results of H4 further support previous research results. For extraverts, they are more inclined to use smartphones for social activities (Horwood, & Anglim, 2018). They use social networks to establish and improve their interpersonal relationships but do not indulge in reacting to information instead of getting more information from their phones (Kuss, & Griffiths, 2011). Therefore, H5 is not valid, indicating no significant correlation between extraversion and SIRS in the specific social background of COVID-19.

Both H6 and H7 were confirmed to be valid in this study. The results show that PIO could serve as a partial mediator to influence the prediction of SIRS by neuroticism. Neuroticism can not only directly cause the immediate reaction of smartphones, but lead to SIRS by triggering PIO. This may be because during the COVID-19 epidemic, people were isolated at home (West *et al.*, 2020), but social needs caused neurotic people to communicate through the Internet. They believed that it was a negative phenomenon that they did not get information quickly (Lu *et al.*, 2011). To get rid of this, they will respond rapidly to smartphone messages. However, during the COVID-19, being in a state of fear or distress changes their use and perception of social media, thereby making them overloaded and fatigued (Whelan *et al.*, 2020), and the desire to receive information in a short time causes them to pay more attention to the signal of their smartphone, triggering SIRS.

In addition, we also found that PIO plays a completely mediating role between extraversion and SIRS, which shows that extroverts do not directly cause SIRS, but under the action of PIO, the indirect effect of extraversion on SIRS has been significantly supported. Doucet and Stelmack (2000) believe that extraverts need extra processing time to deal with information, leading to an insignificant relationship between extraversion and SIRS. However, an abundance of misinformation appeared in the Coivd-19 outbreak, and due to the low perception and processing capacity of extraverted individuals (De Pascalis *et al.*, 2018), an imbalance between individual demand for real epidemic-related information and environmental supply was highly likely to arise, and according to the P-E model, massive misinformation could not be processed in a timely manner, leading to information overload (Rathore, & Farooq, 2020), information needs to be confirmed by increasing the frequency and duration of cellphone use, resulting in the occurrence the SIRS stress behavior. Besides, it is admitted that, PIO may be a potential result of SIRS because the overuse of smartphones increases the proficiency and intensity of information that leads to PIO (Li, & Chan, 2021), but this study did not explore different perspectives on the relationship between SIRS and PIO, and the relationship between PIO and SIRS can be subsequently studied in depth in the model to complement the circular relationship between SIRS and PIO.

7. CONCLUSIONS, LIMITATIONS AND FURTHER STUDY

This study explored the relationships between Extraversion, Neuroticism, PIO and SIRS during university students' learning process in the COVID-19 epidemic based on the P-E model, and validated that PIO has a significant mediating effect between personalities and SIRS. However, neurotic and extroversive students generate SIRS from different psychological mechanisms. Comparatively, Neurotic students were more likely to suffer from PIO and SIRS. While students with an extraverted personality do not form SIRS directly,

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however, they gradually develop SIRS when perceiving abundant information overload. Therefore, during COVID-19, in order to get rid of the harm caused by SIRS, different treatment options for mitigating PIO should be provided according to the personality characteristics of the students.

For extraverted students, teachers should consciously cultivate students' information literacy, improve their ability to process information (Lei *et al.*, 2018), and guide students to choose more authentic and reliable official websites when searching for information, as so to reduce students' spending on reading the COVID-19 related news, and then reduces the impact of irrelevant information on students' PIO (Rathore, & Farooq, 2020). It can be clearly known that the uncontrollable use of smartphones in the learning process has a certain impact on students' learning concentration, learning atmosphere, etc. Therefore, in order to solve the sensory information overload caused by multitask and multichannel information for students, designing for personal boundaries may be a good choice for students, which can instruct them to learn to distinguish between learning and daily life messages, and treat different types of messages in different ways to reduce the experience of information overload and nomophobia. For neurotic students who were more prone to SIRS, it was necessary not only to alleviate their PIO, but also to provide positive psychological exercise to enhance the individual's ability to adapt to environmental changes and ultimately alleviate SIRS (Matz *et al.*, 2020). Soucek and Moser (2010) suggested that necessary training interventions for neurotic students can contribute to the improvement of students' knowledge and media competence, and Ellwart *et al.* (2015) provided a structured online team adaptation procedure to deduce information overload. Moreover, these two interventions have been verified to have a certain effect on reducing PIO. It is expected that these interventions will ultimately reduce students' SIRS and reduce the negative impact of improper use of smartphones in students' learning process during the COVID-19 pandemic.

Future study is recommended to conduct experiments on exploring the effect of manipulating PIO to control SIRS, and obtain empirical evidence on the different psychological mechanism between Extraversion and Neuroticism on cellphone using. In addition, participants in this study were university students who survived a 14-day quarantine during COVID-19 pandemic in China, therefore, it is believed that the findings might be applicable to similar samples from countries that are still suffering from the COVID-19 or the other serious public emergency risk. According to the P-E model, this study believes that the emergence of SIRS is caused by negative emotions of PIO generated by the disruption of environmental equilibrium, using PIO as an influential factor in the creation of SIRS. However, previous research also indicated that PIO could be a result of SIRS, because the overuse of smartphone increased the proficiency and intensity of information, leading to the production of PIO (Li, & Chan, 2021). Different views on the relationship between SIRS and PIO were not explored in this study, but it provides a potential future research direction and subsequent attempts could be made to delve deeper into the relationship between PIO and SIRS in the model, complementing the circular relationship between SIRS and PIO. Moreover, as the psychological and cognitive consequences due to this environmental change are considered stable according to the P-E model. It would also be beneficial to collect another set of data after COVID-19 outbreak and compared with the results of this study, in order to investigate the generalizability of the current model and make further discussion.

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Educational Technology 'Introduced' by the COVID-19 Pandemic

Tecnología educativa 'introducida' por la pandemia COVID-19

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ABSTRACT

As society scrambled to adjust to life amidst the COVID-19 pandemic, new and unprecedented challenges presented themselves within all walks of life. The pressure to adapt the delivery of education within restricted societies fell mainly on the shoulders of teachers. The purpose of the article is a positive know-how transfer with the educational technology use in and out of pandemic times. The article is based on two qualitative content analyses of teacher-chosen technology. One content analysis, done via corpus linguistic analysis, provided data for EXCEL computation to quantitatively calculate the frequency of educational technology usage. The second content analysis resulted in thematic clusters of educational technology based on its function. The study shows that distance learning has gone through many changes 'caused' by the COVID-19 pandemic. Technology has helped education to continue despite the loss of physicality, and educational technology, especially the web-based software solutions, enabled educators to reach, keep or even improve the quality of teaching and learning. In comparison to the past, in which mostly asynchronous distance learning tools were used, the pandemic increased the usage of collaborative, communicative, interactive synchronous tools and portable devices. It also increased the variety of educational software solutions. For the same or similar functions, more tools are now available. The article works with a vast amount of data in which teachers, teacher trainers, students, interested laypeople, and others from all over the world answered the question: "What educational technology do you use?" and can therefore offer suggestions for global teaching praxis.

KEYWORDS Asynchronous communication; synchronous communication; distance education; educational technology; pandemics.

RESUMEN

Vinculado al intento de la sociedad de ajustarse a la pandemia de la Covid-19, han surgido nuevos retos en todas las esferas de la vida. La presión de adaptar la labor educativa en una sociedad con restricciones fue, mayoritariamente, tarea del personal docente. El objetivo del presente artículo es realizar una trasferencia positiva del conocimiento de la tecnología educativa, tanto dentro como fuera de los tiempos de la pandemia. El artículo presenta dos análisis cualitativos sobre la preferencia de la tecnología por parte de los docentes. El primero se basa en la interpretación de los datos recogidos, sometidos a cálculo cuantitativo con el software EXCEL, para conseguir las frecuencias de uso de una u otra tecnología. El segundo análisis interpreta la tecnología por grupos temáticos, basados en su función. El estudio muestra que la educación/enseñanza a distancia ha pasado por muchos cambios causados por la pandemia. La tecnología ayudó a la educación/enseñanza a continuar a pesar de la pérdida de lo físico, y la tecnología educativa, especialmente las soluciones basadas en páginas web, han facilitado a los docentes el camino a seguir para mantener y mejorar la calidad del mismo proceso educativo. Comparando con el pasado durante el cual los instrumentos de educación a distancia se habían

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utilizado asincrónicamente, la pandemia ha posibilitado el uso de posibilidades interactivas y portátiles más colaborativa y comunicativas. También ha incrementado la variedad de los propios instrumentos. Ahora existe más de una solución para cubrir la misma o parecida función. El artículo trabaja una extensa cantidad de datos para responder la pregunta "¿qué tecnología educacional empleas?". Las respuestas las facilitaron profesores, maestros, entrenadores, estudiantes y otras personas interesadas, todo ello para poder ofrecer luego sugerencias para la práctica de una enseñanza más global.

PALABRAS CLAVE Comunicación sincrónica; comunicación asincrónica; educación a distancia; tecnología educacional; pandemia.

1. INTRODUCTION

Technology has gradually found its way into our classrooms. In some cases, it has taken years for the technology to become educational technology. With the onset of the COVID-19 pandemic, the urgency of shifting into a virtual space catalysed in educators attempting to master such technology overnight. During the pandemic, with schools being severely restricted in their face-to-face delivery, the development of educational technologies has accelerated. New apps/websites/software solutions appeared, old ones improved, the worldwide teaching community shared online tools and platforms to transfer the positive know-how, i.e. how to work in the forced online environment in the most effective and beneficial way. Technological developments made the use of online communication tools, learning/teaching applications, and collaborative tools possible. But the shift was rushed.

Amidst COVID-19's "new normal", with the onset of the pandemic, many researchers tried to target the topic of educational technology and its role in education" from various (new) points of view. Researchers investigated synchronous versus asynchronous modes of delivery (Dincher, & Wagner, 2021; Koutska, & Biniek, 2021); (new) necessary skills and competences one has to master for online learning/teaching (Al Lily *et al.*, 2020; Guillén-Gámez *et al.*, 2021; Onyema *et al.*, 2020); teachers' perspectives of the impact of the pandemic on education (Lapada *et al.*, 2022); and unparalleled solidarity within the teaching community regarding the sharing of ideas, tools, plans, and know-how (Shaffhauser, 2020).

The presented research paper aims at continuing this solidarity of the sharing by presenting a by-global-users-justified list of to be used educational technology. The purpose of the present study is to understand the educational tools most frequently used in a global context before and during the COVID-19 pandemic restrictions (2019-2021).

Specifically, two research questions were addressed. The first involves soliciting the specific educational technologies used during the pandemic times and their frequency of use. The second involved understanding the function served by the technologies.

1.1. Literary Review

One of the most discussed aspects of educational technology usage in the COVID-19 pandemic times has been the delivery mode. Without the possibility to carry on with on-campus teaching, modalities shifted to those that allowed social distancing, a virus-safe environment, flexibility of use, and (with good quality

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internet connection) reliability (Corpus, 2020; Turnbull *et al*., 2020). The change in educational technology function, i.e. whether with the pandemic-caused shift to online modalities educational technology already available was used differently from the pre-pandemic times or not, was questioned (Abisado, 2020). Comparisons between face-to-face teaching (Abel, 2020; Orr *et al*., 2019; Stone *et al*., 2019), online learning, "emergency online learning" (Ewing, & Cooper, 2021), "emergency remote teaching" (Bozkurt, & Sharma, 2020) and "emergency eLearning" (Murphy, 2020) were made. Teacher preparedness to switch into this enforced virtual teaching modality without any other option (Howard *et al*., 2020) was discussed. "An inability of teacher education programs to build technical knowledge and skills (Fishman, & Davis, 2006), a lack of funding and resources (Nikolopoulou, & Gialamas, 2015), an absence of direction related to e-course design and delivery (Vongkulluksn *et al*., 2018), limited motivational incentives (Scherer *et al*., 2019)" (all in Christopoulus, & Sprangers, 2021) or "new technologies improving and evolving previous applications (Rachad, & Idri, 2020; Wang *et al*., 2020), availability of software applications and operating systems (Almaiah *et al*., 2020), reaction of information technology market and industry plus cybersecurity (Dwivedi *et al*., 2020)" (all in Qiao *et al.*, 2021) were other topics frequently addressed.

The study presented in this paper complements research on trends in educational technology usage due to the pandemic. It questions the statement that "the pandemic increased frequency (but not the nature) of use" (Kimmons *et al*., 2021). From personal educational practice of the researcher, changers were seen in the educational technology on offer, and the frequency and nature of use/function.

1.2. Context

Distance learning originated as a form of instruction for those who could not get access to an/any educational institution. It was used for students from remote areas or for adults (working, on maternity leave, with health issues, etc.) or generally for anyone who could not attend physically for whatever reason. With globalisation, an even broader audience was targeted but the potential had not been fully used until the COVID-19 pandemic. The restrictions in social contacts meant that members of teaching and learning communities, who did not yet know about the distance learning options or did not know how to use them or were previously reluctant to use them, were forced to shift their courses from face-to-face delivery modes regardless of their wishes, opinions, or competences (Vásquez *et al*., 2023).

Historically, distance learning was used mostly asynchronously. Moore (2000, p. 1) reports that "the most popular delivery technologies used were asynchronous Internet instruction (58%), two-way interactive video (54%) and one-way pre-recorded video (47%)". With the in-person: students will meet face to face in the classroom on a set schedule (Yale University, 2021) not allowed, the education went for either remote asynchronous instructional mode: students will not meet face to face but will interact online, or remote synchronous instructional mode: students will meet face to face online on a set schedule. (Yale University, 2021).

The choice of synchronous or asynchronous distance learning has been influenced by a range of factors, for example when a specific age group is targeted, see Dincher and Wagner (2021, p. 465), who observed that elementary teachers used mainly "paper-based assignments, phone calls and e-mails", whereas secondary school teachers used "platforms —uploading learning material via a digital platform, links— teachers sent

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links to third-party learning content to students and e-mails". For older adult courses, see Koutska and Biniek (2021), distance learning as such was used only rarely as social interaction is one of the main benefits of learning in later life.

Nevertheless, generally speaking, due to the pandemic distance learning opened itself to many new students and new teachers. In the past, courses were targeted at "the wealthy niche market who have access to broadband telecommunication systems, video-conferencing and other hi-tech gadgetry" (Moore, 2002, p. 1). The restrictions of classroom access caused massive investments into either IT skills enhancement or into technological equipment including internet (and WIFI) connection improvement because, at the start, (and sadly to say for many countries up until now), "online education was hindered by poor infrastructures including network, power, inaccessibility and unavailability issues and poor digital skills" (Onyema *et al.*, 2020, p. 108). See also in Denmark, Slovenia, Norway, Poland, Lithuania, Iceland, Austria, Switzerland and the Netherlands, over 95% of students report that they have a computer to use for working at home, but in Indonesia, it is only 34% there tend to be very large gaps across socio-economic groups. (OECD, 2021)

Despite the problems, distance learning became a 'new reality'. The consequences of 'forced' online learning/teaching have included. "Pressure (the sudden urgency for online education notwithstanding unreadiness); limited cognitive activities (non-pedagogical activities have been cancelled); loss of educational values; lack of training, lack of focus and dependent learners (students forced into self-learning without previous training)" (Al Lily *et al.*, 2020, p. 6), and management problems such as "imbalanced student–teacher power relations; imbalanced parent–teacher power relations or large quantities of bureaucracy-related correspondence" (Al Lily *et al.*, 2020, p. 6).

With time, education dealt with the disadvantageous situation where teachers "live in a knowledge and information society […] but do not have solid ICT training, which directly affects their teaching" (Guillén-Gámez *et al.*, 2021, p. 494) and offered workshops and trainings (at least at some places and to some extent). Besides pre-pandemic "technical skills, such as knowing how to turn the sound up or use Skype or access and use some aspect of their institutions' VLE (Virtual Learning Environment)" (Walker, & White, 2013, p. 137) and "basic ICT competence, specific technical competence for the software, dealing with constraints and possibilities of the medium, online socialisation, facilitating communicative competence, creativity and choice and own style" (Hampel, & Stickler, 2005, in Walker, & White, 2013, p. 138), (new) digital competences were enhanced in the pandemic times.

The pandemic brought other positives into distance learning as well: solidarity among teachers who helped each other and shared an abundance of (new) material. As Shaffhauser (2020, p. 1) points out, "education technology companies have stepped forward to help educators reach students in virtual ways. In many cases, the companies are making their paid services free through the rest of the school year; in other cases, they are lifting limits to services and/or adding premium features to what is free".

Sharing of materials lead logically to numerous sources where "all" possible tools are listed and, or described. In these lists, however, no established classification for computer-based education is followed, given there are numerous potential systems that differ greatly. Alessi and Trollip (1991, in Churchill, 2017, p. 86-87), classified digital educational technology tools into instructional modules or tutorials, drill and practice, simulations, and games. MERLOT (Multimedia Educational Resource for Learning and Online Teaching)

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(ibid.) classified the tools into animation, assessment tool, assignment, case study, collection, development tool, drill and practice, e-portfolio, learning object repository, online course, open journal-article, open text-book, presentation, quiz/test, reference material, simulation, social networking tool, tutorial, workshop and training material. Yale University offers yet another classification: class content and lecture delivery tools, communication tools, collaborative tools, homework/assignment activity tools, exam/assessment tools, feedback/polling tools (Yale University, 2021) or building interactive lessons, teaching tools for classroom management, content sources for teachers, audio-visual design tools, communication and collaboration tools (iSpring Solutions, 2001-2021).

If the infrastructure allowed, see above, the education also made use of portable devices more than ever before because these were at hand for the functions needed, see Quahtan (2020, p. 247):

> To find educational material (73.8%), find and download E-Learning Tools (47.6%), download Podcasts (15.5%), search for information (90.5%), send and receive E-mails (31.0%), listen to online lectures (31.0%), browse Internet (36.9%), connect with social networks (52.4.%), watch YouTube (54.8%), download Music and videos (76.2%), take and share pictures (70.2%) and make calls 64.3%.

To find out what educational technology (and with what function) was specifically 'introduced' by the COVID-19 pandemic, empirical research was carried out and is presented in this text.

2. MATERIAL AND METHOD

2.1. Purpose of the study, research questions, and hypothesis

The ultimate goal of the study was to set up a list of the most useful educational technology for pandemic times (as well as post-pandemic times) with a description of their function, so that every member of the teaching community can find inspiration in what to use and what for.

The specific research questions asked were: Q1 -What educational technology was used in the pandemic times and what was the frequency of their usage? and Q2 -What function did educational technology listed in answer to Q1 serve?

2.2. Design, methods and procedure

The article analyses data from online discussion panels and teachers' fora from 2019 to 2021. The discussion panels were used due to their unrestricted affordances for express opinions, share experiences, and discuss ideas, the same applies to the teachers' fora. Both served as a source for subsequent corpus creation with those entries that addressed the question of educational technology. Another reason for preferring these sources was to target the research on population involved or highly interested in education, changes in education due to COVID-19, especially in the usage of educational technology.

For the research 2674 respondents' answers to the question: *What educational technology do you use?* were incorporated to build a corpus. The respondents represented the population under study. The corpus built out of all entries was further divided into two corpora: non-pandemic related (2346 entries) and

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pandemic related (430 entries; selected sample of 328 entries; for more see Data collection and analysis). In all the corpora a content analysis via the Sketch Engine corpus linguistics tool was carried out to answe Q1 -What educational technology was used in the pandemic times and what was the frequency of their usage?

The data were further analysed to research functional usage of educational technology for pandemic and non-pandemic periods, i.e. to answer Q2 - What function did educational technology listed in answer to Q1 serve? Categories were created to sum up the function of educational software solution under a hierarchically higher comprehensive heading resulting in: academic tools, audio/visual making tools, communication tools, gamification tools, presentation tools, realia, plus the extra category of TEFL (Teaching English as a Foreign Language) materials.

2.3. Sample

The respondents of the study were pre-service teachers (i.e. teacher trainees=students of teacher training programs), in-service teachers, mostly English as a second language (ESOL) teachers and teacher trainers, mostly Teaching English as a second language (TESOL) teacher trainers, as well as laypeople interested in (ESOL) education from all around the world.

The majority of respondents came from the Philippines (929), followed by Mongolia (172), Brazil (158), Pakistan (156) and India (140). Altogether, 128 countries were represented.

2.4. Instrument

For the data-collection process no specific calibration was used. Internal validity of the research was, however, enhanced by the use of the corpus linguistic tool alongside the human researcher lead content analysis. The research design limitation is especially in the creation of the subset 'in the pandemic times' which is based on the pre-defined code words. The final number of analysed data (328) allows, however, to accept the research results as transferable to other contexts.

2.5. Data collection and analysis

Altogether 2674 respondents' answers were analysed. The complete data set (AB) was narrowed to a subset 'in non-pandemic times' (A) made of 2,346 answers and the subset 'during the pandemic' (B) made of 430 respondents' answers. The code words for pandemic-related categorization were pandemic/epidemic (168); covid/covid-19 (117); corona/korona/virus (68); lockdown/restriction/closure (39); quarantine (38) (the number shows raw frequency). Possibly, some other terms could have distinguished the entry as being pandemic-related but these were chosen as most distinctive. The respondents were participating through their own choice in online educational fora so no consent on research participation was needed as the data were accessible globally.

The excessive amount of data was organized into three sets. One set was represented by the whole corpus, the other two by its proportion categorized as non-pandemic related or pandemic-related. Further reduction followed with those including more than one of the pandemic-related code words (95) and codewords used in different meaning (7) subtracted, to form a selected sample of 328 entries.

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3. RESULTS

The research results are aggregated for the respective sets, i.e. the whole data set (AB), reduced non-pandemic subset (A), and reduced-pandemic-related subset (B).

In terms of both, pandemic or non-pandemic usage of educational technology, the respondents mirrored high prevalence toward Google Suite. The Google Suite tools were analysed therefore separately from 'the others' due to this frequency disproportion. The frequency of Google plus platform/tool/resource/app, and similar general terms was not analysed as these are not examples of a particular educational technology software tool to be used in the (teaching) praxis.

TABLE 1. Raw frequency of Google Suite tools usage.

EDUCATIONAL TECHNOLOGY	AB	A	B	% B/AB
Google Doc/Docs/Document	930	799	131	14.09
Google Forms	893	751	142	15.90
Google Classroom	173	115	58	33.53
Google Drive	35	31	4	11.43
Google Meet	23	14	9	39.13
Google Slides	13	13	0	0

By extracting minimum and maximum, i.e. Google Slides, Google Hangouts, Google Scholar, and Google Earth, one can say that in the pandemic times there was a distinctive increasement in Google Classroom —a communication tool/online learning platform (by 33.53%) and Google Meet— a communication tool (by 39.13%). The total numbers are, however, rather low, so one could doubt the result if not for the same increasement in other communication tools as e.g. Zoom (26.11%), WhatsApp (29.63%), or Messenger (23.88%). Table 2 shows the comparison of raw frequency of other educational technology software.

TABLE 2. Frequency of educational technology software usage.

NAME	AB	A	B	% B/AB	NAME	AB	A	B	% B/A
Kahoot	307	288	19	6.19	Ted ED/Talks	77	70	7	9.09
Grammarly	229	206	23	10.04	Quizziz	76	70	6	7.89
Edmodo	226	209	17	7.52	Messenger	67	51	16	23.88
Zoom	203	150	53	26.11	Padlet	51	42	9	17.65
YouTube	215	191	24	11.16	Moodle	34	28	6	17.65
Facebook	183	168	15	8.20	Canvas	31	28	3	9.68
MS Teams	119	108	11	9.24	Socrative	26	24	2	7.69
YouGlish	94	88	6	6.38	Udemy	25	25	0	0.00
PowerPoint	84	57	27	32.14	Lingro	22	21	1	4.55
WhatsApp	81	57	24	29.63	Flipgrid	20	15	5	25.00
Quizlet	77	68	9	11.69					

The results can be read as the higher the proportion percentage of B in AB, the bigger increasement of the educational technology software usage in the pandemic times.

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Looking closely at the function of the above listed most frequently mentioned educational technology software, altogether seven categories of function were created and researched within the study: academic tools, audio/visual making tools, communication tools, gamification tools, presentation tools, realia, plus the extra category of TEFL (Teaching English as a Foreign Language) materials, for more see Appendix.

TABLE 3. Educational technology software function – usage development.

	% AB	% A	% B	% B/AB	% B/A
academic	9.52	9.09	8.23	-1.30	-0.87
audio/visual	0.00	0.00	0.00	0.00	0.00
communication	45.45	44.59	46.32	-4.76	0.87
gamification	20.78	22.51	21.21	0.43	-1.30
presentation	5.63	4.33	8.66	8.66	3.03
realia	7.79	7.79	8.23	0.43	0.43
TEFL	10.82	11.69	7.36	-3.46	-4.33

Table 3 shows that regardless of the usage in and out of the pandemic times, educational technology software mentioned by the respondents fulfil mostly communication functions, followed by gamification functions. Decrease in usage due to the pandemic is notable only for TEFL sources, increase on the other hand in communication tools and in presentation tools.

Concerning educational technology hardware solutions, the majority of respondents connected educational technologies to online mode and web-based solutions (59%) or the tools usable both online and offline (39%; as e.g. apps/applications, videos, audios/sound), only 2% spoke explicitly about offline solutions (with code-words like face-to-face/face to face, normal classroom, etc.).

4. DISCUSSION

All the results need to be understood within the context of the COVID-19 pandemic and subsequent restrictions in social contacts leading to the shift into the virtual world along with the redefinition of educational technology towards this "new normal".

4.1.Q1 What educational technology was used in the pandemic times and what was the frequency of their usage?

The research data suggest that in the pandemic times the term educational technology became associated only with online applications or websites as opposed to the pre-pandemic definitions of educational technology, i.e. "the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (Januszewski, & Molenda, 2008, p. 1) or "in the nineteenth century [...] educational toys and other learning tactics [...]; in 1930-40 [...] special types of scrambled books, cards and boards [...]; 1960 [...] industrial revolution [...] progressing in the field of educational technology [...]; now [...] technological inventions like radio, tape-recorder, television, computer, CCTV i.e. closed circuit T.V., electronic video tapes and other audio-visual aids" (Sharma, 2002, p. 20).

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The shift in educational technology perception was caused by "emergency remote teaching" (for more see e.g. Iglesias-Pradas *et al.*, 2021) meaning that during the pandemic, emphasis was placed on remote/distance learning strategies that solved the sudden and panicked rush towards technology by teachers who had previously had no/low interest in it.

4.1.1. Educational technology - hardware

The research has shown a slightly higher frequency of entries on portable devices. If entries for phone (phone, smartphone, cell phone mobile and mobile device) are counted together, this type of hardware accounts for 49% of all listed delivery modes/educational technology hardware solutions. By adding results for a tablet/laptop/notebook (at 2%), all portable devices are mentioned in an educational context in 51% of cases as compared to non-portable devices, such a computer, a lab (meaning IT/English language/language, EFL/ESL lab), a computer lab (46%) plus a TV (1%) and a projector (2%), which makes 49% in total.

4.1.2. Educational technology – software

The top ten entry frequency list of educational technology software usage regardless of the pandemic (G-Suite not included), see Table 2, column A: Kahoot, Grammarly, Edmodo, YouTube Facebook Zoom, Microsoft/MS Teams, YouGlish, Quizziz, Quizlet. The top ten entry frequency list of educational technology software usage 'connected to/introduced by/caused by' the pandemic (G-Suite not included), on the other hand, is column B, Table 2: Zoom, PowerPoint /ppt, YouTube, WhatsApp, Grammarly, Kahoot, Edmodo, Messenger, Facebook, Microsoft/MS Teams.

As said above (see Results) the lists indicate that the shift to online learning affected primarily increasing numbers of communication platforms, rather than educational tools as such, for more see Table 3. Summing up the findings in words one of the respondents:

> When Covid 19 arrived, teachers wanted tools for communication more than anything else. They didn't really want to teach in new ways - they wanted tools to allow them to teach in the same way they already had been teaching. This suggests (to me) that post covid, most teachers will just go back to normal, and the way they teach their classes will be very similar to pre-covid. So, unless there is some kind of training or awareness-raising, most/all of the tools discovered during Covid will be abandoned as teachers go back to the old ways.

4.2. Q2 What function did educational technology listed in answer to Q1 serve?

4.2.1. Academic tools

The first category of 'academic tools' includes all those that one can use while studying or working on an academic task. Via these tools one can share knowledge, refer to/cite someone else's knowledge, develop interest in learning, innovate their learning strategies, enhance learning outcome, do research and many other functions/tasks. The most frequently mentioned citation manager was Zotero. The clouds, i.e. storing managers listed were e.g Dropbox, GoogleDrive. Another tool mentioned for academic purposes were dictionaries, e.g. Cambridge dictionary. For brainstorming and organizing thoughts, mind mapping software solutions were dis-

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cussed among the respondents, such as Mindmeister, or Mindmono. Into the category of academic tools one can put note-taking tools with the following (educational) technology software solutions, e.g. Smart notes.

If one wants to develop their writing skills the online writing labs: Writable can come handy as well as spell checkers: Grammarly, Writefull, et.c and/or thesauri plus corpus linguistics tools, e.g. SkEll or Thesaurus.com. Specifically, for researching survey makers can be utilized like: Survio or SurveyMonkey. Instructional mode changers can also be categorised within academic tools such as e.g. webinar software.

4.2.2. Audio/visual making tools

The second category of 'audio/visual making tools' are all those (educational) technology software solutions that one can use to create, to edit or to adapt audio or visual materials for personal teaching purposes. The first subcategory is all the software that can be used for animations and video creation/editing, e.g. Camtasia, Vyond. To create visually attractive teaching material or to edit someone else's (if copyright allows), graphic designing software such as Meme Creators, Pixton, or ScrapBook, can be used. The tool that could have been put under the heading academic tools (as e.g. live lecture can be streamed but also recorded) is screencast software, e.g. Quiztime or UltraScreen Recorder. The reason for the screencast software being categorised under audio/visual making tools is that it captivates images/videos for later use and these can serve as a great audio/visual teaching material. The fun element can be easily added to one's teaching material when teachers use speaking characters/avatars creators: Voki or video making/editing software like Powtoon. Another tool that can be put into more categories are website creators: blogger.com, or simeplesite.com. The websites communicate their content but this communication is mainly audio-visual and therefore can be seen as audio-visual making/editing tool too.

4.2.3. Communication tools

The third category are communication tools. These are all those (educational) technology solutions that enable to have social contact both synchronous and asynchronous. Communication tools can function without interaction, i.e. as a one-way channel, with semi-interaction (two-way channel but with no interaction to a certain time point), as well as with interaction (two-way channel with simultaneous interaction). The functions are principally calling/messaging, e.g. Microsoft Teams, Skype, WhatsApp, or Zoom, and enhancing cooperation as in collaborating educational platforms: EDMODO, or SkillShare. Instruction delivery tools like Coursera, Khan Academy, MOOC, Openuniversity, etc. or learning management systems: Canvas, MOODLE, or Udemy fall into the communication tools category too. The same applies to learning applications like e.g. Duolingo, or Hello English.

4.2.4. Gamification tools

The next category are gamification tools. These tools add an element of gaming into the classroom. One can create quizzes or tasks in many different formats. One subcategory is gamification software: Flipgrid, Kahoot, Padlet, Quizlet, or Quizzis, etc., i.e. those tools that allow the teachers to create/edit games/quizzes and similar activities. The other subcategory is that type of software that generate tests or serve as a testing source: Testmoz, Zipgrade.

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4.2.5. Presentation tools

The fifth category are presentation tools. These tools generally allow people to share their knowledge, ideas, images, texts and so on. These presentations can serve professional as well as entertainment purposes. The presentation tools by the respondents were: e.g. Microsoft Sway, Power Point, Prezi, or SlideShare. As the presentation can be seen also as a phase in the classroom procedure one can put also e.g. online whiteboards into the category of presentation tools like aww.com or Jamboard.

4.2.6. Realia

The sixth category contains sources were realia can be found. Realia are invaluable for learning and one can use e.g. sounds/music/lyrics such as LyricsTraining, Soundhound, The Hat, or (royalty free) pictures: Canva, Pinterest, Pixabay, or Shutterstock. To promote intercultural understanding, tolerance and (critical) reading literature is a great choice which could be the reason why respondents mentioned (free) e-books: Bookscool.com or Scribd, and (free) audio e-books, e.g. Librivox.org. For creativity enhancement, fun fiction writing activities, self-assessment portfolio creation and many other functions respondents discussed the possibility to use book creators: Book Creators and Kotobee Author. Special position among the realia are real videos e.g. on YouTube.

4.2.7. TEFL (Teaching English as a Foreign Language) materials

Because the author is personally interested in English as a foreign language teaching, an extra category was created from the respondents' most mentioned educational tools for learning/teaching English. These can be subcategorised into listening sources: ESL lab, or TED Talks/TED ed; reading sources: breakingsnewsenglish.com, fanfiction.net, or newsinlevels.com, and pronunciation sources, e.g. YouGlish.

A comprehensive collection of English language skills and knowledge development resources can be found e.g. in AE (American English), British Council, BusyTeacher, ESLcollective, Fluentu, etc. with some sources interactive, e.g. Edpuzzle, Liveworksheets.com, Nearpod, or Wordwall.

Nevertheless, the main finding from the qualitative analysis of educational technology function is that there is a large number of solutions one can use. One can choose what suits them best as the tools differ in style, design, options, etc. and can fulfil the same or similar function.

5. CONCLUSIONS

5.1. Limitations and future lines of research

There are several limitations to the research.

Firstly, the respondents were not specifically selected, i.e. do not represent any specific group and no detailed data is known about the respondents, nor their gender, age, region, or teaching experience. The participation on the research was a result of their online fora discussion contribution.

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Secondly the pandemic-related subset was created on the basis of code words. The code words were pre-defined as the most distinctive but for sure some other features could have distinguished the entry as 'due to/during the pandemic'.

Third limitation is caused by the fact that entries were not edited manually and therefore misspelled occurrences were not counted, i.e. WatsApp, WhatApp, and similar 'representations' of WhatsApp were not considered in the analysis.

Future lines of research can be:

1. Has the pandemics 'helped' digitally less/not equipped areas to support further growth in digital access and digital literacy, especially with using synchronous tools and their all possible functions? As it seems that digital access is still restricted to wealthier and younger and digital literacy is not further promoted once 'the need to work online is not present' globally anymore.

2. Do the changes in educational technology usage last when the pandemics is 'over'? As the education tend to 'forget everything connected to the pandemics' and have gone back to the face-to-face mode without using the acquired knowledge and skills regarding the educational technology.

5.2. Integration into the current literature

The study results complement previous research on educational tools. The text offers an updated and by-vast-data-analysis-justified list of educational technology tools to be used similarly to the lists in e.g. Onyema *et al*. (2021). Alongside with Abisado (2020), the text studies the change in educational technology function due to the COVID-19 pandemic.

5.3. Implications for theory and praxis

A similar situation in education happened in 2003 in Asia with the outbreak of SARS. Fung and Ledesma (2005, p. 1) summed up the change in education as "extending classroom [using] an interactive, real-time platform using web-technology in the delivery of teaching and learning" (see also Tatnall *et al.*, 2005). In Europe, the COVID-19 pandemic brought the same change but instead of (re)discovering what Asia had already found out, many first panicked. Even if not taking inspirations from SARS pandemics experience, educators had already many options at hand, e.g. flipped classrooms, defined as "with the help of the technology exchanged roles of teachers and students so that what teachers could do in class, (such as the theory explanation) it was done at students' homes." (Galindo-Domínguez, & Bezanilla, 2019, p. 82) or blended or hybrid learning modes. But technologies (including educational technology) started to be used only later, at first asynchronously and subsequently synchronously. Interaction and communication gained in significance in distance learning during the pandemic because no face-to-face contact was possible or there were severe restrictions.

The implication for the future is that "network-based communication" and "virtual communities" (for more see e.g. in Arnó Macià *et al*., 2020) need to be created and used to cross distances between people and to support the human need for dialogue within distance learning similarly to contact education. In contrast to the "Netspeak [talking online] that lacks facial expressions, gestures and conventions that are

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important in communicating face to face" (Salmon, 2002, p. 223), such technology is to be used that enables 'real-life-like' contact, e.g. Google Meet, Zoom, Microsoft Teams, Discort, Skype, Adobe connect or collaborative tools e.g. Google Slide + PearDeck, Nearpod, Google Docs. Chiappe *et al*. (2020) talk about the need to foster "educommunication in digital environments" warning however that "different digital environments involve different ways of conceiving and deploying interaction processes, inside and outside the classroom" (Chiappe *et al*., 2020, p. 34).

The subsequent suggestion might sound too obvious but a key enabling factor for synchronous distance learning is internet connection with camera on, only thus can the benefits of "original" distance learning and with the additional benefits of face-to-face learning be maintained, i.e. that "learning 'with' and learning 'from' [media and technology] increases performance […] enriches the maintenance of educational process, raises motivation of pupils to learn the English language and at the same time close cooperation between teacher and pupils is achieved." (Bagapova *et al*., 2020, p. 206), because blended learning offers this possibility to intertwine the above-mentioned benefits, as Morán (2012) emphasizes "b-learning combines face-to-face learning and distance learning in such a way that the best strategies of each modality are integrated and complemented to provide more flexible and solid learning experiences." (Morán, 2012, in Chiappe *et al*., 2020, p. 36)

With (new) web-based technology, (new) competences are to be enhanced among teachers and students or pupils. These (new) competences are, e.g. in Biletska, *et al*. (2021, p. 19): "literacy, quantitative thinking, inter/intrapersonal skills, civic awareness, professional skills, 21st-century skills that include cooperation, critical thinking, communication or problem solving, research skills, digital literacy, creative skills" but also "a set of skills that cannot be standardised. However, they are useful in atypical educational situations, the solution of which requires creativity, spontaneity, self-confidence, openness to new things, power to adjust" (Biletska, *et al*., 2021, p. 23). Developing digital literacy is discussed in numerous studies, in the pre-pandemic times, e.g. Padilla-Hernández *et al*. (2019) or in the 'post-pandemic' times, e.g. González-Rodríguez *et al*. (2022) or Gabarda *et al*. (2022) and educators can review these and act upon.

The last suggestion is to choose from the great variety of educational technologies, especially web-based technologies, those that suit the teacher best and use these to the fullest potential not only in times of pandemic, but also in the 'normal' face-to-face operation delivery.

5.4. Summary

Distance learning has gone through many changes caused by the COVID-19 pandemic with restrictions in social contacts and rapid transfer to the virtual world. Technology has helped education to continue despite the loss of physicality and educational technology, especially the web-based software solutions, enabled to reach, keep or even improve the quality of teaching and learning.

Educational technology moved mainly to portable devices and the term was understood by the respondents as virtual online tools more than in its original sense. In comparison to the past, in which mostly asynchronous distance learning tools were used, the pandemic increased the usage of collaborative, communicative, interactive synchronous tools. In addition to non-communicative ways (no interaction involved) and semi-communicative (no real time interaction involved or possible), communicative distance learning (real

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time interaction allowed) became very popular. Non-communicative delivery was organised via sending students homework, setting individual assignments via e-mail, mail or LMS=Learning Management System, and prompting autonomous learning. No or low possibility of social contacts meant that tools used normally in the classrooms needed to be adapted, for example, adding interactivity to textbooks. Teachers 're-discovered' that e.g. writing blogs, creating vlogs or finding a pen friend could serve their teaching purposes very well. These tools offered teachers at least semi-communication, asynchronous interaction between the communication partners. The same applies to chats, fora, discussion panels or LMS like Moodle and Canvas.

Google company products largely dominated in the preferences. The reasons were not researched but would be very interesting (at least for the Microsoft company), but generally most frequently used educational technology software solutions were online collaborative tools (mostly Google Docs, Google Forms) and communicative tools (mostly Google Classroom, Google Meet, Zoom, WhatsApp, Facebook, Messenger, and Microsoft/MS Teams), followed by gamification tools (most frequently Kahoot, Quizziz and Quizlet), presentation tools (PowerPoint), academic tools (Grammarly), e-learning (Edmodo), realia (YouTube). Communication tools and presentation tools together with realia underwent also the biggest increase in the usage during the pandemic times.

The pandemic also increased the variety of educational software solutions. For the same or similar function, more tools are now available, e.g. for online whiteboard respondents mentioned eight different platforms or for games twenty-one webpages that one can use. If for any reason the given tool is not suitable, there are or soon will be other options at hand and the teaching community worldwide is sharing, caring and helpful.

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7. APPENDIX

TABLE 3. Educational technology software function – usage development.

EDUCATIONAL TECHNOLOGY SOFTWARE FUNCTION – COMPLETE LIST	
FUNCTION	**NAME**
academic tools	
citation managers	Zotero
clouds	Box, Dropbox, EdWordle, GoogleDrive, MoodleCloud, Smart word
cloud, Symbaloo, Wakelet	
dictionaries	Cambridge dictionary, Collins dictionary, Longman dictionary,
Macmillan, MerriamWebster, Oxford dictionary, wikidiff.com	
mind maps	Mindmeister, mindmono, SpiderScribe
note taking	Evernote, Microsoft OneNote, Smart notes
online writing labs	Purdue OWL, storybird, Writable
spell checker	Grammarly, Hemingway editor, Writefull
survey makers	Likert, MOOCS, Nvivo, pollseverywhere.com, Polly, Survio,
SurveyMonkey	
thesauri/corpus linguistics	BNC, COCA/COHA, Lingee, Lingro, SkEll, Sketchengine,
Thesaurus.com, WordReference.com	
webinar software	Adobe connect

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audio/visual aid making tools	
video creation/editing	Camtasia, Vyond
graphic designing software	Meme Creators, Mozaik 3D, Pixton, piktochart, PosterMyWall,
ScrapBook, smore, ThingLink	
screencast software	Ocam Screen recorder, Recorder, Screen, Quiztime, UltraScreen
speaking characters/avatars	voki
video making/editing	Filmora, moviemaker, Powtoon
website creators	blogger.com, simplesite.com, Tumblr, Wix, Wordpress
communication tools	
calling/messaging	Blue Button, ClassDojo, DepEd, Discord, Doodle, Facebook
Messenger/Lite, Google Meet, GoToWebinar, Hangouts, Microsoft Teams, PearDeck,	
Schoology, Skype, Slack, Slido, Typeform, Vocaroo, VoiceThread, Webex, WeChat, WhatsApp, Whereby, Zoom	
"e-learning"	EDMODO, Google Classroom, PBworks, SkillShare, WIKI, WizIQ,
distance learning	Cake, Coursera, Engvid, FutureLearn, GOC, Khan Academy, MOOC, Openuniversity, Wakelet
online courses	Canvas, Gnomio, Iscollective, MOODLE, MyELT, Quipper School, Socrative, Udemy
learning applications	Agendaweb, Berlitz, Bus, Duolingo, Educreations, Elsa, Genyo, Hello English, Lingualift, Memrise, TOP 20 English
gamification tools	
gamification software	Baamboozle, Educaplay, Flipgrid, ChatterPix, Minecraft Edu
(Office 365), Padlet, Triventy, VocabularySpellingCity, Wordwall	
games/quizzes, tests	Battletex, BookWidgets, Crossword Puzzle, Freerice, Hot potato,
iCivics, iSpring, Kahoot, Kyon, learningapps.org, MindSnacks, Playbuzz, Plickers cards, Quizalize, Quizlet, QuizStar, Quizzis, studystack.com, Topquiz, Wondershare QuizCreator	
testing sources	Testmoz, Zipgrade
presentation tools	Blendspace, Mentimeter, Microsoft Sway, PearDeck, Photopeach, Piktochart, Power Point, Prezi, SlideShare
online whiteboards	aww.com, Blackboard, ExplainEverything, jamboard, Miro,
Smartdraw, Starboard, stormboard	
realia	
sounds/music/lyrics	LyricsTraining, Soundhoud, The Hat
royalty free pictures	canva, pinterest, pixabay, shutterstock
(free) e-books	bookscool.com, Freebooks, Project Gutenberg, Scribd, Vooks, Wattpad
(free) audio	e-books/book creators Aralinks ebooks, Book Creator, Kotobee
Author, librivox.org	
free video	YouTube

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TEFL (Teaching English as a Foreign Language) materials	
listening sources	ELLLO, ESL lab, Manythings.org, TED Talks/TED ed
reading sources	BBC Learning English, breakingsnewsenglish.com, Fandom,
fanfiction.net, newsinlevels.com, readable.com, Reading A-Z, ReadTheory, storylineonline.net, The Guardian, Voice of America (VOA)	
pronunciation	Balabolka, dragonVoice, soundcomparisons.com, VoiceOver,
YouGlish	
ESL resources	AE (American English), British Council, BusyTeacher, Englishwsheets, ESLcollective, Twinkl, Viwe Worksheets, VoA (Voice of America)
ESL resources live	edpuzzle, English banana, Liveworksheets.com, Nearpod, Wordwall

Recursos Educativos Abiertos (REA) en la formación inicial docente: aproximación tecnológica en la enseñanza de Lengua

Open Educational Resources (OER) in Initial Teacher Training: Technological Approach in Language Teaching

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RESUMEN

En este artículo se presenta una propuesta de enseñanza de los recursos educativos abiertos (REA) llevada a cabo en la formación inicial docente, basada en: el conocimiento y revisión de una selección de materiales educativos digitales para su futuro uso y adaptación en la clase de Lengua en Educación Secundaria; la elaboración de un diseño de REA como procedimiento de evaluación; y, finalmente, la cumplimentación de una encuesta de valoración de la intervención realizada. Los resultados obtenidos muestran que la mayoría de los estudiantes percibieron los REA como una propuesta innovadora y recomendable para mejorar su práctica en el aula, aunque también revelaron que se trata de una actividad compleja que necesita de un acompañamiento guiado. El desconocimiento de los REA y cierta inseguridad a la hora de emplearlos y adaptarlos a sus diferentes contextos fueron percibidos como algunas de las principales dificultades. A partir de estos resultados iniciales, se propone una línea de investigación que necesita de un contexto de estudio más amplio para elaborar nuevas estrategias en la formación inicial del profesorado que permitan el empleo de estos recursos en sus prácticas docentes.

PALABRAS CLAVE Recursos educativos abiertos (REA); enseñanza de la lengua materna; Formación de profesores; competencias del docente; tecnologías de la información.

ABSTRACT

This article presents a proposal for teaching open educational resources (OER) carried out in initial teacher training, based on: the knowledge and review of a selection of digital educational materials for future use and adaptation in the Language class in Secondary Education; the development of an OER design as an evaluation procedure; and, finally, the completion of a survey to assess the intervention carried out. The results obtained show that most of the students perceived OER as an innovative and recommendable proposal to improve their classroom practice, although they also revealed that it is a complex activity that needs guided accompaniment. Lack of knowledge of OER and a certain insecurity when it comes to using and adapting them to their different contexts were perceived as some of the main difficulties. On the basis of these initial results, a line of research is proposed that needs a broader context of study in order to develop new strategies in initial teacher training that allow the use of these resources in their teaching practices.

KEYWORDS Open educational resources (OER); mother tongue instruction; initial teacher training; teacher qualifications; information technology.

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1. INTRODUCCIÓN

1.1. Los retos de la sociedad digital y el aprendizaje activo con tecnología

Los docentes del siglo XXI deben estar preparados para afrontar los nuevos retos que plantea la educación, donde la globalización y las tecnologías de la información y la comunicación (TIC) han producido la transformación del panorama de una inmensidad del planeta. A ello se une el actual contexto, posterior a la pandemia de la COVID-19, en el que muchas instituciones, tanto preuniversitarias como universitarias, se han planteado un modelo de enseñanza híbrido en el que alternen las actividades en línea y presenciales de una manera más eficaz, y en el que se impone la necesidad de crear y adaptar contenidos en diferentes formatos que permitan la combinación de ambos aprendizajes (Bethencourt-Aguilar *et al.*, 2021; Cabero, & Pallares, 2021; Santa María *et al.*, 2022; Vásquez *et al.*, 2023). Otro de los retos actuales es garantizar una educación inclusiva y equitativa de calidad y promover oportunidades de aprendizaje durante toda la vida para todos (Unesco, 2017), que se recoge en el objetivo de desarrollo sostenible (ODS) 4 de la Agenda 2030.

Ante este cambio de paradigma y progresión en la educación, los recursos educativos abiertos (en adelante, REA) brindan la oportunidad de repensar la manera de enseñar y aprender mediante el uso de la tecnología e impulsan la adquisición de competencias a través de la resolución de retos de aprendizaje a partir de nuevas metodologías. Desde el punto de vista del profesorado, se requiere de mayor innovación, planificación y colaboración entre iguales (Martínez-Garrido, 2018; Santos-Hermosa, & Abadal Falgueras, 2022), por lo que consideramos que una aproximación a los REA en la formación inicial puede ser una oportunidad para: definir retos de aprendizaje, utilizar formatos multimodales, adaptar los contenidos a la diversidad del alumnado y ritmos de aprendizaje, participar y colaborar activamente con otros docentes, etc. (Valdera López, & Alberdi Causse, 2019).

En el estudio que presentamos ofrecemos una propuesta de enseñanza basada en el conocimiento y revisión de una selección de REA para su futuro uso, adaptación y /o creación, y en el análisis de las percepciones de los estudiantes a partir de su aplicación en el aula.

1.2. Los REA: concepto y trayectoria en el panorama de la enseñanza

La publicación del texto Recomendación sobre los REA, aprobada por la Conferencia General de la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (UNESCO) celebrada el 25 de noviembre de 2019, comienza con una aproximación a este concepto que se define como:

> (…) materiales de aprendizaje, enseñanza e investigación, en cualquier formato y soporte, de dominio público o protegidos por derechos de autor y que han sido publicados con una licencia abierta que permite el acceso a ellos, así como su reutilización, reconversión, adaptación y redistribución sin costo alguno por parte de terceros (Unesco, 2019, p. 22).

No obstante, la trayectoria de los REA es mucho anterior y se remonta a 2002 coincidiendo con el Fórum de la Unesco sobre el impacto de los cursos abiertos para la Educación Superior en los países en desarrollo donde se acuña el término REA (Unesco, 2002). Posteriormente, se han producido varios hitos de importancia como son: la Declaración de Ciudad del Cabo (Cape Town Open Education Declaration,

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2007), que recoge las estrategias para el desarrollo de la Educación Abierta; la aprobación de la Declaración de REA (Unesco, 2012) en el I Congreso Mundial de Recursos Educativos Abiertos, celebrado en París, donde se hace un llamamiento a los gobiernos para su promoción; la publicación del Plan de Acción REA (Unesco, 2017) en el II Congreso Mundial REA en Ljubljana, donde se debate cómo crear conciencia entre las partes interesadas, además de cómo comprometer a más gobiernos con la adopción de políticas de licencias abiertas para materiales educativos financiados con fondos públicos; y la Recomendación sobre los REA (Unesco, 2019), que viene a respaldar los esfuerzos realizados por la Unesco en la consolidación de los resultados de su Plan de Acción.

Como ya advertimos anteriormente, la propagación de la COVID-19 ha tenido también un papel significativo, ya que en el contexto de emergencia sanitaria los REA han sido componentes fundamentales de la estrategia educativa global por la búsqueda de una educación capaz de llegar a todos y numerosas organizaciones internacionales o gubernamentales se han sumado con iniciativas interesantes, favoreciendo la presencia de los REA en el panorama de la enseñanza (Santos-Hermosa, & Abadal Figueras, 2022).

1.3. Los REA en el contexto de la Educación Secundaria

En los institutos de Educación Secundaria, escenario educativo en el que impartirán docencia los estudiantes del Máster en Profesorado, la irrupción de los REA era hasta hace poco testimonial y recaía sobre todo en la voluntad del profesorado que decidía introducir su uso en la práctica docente (Escámez Pastrana, 2018). Las redes sociales, Twitter principalmente, han favorecido la difusión de estas prácticas y, en los últimos años, están siendo foco de llamativas experiencias educativas que hacen uso de REA, e incluso son frecuentes entre el claustro de profesorado los grupos creados con aplicaciones de mensajería instantánea, como Telegram, que surgen para compartir, asesorar y trabajar de manera colaborativa en torno a proyectos comunes (Capilla Sánchez, 2020; 2021).

En paralelo a esta realidad, las administraciones educativas parecen haber apostado por las posibilidades que ofrecen los REA y su implantación en el contexto educativo de Secundaria, y existen proyectos institucionales que persiguen la transformación metodológica y digital en el aula. En concreto, cabe destacar la importante labor que, a través del Proyecto EDIA (Valdera López, & Alberdi Causse, 2020), realiza el Centro Nacional de Desarrollo Curricular en Sistemas no Propietarios (CEDEC, en adelante), organismo dependiente del Ministerio de Educación y Formación Profesional a través del Instituto Nacional de Tecnologías Educativas y Formación del Profesorado (INTEF, en adelante) y de la Consejería de Educación y Empleo de la Junta de Extremadura. A ello se han ido sumando otras iniciativas de distintas comunidades autónomas como el Proyecto CREA de Extremadura o el Proyecto REA de Andalucía. Todos ellos comparten el objetivo de promover nuevos modelos de enseñanza aprendizaje apoyados en los REA y orientar en su uso y/o adaptación con la creación de redes docentes que cuentan con el apoyo de las instituciones educativas.

De manera análoga, el INTEF tiene a disposición de la comunidad docente y el alumnado, el Espacio Procomún Educativo, una iniciativa del Ministerio de Educación y Formación Profesional que se sustenta sobre el Proyecto Agrega, y donde la comunidad educativa puede encontrar material didáctico, además de comunidades virtuales docentes de diferente temática (Recio Mayorga *et al.*, 2021). Junto a ello, y debido a la crisis de la COVID-19, en marzo de 2020 el INTEF puso en marcha un espacio con información y acceso a

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diferentes tipos de recursos disponibles en línea: itinerarios didácticos, píldoras audiovisuales, materiales creados con GeoGebra, etc.

1.4. Los REA: una apuesta de transformación digital y metodológica en el aula

A pesar del incremento de los REA en los últimos años, de los numerosos proyectos y repositorios institucionales en el ámbito de Secundaria disponibles y de la difusión de numerosas prácticas, no podemos hablar de una realidad normalizada, universal, extendida y cotidiana en los Institutos de Educación Secundaria (Escámez Pastrana, 2018; Sánchez García, & Toledo Morales, 2016). Se considera que, para que su presencia sea efectiva, los docentes necesitan seguir intercambiando información y colaborando para difundir prácticas innovadoras que impacten en los miembros de la comunidad docente (Ellis, 2017, citado en Recio Mayorga *et al*., 2021).

Un reciente estudio sobre la revisión de la literatura REA en los procesos de enseñanza aprendizaje destaca que su incorporación en los distintos niveles educativos está relacionada con la capacidad que desarrolle el profesorado para buscar, implementar y usar REA (Ramírez Terán *et al*., 2022). Mortera *et al*. (2012) ofrecen una serie de recomendaciones sobre la metodología de búsqueda y adopción de REA en la práctica académica y educativa: (1) la difusión de la importancia del uso de REA en el ámbito académico y científico; (2) las campañas de alfabetización digital e informática para enseñar los procesos de búsqueda y manejo, y en el que las bibliotecas escolares tienen mucho que aportar (Baas *et al*., 2019); (3) los talleres sobre las distintas licencias, uso, redistribución y reproducción de REA; y (4) los cursos de actualización no solo en el manejo de los REA, sino también sobre qué y cómo enseñar a través de las ventajas que estos ofrecen. De ahí la importancia de que los docentes sigan formándose y, en ello, el acompañamiento y asesoramiento sobre este material didáctico, puede ser clave para integrar la tecnología en su práctica de aula (Bethencourt-Aguilar *et al*., 2022; Mata Pardo & Rubio Perea, 2022).

El uso educativo de los REA en la Educación Secundaria sigue avanzando como una propuesta de transformación metodológica y digital en el aula que favorece el proceso de enseñanza aprendizaje de calidad, inclusivo y equitativo (Ramírez Terán *et al*., 2022). Además de ser una propuesta tecnológica y de desarrollo de la competencia digital del docente, incide en un cambio de modelo de enseñanza que favorece la creación de nuevos entornos de aprendizaje abiertos, flexivos e inclusivos y que promueven vínculos para el diálogo y la comunicación, generando relaciones de igualdad y reciprocidad (Recio Mayorga *et al*., 2021). Es nuestro interés con este artículo, corroborar lo investigado hasta el momento, y aproximar los REA a los futuros docentes para que conozcan y puedan seleccionar materiales educativos de calidad y para que aprovechen las ventajas que ofrecen en la mejora del aprendizaje activo con tecnología y como medio para desarrollar su competencia digital y trabajar de manera colaborativa entre iguales.

2. MATERIAL Y MÉTODO

2.1. Enfoque

El trabajo que presentamos está basado en un estudio descriptivo cualitativo de una propuesta de enseñanza de los REA presentada dentro de la formación inicial del profesorado de Lengua Castellana y Literatura,

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Latín y Griego. El objetivo principal era que los estudiantes del Máster en Profesorado conocieran los REA para su futuro uso, adaptación y/o creación como docentes en la clase de Lengua en Educación Secundaria. Para ello, se han tenido en cuenta los siguientes procedimientos:

a. La descripción del proceso de revisión de los REA seleccionados y presentados en el aula.

b. La evaluación de las propuestas de REA diseñadas por los estudiantes.

c. El análisis de las percepciones de los estudiantes sobre el conocimiento de los REA y su utilidad para su futura práctica docente.

Presentamos, a continuación, un análisis del contexto y los participantes que han intervenido en la muestra, los materiales e instrumentos empleados en la intervención y la descripción detallada de los procedimientos realizados.

2.2. Contexto y participantes

La intervención fue realizada durante el curso 2021-2022 en el Máster Universitario en Profesorado en Educación Secundaria Obligatoria y Bachillerato, Formación Profesional y Enseñanza de Idiomas (especialidad Lengua y Literatura. Latín y Griego) de la Universidad de Málaga. Concretamente, en la asignatura obligatoria "Complementos para la formación disciplinar de Lengua, Literatura, Latín y Griego" (6 créditos, en tipo de enseñanza teórica y práctica), que se imparte en el segundo cuatrimestre y que coincide con el inicio del periodo de prácticas en los centros. Se subdivide en su estructura interna y carga docente en tres áreas de conocimiento: lengua, literatura, y latín y griego. El módulo de lengua se impartió en las tres últimas sesiones del mes de marzo, los días 9, 16 y 23, y se subdividieron, atendiendo al tipo de créditos, en tres horas de enseñanza teórica para el grupo grande y en una hora y media de enseñanza práctica para dos grupos reducidos.

Con respecto a la muestra, se compuso de un total de 46 estudiantes correspondientes al único turno de mañana ofrecido para la especialidad. Un grupo heterogéneo al que se sumaron otras titulaciones como Periodismo, Comunicación Audiovisual o Traducción e Interpretación.

2.3. Materiales e instrumentos

Cada una de las sesiones contó con una presentación en PowerPoint con imágenes y enlaces, que permitía acceder directamente a los REA, y que fue compartida con los estudiantes a través del campus virtual.

Los REA seleccionados correspondían a dos repositorios institucionales: el Proyecto Itinerarios didácticos del INTEF y el proyecto EDIA del CEDEC, ambos organismos dependientes del Ministerio de Educación y Formación Profesional.

Para el procedimiento de evaluación se habilitó una guía en el campus virtual con los pasos a seguir en la elaboración de sus itinerarios didácticos y el desarrollo de uno de sus recursos, además de con cuestiones relativas al formato de los trabajos y los plazos de entrega y revisión. Aunque no era un requisito publicar el diseño o propuesta de REA como libre acceso, dado el interés del alumnado, se creó un espacio donde se compartió los enlaces relacionados con el programa y tutorial del editor de recursos educativos *eXeLearning* y de la herramienta *Grassp* para poder publicar en abierto su proyecto.

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Asimismo, se realizó una consulta en el campus virtual para conocer los estudiantes interesados en la evaluación de esta asignatura a través del módulo de Lengua y se abrió un foro de comunicación, lo que facilitó la resolución de dudas durante el proceso de elaboración, y la cooperación y retroalimentación entre iguales.

Por último, se diseñó una encuesta de valoración con la herramienta Google, con preguntas de "sí"/ "no" (n=6), de selección múltiple (n=1) y con escala de Likert (n=1), para conocer la percepción de los estudiantes sobre los REA y su práctica en el aula.

2.4. Procedimiento

Para llevar a cabo la selección y revisión de los REA, se tuvo en cuenta como criterios de exclusión los que no trataban específicamente de contenidos lingüísticos, ya que el módulo giraba en torno a las distintas ramas del estudio del lenguaje y las lenguas. Como criterios de selección, se consideró aquellos materiales educativos que correspondían, según el currículo básico de la Educación Secundaria Obligatoria y Bachillerato (Real Decreto 1105/2015, vigente en el momento), al bloque de Conocimientos de la lengua.

La muestra analizada se dividió según las ramas clásicas del estudio de la lengua y se seleccionó materiales de contenido: léxico y semántica (n=3), morfología y sintaxis (n=2), tipologías textuales (n=2) y comentario de texto (n=1). En total se analizaron 8 recursos de manera pormenorizada, aunque también se examinaron actividades propias de otros materiales educativos digitales que por su calidad merecían ser presentados. Para la revisión de los REA se tuvieron en cuenta las siguientes categorías: la descripción didáctica de los materiales, la calidad de los contenidos, la capacidad para generar aprendizaje y las propiedades tecnológicas, centrándonos en aspectos clave como su adaptabilidad, interactividad o accesibilidad.

Para la evaluación del módulo de Lengua, se propuso la elaboración de un itinerario didáctico que debía contener al menos tres recursos y desarrollar tan solo uno de ellos. El recurso debía contener 6 apartados (presentación, elementos curriculares, contenidos y actividades, evaluación, créditos y fuentes) y entregarlo en formato de archivo de texto (preferiblemente *doc y *docx) o pdf.

Finalmente, una vez cumplidas las sesiones teóricas y prácticas del módulo de Lengua, y entregados sus trabajos, se facilitó por correo electrónico una encuesta de valoración anónima y voluntaria a los estudiantes evaluados del módulo de Lengua.

3. RESULTADOS

A continuación, se presentan los principales resultados de cada uno de los procedimientos de análisis.

3.1. Descripción del proceso de revisión de los REA

Para aproximar los REA a los estudiantes y futuros docentes, se optó por analizar el material educativo seleccionado atendiendo a las siguientes categorías.

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3.1.1. Descripción didáctica

Lo primero fue revisar que, tanto los recursos educativos del INTEF como los del CEDEC, contaban con un apartado específico de descripción didáctica donde recoger los objetivos, los receptores a los que iban dirigidos, las competencias, así como unas indicaciones para su uso. Este hecho permitió al alumnado un acercamiento práctico del currículo a la secuencia didáctica, ya que una identificación de los objetivos, contenidos y estándares de aprendizaje es necesaria para programar qué enseñar y prever si el material educativo se adapta al contexto de nuestra aula. Además, puso de manifiesto el diseño planificado de los REA, donde el docente toma previamente las decisiones relacionadas con los objetivos del material educativo (Ramírez Terán *et al.*, 2022). Una de las cualidades de los REA es que son materiales referenciados curricularmente.

3.1.2. Calidad de los contenidos

Por otro lado, con respecto al contenido, se comprobó que su presentación era atractiva e innovadora y que invitaba, mediante una tarea real o virtual, a captar el interés del alumnado y a adquirir las habilidades del siglo XXI y las competencias necesarias a través del proceso de aprendizaje. De este modo, convertirse en los vigilantes de la Lengua y cazar los errores ortográficos, crear u folleto turístico para dar a conocer su propia localidad o convertirse en humoristas y crear un concurso de chistes son algunos de los retos propuestos para involucrar al alumnado en su propio aprendizaje. Se observó cómo la información era presentada en diversos formatos (textuales, audios o vídeos) y con elementos motivadores e interactivos (actividades, retroalimentación, retroacción, etc.), lo que facilitaba la percepción y el proceso de aprendizaje de sus usuarios.

Uno de los puntos destacados en la Declaración del Cabo era indicar que los REA no son libros de texto y que equipararlos con ellos limita la imaginación de los docentes y estudiantes con respecto a la mejoría que implican unos materiales modernos, abiertos y enriquecidos digitalmente (Valdera López, & Alberdi Causse, 2019). En los REA analizados se comprobó que los contenidos teóricos son limitados, expuestos con un lenguaje cercano y sencillo, donde el alumnado adquiere un papel activo, reestructurando y organizando la información.

3.1.3. Capacidad para generar aprendizaje

Otra de las características propias de los REA es su capacidad para generar aprendizaje. Son recursos contextualizados que promueven el aprendizaje significativo y el desarrollo competencial y, por tanto, que este sea activo, constructivo y duradero. En el recorrido por los REA, los estudiantes destacaron las numerosas tareas previas de activación del conocimiento. Así, por ejemplo, son frecuentes en estas secuencias las dinámicas cooperativas (lápices al centro, folio giratorio, la tela de araña, etc.) para conectar saberes nuevos y previos, que permiten además atender juntos en una misma aula a alumnado diferente (Pujolás, & Lago, s.f.). La creatividad de las tareas propuestas y las diferentes posibilidades que ofrecen para que el alumnado exprese lo aprendido fueron otros de los factores claves comentados: la creación de una sesión de podcast con "La palabra del día", la reproducción de una conversación informal en WhatsApp o la resolución de una duda lingüística convirtiéndose en la propia @RAEinforma son algunas de las tareas que los estudiantes del Máster consideraron motivadoras. No obstante, también hay cabida en estos recursos para que el alumnado

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reflexione críticamente sobre el conocimiento y el uso de la lengua materna (Marqueta *et al*., 2022): ejercicios de formación de palabras que invitan a realizar sus propias hipótesis y generalizaciones sobre los significados de ciertos morfemas (-dor, -ción, -ero) o el empleo de pares mínimos para la desambiguación léxica. Además, los REA analizados aportaron estrategias e instrumentos de autoevaluación y coevaluación (rúbricas, listas de control, diarios de evaluación del aprendizaje, etc.) que permitieron a los estudiantes reflexionar sobre la importancia del qué y el cómo aprende el alumnado.

3.1.4. Propiedades tecnológicas

En cuanto a la dimensión tecnológica, los REA analizados se presentan en el editor de contenidos *eXeLearning*, no muestran dificultades de acceso, ni enlaces incorrectos, ni es necesario descargar complementos para la visualización de los contenidos. La navegabilidad por los recursos resulta sencilla e interactiva y su uso es muy intuitivo. En el aula se mostró a los estudiantes como tanto alumnado como profesorado pueden saber en todo momento en qué parte se hallan, ya que avanzar y retroceder es una tarea sencilla. Otra de las ventajas que ofrecen, es la posibilidad de descargar el archivo fuente original del recurso y modificarlo ajustándose a contextos concretos con facilidad. La limitación de horas de clase nos impidió trabajar con el editor de contenidos educativos *eXeLearning*; sin embargo, se pudo revisar y trabajar con los estudiantes las distintas utilidades de los módulos y las opciones que ofrecían para integrar información textual, no textual, actividades interactivas, etc. Finalmente, nos detuvimos en el carácter accesible de los REA que, por su perspectiva abierta e inclusiva, facilitan al máximo su comprensión e interacción.

3.2. Descripción de los resultados obtenidos de los diseños REA realizados

De los 46 estudiantes de la asignatura, 19 optaron por el procedimiento de evaluación del módulo de Lengua, frente a las otras dos opciones, y presentaron 13 diseños de itinerarios didácticos, realizados de manera individual (n= 7) y en pareja (n=6). Los contenidos sobre los que versaron sus diseños correspondían a las tres ramas del estudio de la lengua tratadas en clase: la rama del léxico y la semántica (n=3), la rama de las tipologías textuales (n=5), la rama de la morfología y la sintaxis (n=3), y dos de ellos trataron las lenguas y las variedades lingüísticas de España.

Para su evaluación se habilitó una guía en el campus virtual con los pasos a seguir en la elaboración de sus itinerarios didácticos y el desarrollo de uno de sus recursos. De este modo, las propuestas REA debían presentar el título de un itinerario que contuviera al menos 3 recursos, de los cuales tenían que desarrollar uno de ellos como secuencia didáctica autónoma.

Para evaluar sus diseños se tuvo en cuenta las categorías empleadas en la revisión de los REA analizados en clase.

En primer lugar, de los 13 diseños presentados, 12 contaron con un apartado de descripción didáctica más o menos detallada y tan solo uno no siguió los criterios exigidos en el enunciado de la tarea. Por lo general, todos presentaron unas indicaciones claras sobre el uso del itinerario, los objetivos, contenidos y estándares de aprendizaje del recurso y el curso al que iba dirigido. Se observó un diseño planificado y una toma previa de decisiones sobre los objetivos del material educativo que presentaban.

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Con respecto a los contenidos, se propusieron tareas atractivas y motivadoras para captar el interés y estimular la motivación del alumnado: la elaboración de un *TikTok* con pautas para la realización de un texto escrito adecuado, la reelaboración de cuentos clásicos en clave no sexista, la entrevista a un familiar para investigar sobre temas tabú o la elaboración de hilos de *Twitter* para contar anécdotas curiosas fueron algunas de las propuestas. Se optó por presentar los contenidos empleando diferentes formatos, siendo los enlaces de audio o vídeo los más comunes, pero también se proporcionaron gráficas e infografías para facilitar la percepción del alumnado.

Los diseños presentados por los estudiantes mostraron en su mayoría capacidad para generar aprendizaje y, aunque se echó en falta variedad de tareas para el entrenamiento de procesos psicológicos inferiores y superiores (memorizar – comprender – aplicar – analizar – evaluar – crear), no faltaron las actividades de comprensión, de análisis y de creación. Además, todos los recursos presentaron instrumentos de evaluación, siendo la rúbrica y la lista de comprobación los más empleados.

En cuanto a las propiedades tecnológicas, los diseños fueron realizados en formato cerrado, archivo de texto (n=3) o pdf (n=10), por lo que en principio no cumplen la filosofía REA, modificables y fácilmente editables. No obstante, uno de los itinerarios didácticos presentados se elaboró con el editor de contenidos *eXeLearning*, demostrando una competencia digital notable en el empleo de la herramienta. Sí se consideró el uso y manejo de REA, por lo que en el apartado de fuentes debían citar aquellos materiales educativos digitales en los que se habían inspirados, ya fueran los vistos en clase u otros de los mismos repositorios (n=9), ya fueran otros que no permitían su reutilización (n=4). Además, los estudiantes mostraron habilidades digitales en el empleo de contenidos en diferentes formatos y en la adaptación de algunos de los módulos presentados en los REA analizados, como la elaboración de actividades interactivas mediante cuestionarios de Google o herramientas colaborativas (*Padlet, Lino.it*, principalmente), enlaces a vídeos o audios, y diseño y adaptación de herramientas de evaluación.

3.3. Análisis de las percepciones del alumnado sobre el conocimiento, uso y adaptación de los REA

Finalizadas las clases y el proceso de evaluación del módulo de Lengua se les envió la encuesta de valoración por correo electrónico indicándoles que era voluntaria y anónima. De los 19 estudiantes evaluados, 16 la cumplimentaron.

Los resultados del análisis de la encuesta administrada mostraron, por un lado, un amplio desconocimiento de estos recursos anterior a la intervención realizada y, por otro, manifestaron su aprobación total en el uso de la práctica en el aula y en la recomendación al claustro docente una vez conocidos.

TABLA 1. Conocimiento REA.

PERCEPCIONES SOBRE EL CONOCIMIENTO REA	SÍ	NO	TAL VEZ
Con anterioridad a la formación realizada en el Módulo de Lengua del Máster de profesorado, ¿conocías los Recursos Educativos Abiertos (REA)?	1 (6.3%)	15 (93.8%)	
Ahora que los conoces, ¿los usarías en tus clases?	16 (100%)		
¿Recomendarías el uso de REA a tu futuro claustro de profesorado?	16 (100%)		

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En segundo lugar, con respecto a la adaptación y/o creación de sus propios REA, las respuestas fueron más heterogéneas. La mayoría de los estudiantes afirmó estar capacitado para adaptar estos recursos, pero dudó más sobre su posible creación. La inseguridad a la que aludían estos estudiantes se reflejó también en el resultado de los trabajos presentados y puso de manifiesto que hay que seguir trabajando no solo en la creación sino también en la adaptación de estos materiales.

TABLA 2. Adaptación y creación REA.

PERCEPCIONES SOBRE LA ADAPTACIÓN Y CREACIÓN	SÍ	NO	TAL VEZ
¿Serías capaz de adaptarlos al contexto propio de tu aula?	12 (75%)		4 (25%)
Con los conocimientos que posees, ¿te atreverías a crear tu propio REA?	3 (18.8%)	3 (18.8%)	10 (62.5%)

Con respecto a las ventajas que ofrecía el empleo de los REA en el aula, los estudiantes destacaron principalmente los ítems innovadores, educativos y accesibles, y gratuitos. En menor medida fueron señaladas las ventajas modificables y fácilmente editables, respuestas que estuvieron en consonancia con los objetivos específicos del módulo, el conocimiento de los REA y su uso.

TABLA 3. Ventajas REA.

VENTAJAS REA	RESULTADOS
Educativos	12 (75%)
Gratuitos	10 (62.5%)
modificables	7 (43.8%)
Accesibles	12 (75%)
fácilmente editables	5 (3.1%)
Innovadores	15 (93.8%)

TABLA 4. Desarrollo ODS 4.

DESARROLLO ODS 4	SÍ	NO	TAL VEZ
¿Consideras que los REA favorecen al desarrollo de este objetivo?	13 (81.3%)		3 (18.8%)

La consideración de los REA como materiales que, por su perspectiva abierta e inclusiva, podían favorecer al desarrollo de una educación de calidad era otra de las percepciones de los estudiantes que queríamos conocer. Un amplio porcentaje respondió afirmativamente que los REA sí favorecían el desarrollo de este ODS.

Finalmente, para conocer su opinión sobre la utilidad de estos recursos para su futura labor docente, empleamos una escala de Likert. De los 16 estudiantes, 15 situaron entre importante y muy importante su valoración (25% y 68.8% respectivamente). Un resultado muy positivo, solo 1 estudiante (6.2%) se mostró neutral, teniendo en cuenta la limitación de horas de la formación para trabajar en la adaptación o creación de REA necesaria para la competencia digital de los futuros docentes.

4. DISCUSIÓN Y CONCLUSIONES

En este estudio hemos descrito una propuesta de enseñanza de los REA, basada en la selección y revisión de materiales educativos digitales relacionadas con aspectos lingüísticos, hemos evaluado los resultados obtenidos de los diseños REA como estrategia didáctica y hemos indagado empíricamente sobre las percepciones de los estudiantes respecto a dicha intervención y su futura aplicación en el aula.

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Los resultados indican, en primer lugar, que una formación sobre REA es necesaria debido el desconocimiento de estos materiales, la dificultad para encontrar repositorios y la confusión para diferenciar los REA de otros recursos digitales (Belikov, & Bodily, 2016; Recio Mayorga *et al*., 2021). La mayoría de los estudiantes valoraron positivamente el descubrimiento de los repositorios y los proyectos institucionales sobre REA y apreciaron su utilidad para la futura práctica docente. De hecho, su revisión detallada permitió hacer hincapié en aspectos clave para el desarrollo de su competencia digital docente como la necesidad de vincular el currículo con la práctica docente y prever si el material educativo a emplear es adecuado al contexto del aula o, por el contrario, necesita ser adaptado (Ramírez Terán *et al*., 2022); en cuyo caso, dada las propiedades tecnológicas de los REA —modificables y fácilmente editables—, no supone una barrera. Otro aspecto reseñable es la diversidad de enfoques y estrategias pedagógicas que los REA utilizan (Santos-Hermosa, & Abadal Falgueras, 2022), lo que mostró a los estudiantes propuestas metodológicas que ponen el foco en generar aprendizaje significativo, activo, constructivo y duradero. Este hecho puso de relieve la importancia del binomio formado por la tecnología y la pedagogía, que es clave para lograr las mejoras significativas en el proceso de enseñanza y aprendizaje (Sánchez Rivas *et al*., 2022). Además, la mayoría de los estudiantes destacó los distintos procedimientos de evaluación de los REA, así como los numerosos instrumentos (rúbricas, dianas, listas de comprobación o diarios de aprendizaje) que el CEDEC pone a su disposición (Valdera López, & Alberdi Causse, 2019).

En segundo lugar, sobre los resultados de sus diseños REA, se constató una asimilación de los objetivos que todo REA debe cumplir para un aprendizaje efectivo (Santos-Hermosa, & Abadal Falgueras, 2022). Concretamente, 12 de los 13 trabajos realizados presentaron las directrices establecidas y cumplieron en su mayoría con los ítems propuestos, destacando el enfoque basado en el estudiante y la capacidad para generar aprendizaje. Además, el 69% de los estudiantes puso en práctica el conocimiento de los REA seleccionados y analizados en el aula e hizo uso de los repositorios presentados. En cuanto a los contenidos lingüísticos, los estudiantes en su mayoría supieron combinar la concreción de los aspectos teóricos con una exposición accesible e inteligible para el alumnado que busca que sean capaces de reflexionar críticamente sobre el conocimiento y el uso de su propia lengua (Bosque, & Gallego, 2016; 2018; Durán Rivas, & Rodríguez-Gonzalo, 2020; Marqueta *et al*., 2022).

Por otra parte, los estudiantes mejoraron sus competencias digitales con la búsqueda, descarga y adaptación de algunos de los módulos de contenidos de los REA e incluso se atrevieron a presentar y publicar su diseño con el editor de contenidos *eXeLearning*, demostrando una notable competencia digital.

En tercer lugar, respecto a la intervención realizada, la gran mayoría de los estudiantes consideró muy positiva la aproximación didáctica a los REA. Su conocimiento a partir de la formación realizada hizo que un 100% de los estudiantes afirmara que los usará y recomendará a su futuro claustro de profesorado, lo que interpretamos como un cambio en la cultura escolar (López Gil, & Bernal Bravo, 2016; Recio Mayorga *et al*., 2021); y una muestra de cómo este tipo de intervenciones con mayor planificación en los programas de formación del profesorado pueden ser beneficiosas para reforzar una educación lingüística basada en la implementación de metodologías activas de aprendizaje, uso de recursos tecnológicos y enfoques innovadores (Gómez Carrasco *et al*., 2022).

Con respecto a los resultados sobre la adaptación o creación de REA, la gran mayoría demostró interés, aunque se percibió cierta inseguridad, que achacamos, principalmente, a la falta de competencias digitales

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(Moreno Guerrero *et al*., 2020). De nuevo, consideramos que este tipo de intervenciones requeriría una formación más detenida. No obstante, sí observamos en los resultados de sus diseños REA, que la mayoría de los estudiantes usó los REA y los repositorios vistos en clase y también adecuó las secuencias didácticas a sus contextos de aula, así como sus herramientas de evaluación.

De las valoraciones realizadas sobre los REA, el 50% de los estudiantes destacó su carácter innovador, educativo, accesible y gratuito, y algo más del 80% consideró que favorecen al desarrollo del ODS 4, una educación de calidad. Todo ello nos lleva a sugerir que, además de la apuesta por la práctica digital, el uso de REA supone un cambio en la forma de pensar, sentir y hacer con la tecnología (Recio Mayorga *et al*., 2021; López Esteban, 2022).

En definitiva, podemos concluir que la aproximación realizada a los REA desde el módulo de Lengua fue útil para dar a conocer a estos estudiantes los recursos y sus repositorios, para hacer uso de ellos animándolos a adaptar algunas de sus secuencias y a elaborar sus propios diseños, y para repensar las funciones del docente que se vuelve más activo y donde los escenarios educativos aprovechan la digitalización para una enseñanza más comprometida con los estudiantes, flexible y abierta.

Antes de finalizar, nos gustaría matizar los resultados a la luz de las limitaciones del estudio. Somos conscientes de que el hecho de partir con una muestra inferior a 50 estudiantes de la especialidad de Lengua y Literatura, Latín y Griego de una misma universidad limita el alcance de los resultados que podrían ser muy diferentes si se modifican las condiciones contextuales. Además, el hecho de que hayamos restringido la encuesta de valoración a los estudiantes evaluados por el módulo de Lengua podría ser también otra de las limitaciones. Sin embargo, nuestro interés era una primera aproximación que parte, por un lado, de las buenas prácticas de docentes de Secundaria y Bachillerato; y, por otro lado, de nuestra propia experiencia como docente y creadora de estos recursos. Teniendo en cuenta la escasez de investigaciones en relación con el empleo de REA en la formación inicial del profesorado y, concretamente, en el área de Lengua, consideramos que un conocimiento de estos recursos puede enriquecer la práctica docente, además de abrir un espacio para la reflexión, la actualización, la formación y la innovación docente en la preparación del profesorado (Vaillant, & Marcelo, 2021). La propuesta de intervención aquí presentada no solo puede ser un acicate para el desarrollo de propuestas similares, también puede enriquecer el debate acerca de cómo formar a los futuros docentes en la Educación Abierta, entendiendo que los REA son una pieza fundamental para afrontar los retos con los que, en definitiva, tendrán que enfrentarse los futuros docentes (Santos-Hermosa, & Abadal Falgueras, 2022).

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Impacto del Plan Lector en estudiantes de educación primaria

Impact of the Reading Plan on Primary Education Students

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RESUMEN

El mundo actual se encuentra condicionado no solo por la pandemia derivada de la COVID-19, sino por la facilidad e inmediatez de la información en diversos formatos. En su vertiente escrita, para ser procesada la información, necesita de una lectura previa por parte de las personas. Por ello, la lectura se alza como una habilidad fundamental en la vida social y académica de las personas. Este aspecto se fomenta en los centros educativos por medio de diversas prácticas recogidas en un documento oficial denominado Plan Lector. Los objetivos del presente estudio se centran en conocer la influencia de dicho plan en la motivación, la inteligencia emocional, la fluidez y comprensión lectora del alumnado de educación primaria. Para alcanzar estos objetivos se ha propuesto un diseño de investigación cuasi-experimental de tipo pre-post fundamentado en una metodología cuantitativa. En el estudio han participado 114 estudiantes de educación primaria de un centro educativo de Ceuta (España). La recogida de datos se ha llevado a cabo mediante tres instrumentos validados (Cuestionario de Estrategias Motivadas para el Aprendizaje, Inventario de Inteligencia Emocional de BarOn y el EMLE-TALE 2000). Los resultados revelan que las acciones desplegadas en el plan lector del centro educativo han supuesto mejoras en la fluidez y comprensión lectora. Sin embargo, las actuaciones realizadas no han mejorado la motivación ni la inteligencia emocional de los discentes.

PALABRAS CLAVE Comprensión lectora; fluidez lectora; motivación; inteligencia emocional.

ABSTRACT

The current world is conditioned not only by the pandemic derived from COVID-19, but also by the ease and immediacy of information in various formats. In its written aspect, in order to process the information, it needs prior reading by people. Therefore, reading stands as a fundamental skill in the social and academic life of people. This aspect is promoted in educational centers through various practices included in an official document called the Reading Plan. The objectives of this

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study are focused on knowing the influence of this plan on the motivation, emotional intelligence, fluency and reading comprehension of primary school pupils. In order to achieve these objectives, a quasi-experimental pre-post research design has been proposed, based on a quantitative methodology. 114 primary school students from an educational center in Ceuta (Spain) participated in the study. Data collection has been carried out using three validated instruments (Motivated Strategies for Learning Questionnaire, BarOn Emotional Intelligence Inventory and EMLE-TALE 2000). The results reveal that the actions deployed in the reading plan of the educational center have led to improvements in reading fluency and comprehension. However, the actions carried out have not improved the motivation or emotional intelligence of the students.

KEYWORDS Reading comprehension; reading fluency; motivation; emotional intelligence.

1. INTRODUCCIÓN

La era digital ha afectado drásticamente a la forma en que las personas consumen contenido, adquieren conocimientos y se comunican (Ruiz-Palmero *et al*., 2021). La información se puede adquirir a través de diferentes medios como textos, imágenes, videos y audio (Moreno-Guerrero *et al*., 2021). A pesar de los rápidos avances tecnológicos (Marín-Marín *et al*., 2020), la lectura sigue siendo una de las principales formas de informarse y educarse y, por lo tanto, se considera una habilidad esencial para que los estudiantes la desarrollen y la dominen, ya que no solo conduce al éxito académico, sino que también ayuda a mantener una calidad de vida que le permita convivir en una sociedad cada vez más alfabetizada. En este contexto, las imágenes, ilustraciones e información virtual, así como los libros electrónicos y el material digital pueden afectar a la motivación y comprensión lectora de los estudiantes (Ramos-Navas-Parejo *et al*., 2020; Schallert, 2017). Por lo tanto, para apoyar la lectura, específicamente, y la alfabetización, en general, se han creado varias herramientas de instrucción que capitalizan las tecnologías digitales (Biancarosa, & Griffiths, 2012). A medida que el aprendizaje basado en contenido electrónico se vuelve más popular, la forma en que los estudiantes aprenden a leer, escribir y acceder a la información está cambiando y, al mismo tiempo, las actividades de enseñanza y aprendizaje se inclinan hacia el aprendizaje personalizado y utilizan herramientas como dispositivos digitales, libros electrónicos, para asistir el proceso educativo (Baron, 2017).

La lectura constituye una habilidad cultural fundamental que puede tener un gran impacto en la vida social de una persona (Díaz Díaz *et al*., 2022; García-Delgado Giménez, & Arias Rubio, 2021) y, a menudo, se correlaciona con su rendimiento académico, ya que la mayoría de las materias escolares dependen de sus habilidades de lectura. En consecuencia, es fundamental cultivar, fomentar y promover la habilidad y la voluntad de leer desde la educación temprana (Cáceres Reche *et al*., 2022; Watkins, & Coffey, 2004) ya que las dificultades para aprender a leer pueden tener graves consecuencias en la vida (Hulme, & Snowling, 2012).

Más específicamente, la lectura es multidimensional y consta de demasiados componentes para ser caracterizada por una sola teoría y, por lo tanto, se han examinado varios métodos, teorías y herramientas para evaluar la capacidad de lectura de un individuo (Perfetti, & Stafura, 2013). La comprensión lectora es un elemento fundamental de la educación cuyo impacto, aunque solo se observe indirectamente, afecta a la competencia, el rendimiento y los logros lectores de los estudiantes (Ramos-Navas-Parejo *et al*., 2022).

La comprensión se logra cuando el significado se obtiene a través de la interacción y la participación del lector con la información del texto en función de sus puntos de vista, conocimientos y experiencias actuales (McNamara, & Magliano, 2009). La comprensión lectora puede describirse como el resultado de la

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identificaciónde palabras impresas y la comprensión auditiva. Adicionalmente, la comprensión ocurre como una representación mental del texto y su significado y para que se logre la comprensión se materializan varios procesos cognitivos en los niveles de palabra, oración y texto (Perfetti *et al*., 2005). Por lo tanto, las habilidades cognitivas de los estudiantes que respaldan la comprensión lectora, como las habilidades verbales y las habilidades de descodificación son cruciales.

Dado que la comprensión lectora implica la integración de la información, el razonamiento y la correlación del material relacionado (Kočiský *et al*., 2018), la forma en que los estudiantes leen puede tener un impacto diverso en su aprendizaje, como la velocidad de lectura y la comprensión, así como su vocabulario y conocimiento (Blachowicz, & Ogle, 2017). Específicamente, los estudiantes obtienen más beneficios en su aprendizaje cuando siguen un horario de lectura extenso en lugar de uno intensivo (Suk, 2016). Cuando los estudiantes comienzan a aprender a leer, existe una ligera correlación entre el lenguaje hablado y la lectura, pero a medida que crecen y desarrollan sus habilidades, esta correlación aumenta y se nivela y, como resultado, la comprensión del lenguaje hablado se convierte en el factor limitante en la lectura (Perfetti *et al*., 2005). Por lo tanto, la comprensión y la descodificación del lenguaje son determinantes en la comprensión lectora, en particular, para estudiantes jóvenes (Hjetland *et al*., 2019; Ramos-Navas-Parejo *et al*., 2021). A medida que los lectores maduran, adquieren un vocabulario más amplio y una comprensión más profunda de las estrategias de aprendizaje y se vuelven mejores para resumir y extraer conclusiones (Pearson, & Gallagher, 1983).

Las dificultades en la fluidez lectora traen consigo problemas en la comprensión lectora de textos escritos que se traducen en fracaso escolar (Álvarez-Cañizo *et al*., 2020). De acuerdo con Pikulski y Chard (2005), la fluidez lectora puede considerarse como una habilidad que contribuye al reconocimiento o descodificación efectiva y eficiente de palabras que permite a los lectores construir el significado del texto durante la comprensión lectora silenciosa. Es difícil comprender el significado del texto cuando el reconocimiento de palabras es lento y laborioso. Para facilitar la comprensión lectora, la fluidez lectora se considera esencial, ya que permite a los lectores concentrarse en el significado del texto liberando sus recursos cognitivos (Adlof *et al*., 2006). El uso de intervenciones de componentes múltiples, audiolibros y lectura repetida es una forma eficiente de mejorar la fluidez y la comprensión de la lectura (Stevens *et al*., 2016). Esto es particularmente cierto cuando se trata de estudiantes con problemas de aprendizaje, en cuyo caso la identificación temprana de problemas de lectura y la prestación de asistencia para el desarrollo de habilidades lingüísticas son cruciales (Catts *et al*., 2016). Los tres factores principales superpuestos e interdependientes de la fluidez lectora son la velocidad, la precisión y la expresión. Los estudiantes que logren mejorar en estas tres áreas tendrán una mejor fluidez lectora, comprensión lingüística y reconocimiento de palabras, lo que conducirá a una mejor comprensión lectora (Kim, & Wagner, 2015).

Además de estos factores, la automaticidad y los componentes prosódicos de la lectura afectan a la fluidez y comprensión lectora de los estudiantes de manera diferente según su edad (Calet *et al*., 2013). En este sentido, la dificultad para leer, expresar pensamientos y la distracción conducen a habilidades de lectura deficientes en los primeros años de aprendizaje, principalmente debido a un control inadecuado de la atención (Arrington *et al*., 2014). Del mismo modo, la atención es un factor determinante en la transformación del lenguaje escrito en lenguaje hablado, lo que posteriormente mejora la fluidez lectora (Reynolds, & Besner, 2006). Por lo tanto, la atención enfocada, sostenible, dividida y selectiva son requisitos previos para un aprendizaje efectivo. El uso de actividades para mejorar la atención puede ayudar a mejorar la velocidad de

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lectura, la comprensión, la prosodia y la precisión en el reconocimiento de palabras de los buenos lectores (Yildiz, & Çetinkaya, 2017), que son factores determinantes de la fluidez lectora (Wolf, & Katzir-Cohen, 2001).

La fluidez lectora tiene una relación bidireccional con la comprensión lectora, ya que un aumento en la fluidez se asocia más comúnmente con un aumento en la comprensión (Klauda, & Guthrie, 2008). Cuando se trata de estudiantes de educación primaria, la fluidez lectora constituye un indicador de la comprensión lectora, mientras que la prosodia es un predictor significativo de las habilidades lectoras fluidas. Por lo tanto, al mejorar sus habilidades de lectura, los estudiantes mejoran simultáneamente sus habilidades de comprensión lectora (Başaran, 2013). A medida que los estudiantes pasan de la educación primaria a la secundaria, su fluidez lectora continúa desarrollándose, pero a medida que los textos narrativos y expositivos se vuelven más difíciles de comprender, se debe dar más énfasis a la prosodia y a la adopción de métodos de lectura repetidos para mejorar la fluidez de los estudiantes (Álvarez-Cañizo *et al.*, 2020). A lo largo de los años escolares, las habilidades de descodificación son vitales en la fluidez de lectura tanto oral como silenciosa, que están fuertemente relacionadas con la fluidez de lectura de listas y textos, así como con la comprensión auditiva y lectora. Las relaciones entre todos estos difieren de manera predecible con el desarrollo (Kim *et al.*, 2012).

Por ello, se requieren habilidades cognitivas complejas para que los estudiantes desarrollen su fluidez y comprensión lectora. Además, una mayor motivación y compromiso con la lectura conducen a aumentar los resultados de aprendizaje y los logros de lectura para estudiantes de todos los niveles y de diferentes culturas (Taboada, & Klauda, 2020). Dado que las habilidades cognitivas y la motivación intrínseca por la lectura son contribuyentes importantes en el rendimiento y crecimiento de la comprensión lectora de los estudiantes, deben promoverse a lo largo de su educación (Taboada *et al.*, 2008).

En consecuencia, es importante integrar programas de motivación lectora en el plan de estudios para mejorar las habilidades lectoras y la motivación de los estudiantes y para evitar que se produzca una disminución de la motivación de los estudiantes jóvenes, ya que podría predecir su futura afición a la lectura. Como la motivación es esencial en las actividades de lectura, la motivación por la lectura afecta positivamente la comprensión lectora de los estudiantes y los alienta a desempeñarse mejor, hacer conjeturas fundamentadas, resolver dificultades o problemas de lectura y reducir la ansiedad de comprensión (Ahmadi *et al.*, 2013). Según Miyamoto *et al.* (2019), los estudiantes que están intrínsecamente motivados para leer lo hacen porque disfrutan y están interesados en el proceso de lectura, por lo que existe una asociación positiva y efectos significativos entre la motivación intrínseca y la comprensión lectora. Por otro lado, los alumnos extrínsecamente motivados leen por razones instrumentales. Como resultado, la motivación extrínseca no se relaciona significativamente con su comprensión lectora.

Otro factor determinante es la inteligencia emocional. Esta se puede considerar como un tipo de inteligencia social que contribuye al bienestar de uno, ya que se refiere a la evaluación y expresión verbal y no verbal de las emociones, la identificación precisa y la regulación eficiente del afecto dentro de uno mismo y de los demás y el uso de información emocional para mejorar el pensamiento, la resolución de problemas y las acciones propias (Mayer, & Salovey, 1993). En particular, la inteligencia emocional se puede describir como la capacidad de identificar, comprender, expresar, regular y usar las emociones para razonar con precisión con las emociones y utilizarlas para mejorar el pensamiento (Kotsou *et al.*, 2018). La inteligencia emocional utiliza habilidades que combinan la inteligencia con las emociones, como la percepción, evaluación,

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manejo, comprensión y conocimiento emocional, así como la utilización de las emociones para facilitar el proceso de pensamiento. Por lo tanto, la inteligencia emocional tiene un gran impacto en la salud física y psicológica, las relaciones sociales, así como los logros laborales y académicos (Nelson, & Low, 2011).

Cuando se trata del rendimiento en la lectura de los estudiantes, existe una relación directa y positiva de la inteligencia emocional con la comprensión y fluidez lectora, con los hábitos de lectura, con el dominio del vocabulario y con las habilidades lectoras en general, ya que los estudiantes con mayor inteligencia emocional tienden a desempeñarse mejor en las tareas de lectura (Resmisari, & Sitepu, 2022).

1.1. Justificación y objetivos

Como se ha reflejado, el fomento y desarrollo de hábitos de lectura resulta fundamental para los procesos formativos y madurativos del discente. No obstante, esto se ha visto afectado en los últimos años debido a la pandemia originada por la COVID-19 que ha condicionado fuertemente las acciones instructivas (Corell-Almuzara *et al*., 2021; Trujillo *et al*., 2020). Para paliar los efectos de la pandemia a nivel educativo han proliferado numerosos recursos remotos para poder efectuar los procesos de enseñanza y aprendizaje de manera ubicua y segura (López-Belmonte *et al*., 2021; Pozo-Sánchez *et al*., 2021). En este sentido, la pandemia a nivel educativo ha derivado en una gran aparición de recursos didácticos mediados por la tecnología, para continuar con la práctica educativa desde diversos medios y entornos de trabajo motivadores y autónomos (Bautista-Vallejo, & Hernández-Carrera, 2020; Marín-Marín *et al*., 2021; Pozo-Sánchez *et al*., 2022), facilitando la tarea y adecuándose a las distintas capacidades y necesidades de los estudiantes (Carmona-Serrano *et al*., 2021) a través de prácticas interactivas e inmersivas (López-Belmonte *et al*., 2022). Fruto de ello, en este estudio se presentan los principales hallazgos tras el diseño, implantación y desarrollo de un plan lector confeccionado por un centro educativo desde una vertiente innovadora, teniendo en cuenta las bondades de las TIC expuestas.

Los objetivos que conducen la realización de este trabajo son los siguientes: a) Conocer la influencia del plan lector en la motivación de los estudiantes; b) Descubrir la determinación del plan lector en la inteligencia emocional de los discentes; c) Demostrar la incidencia del plan lector en la fluidez y comprensión lectora del alumnado.

2. MATERIAL Y MÉTODO

2.1. Diseño de investigación

Este estudio se ha sustentado en una metodología de investigación cuantitativa. Concretamente, se ha desplegado un diseño de investigación cuasi-experimental de naturaleza pre-post. Todo ello siguiendo las consideraciones de los expertos para evitar sesgos durante su desarrollo (Hernández *et al*., 2014).

2.2. Participantes

Del total de 130 estudiantes que han realizado las pruebas pre y post, se ha llevado a cabo el análisis con 114, siendo eliminado un estudiante que no realizó el pretest y quince que no realizaron el postest. Este estudio

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se realizó en el Centro de Educación Infantil y Primaria (CEIP) Mare Nostrum (Ceuta, España). De esta cifra, 58 son chicos y el resto chicas de educación primaria que presentan una media de edad de 10.3 años (DT = 0.676). Estos participantes fueron seleccionados por medio de una técnica de muestro intencional. En cuanto al tamaño de la muestra, los expertos consideran que el número de sujetos participantes en esta investigación es adecuado para efectuar el diseño planteado y alcanzar resultados pertinentes (Chou, & Feng, 2019).

2.3. Instrumentos

La recogida de datos se ha producido mediante diversos instrumentos validados y que reúnen adecuadas propiedades psicométricas:

- *Motivated Strategies for Learning Questionnaire* (MSQL) que analiza la motivación intrínseca y extrínseca de los estudiantes en la aplicación de estrategias pedagógicas. Dicho instrumento está compuesto por dos dimensiones (intrínseca y extrínseca), de cuatro ítems cada una (Bonanomi *et al.*, 2020).
- Inventario de Inteligencia Emocional de BarOn: versión para jóvenes (EQ-i:YV) que analiza la inteligencia emocional de los estudiantes. El instrumento está conformado por 60 ítems, agrupados en cuatro dimensiones (intrapersonal, interpersonal, manejo del estrés y adaptabilidad) (Serrano, 2017).
- Escalas Magallanes de Lectura y Escritura (EMLE-TALE 2000) que está formado por cuatro sub-tests: lectura en voz alta (conversión grafema-fonema y fluidez), comprensión lectora, copia y dictado (Toro *et al.*, 2000).

2.4. Procedimiento y análisis de datos

Esta investigación se ha desarrollado en cuatro fases. La primera fase comenzó con la solicitud de los permisos necesarios a la Dirección Provincial del Ministerio de Educación y Formación Profesional (MEFP) de la ciudad donde se encuentra el centro educativo en cuestión y, al mismo tiempo, la solicitud del Comité de Ética por la Universidad competente. Una vez obtenidos los permisos y la aprobación de dicho Comité, se pasó a la segunda fase del estudio, la primera medición (pretest), para conocer el punto de partida de los estudiantes en las diferentes dimensiones analizadas. Esta medida se realizó en el mes de septiembre de 2021. La tercera fase consistió en la realización de las diferentes propuestas formativas innovadoras recogidas en el plan lector de dicho centro educativo (https://cutt.ly/8L8qoee). Por último, se efectuó la segunda medición (postest), con la finalidad de poner de relieve el impacto que ha tenido dicho plan. En este caso, la medida se efectuó en el mes de marzo de 2022.

El análisis de datos se ha llevado a cabo mediante el programa *Statistical Package for the Social Sciences* (SPSS) en su versión 28. Se han efectuado pruebas de carácter descriptivo, tales como la media, desviación típica, el error típico de la media, asimetría, curtosis y el coeficiente de varianza para revelar la tendencia de la distribución. Además, se ha utilizado la prueba *t* de Student para comparar las medias entre los momentos de medición.

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3. RESULTADOS

A continuación, se muestran los principales resultados obtenidos en el estudio. Las medias obtenidas revelan cómo los valores de las dimensiones de motivación e inteligencia emocional se mantienen parejos en las medidas pretest y postest. En cambio, en las dimensiones de fluidez y comprensión lectora sí se observan diferencias significativas. Asimismo, los valores de las medias en las medidas postest son superiores a las medias de las medidas pretest (tabla 1).

TABLA 1. Datos descriptivos de las medidas pretest y postest.

	GRUPO	M	DT	CAF	C_{me}
MOTIVACIÓN	PRE	4.17	.670	-1.627	4.402
	POST	4.21	.599	-2.395	9.305
INTELIGENCIA EMOCIONAL	PRE	2.98	.297	-.098	1.562
	POST	2.97	.280	.182	-.443
LECTURA Y ESCRITURA					
-Fluidez lectora	PRE	103.61	33.588	.357	.443
	POST	117.52	31.363	-.296	.089
-Comprensión lectora	PRE	1.89	.688	2.307	10.103
	POST	2.92	1.488	.039	-1.426

M=media; DT=desviación típica; CAF=asimetría; C_{me}=curtosis.

TABLA 2. T de Student para muestras relacionadas.

	t	gl	Sig.
MOTIVACIÓN	-.584	113	.560
INTELIGENCIA EMOCIONAL	.223	113	.816
LECTURA Y ESCRITURA			
-Fluidez lectora	-8.613	113	.000
-Comprensión lectora	-6.508	113	.000

t=t de Student; gl=grado de libertad; Sig.=significatividad.

Según se establece en la tabla 2, hay diferencias significativas en las dimensiones de fluidez y comprensión lectora, siendo estos valores superiores en las medidas postest que en las medidas pretest.

La tabla 3 indica que las medias obtenidas tanto en la motivación intrínseca como en la motivación extrínseca son parejas, tanto en las medidas pretest como postest. Del mismo modo, se aprecian valores ligeramente superiores en la motivación extrínseca, concretamente en las medidas postest.

TABLA 3. Datos descriptivos de las medidas pretest y postest en la motivación intrínseca y extrínseca.

	GRUPO	M	DT	CAF	C_{me}
MOTIVACIÓN INTRÍNSECA	PRE	3.98	.793	-1.240	2.053
	POST	3.98	.659	-1.385	2.754
MOTIVACIÓN EXTRÍNSECA	PRE	4.35	.715	-1.692	4.178
	POST	4.44	.724	-2.336	7.695

M=media; DT=desviación típica; CAF=asimetría; C_{me}=curtosis.

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En la tabla 4 se comprueba que las diferencias no son estadísticamente significativas, por lo que no hay cambios en la motivación intrínseca y en la motivación extrínseca en las medidas de pretest y postest.

TABLA 4. T de Student para muestras dependientes.

	t	gl	Sig.
MOTIVACIÓN INTRÍNSECA	.080	113	.936
MOTIVACIÓN EXTRÍNSECA	-1.174	113	.243

t=t de Student; gl=grado de libertad; Sig.=significatividad.

Los datos mostrados en la tabla 5 reflejan las dimensiones de la inteligencia emocional. En este caso, se observan diferencias de medidas en el estado de ánimo general y en el manejo del estrés, pero con tendencias distintas. En el primer caso, el estado de ánimo es superior en las medidas pretest que en las medidas postest. En cambio, en el manejo del estrés, es ligeramente superior en las medidas postest que en las medidas pretest. En el resto de dimensiones, los valores son parejos.

TABLA 5. Datos descriptivos de las medidas pretest y postest de la inteligencia emocional.

	GRUPO	M	DT	CAF	C_{me}
ESTADO ÁNIMO GENERAL	PRE	3.38	.410	-1.068	.858
	POST	3.29	.441	-1.313	2.212
ADAPTABILIDAD	PRE	3.09	.509	-.431	.006
	POST	3.10	.499	-.097	-.422
MANEJO ESTRÉS	PRE	2.38	.540	.636	.284
	POST	2.51	.500	.340	-.146
COMPETENCIA INTERPERSONAL	PRE	3.31	.404	-.414	-.140
	POST	3.29	.423	-.479	-.027
COMPETENCIA INTRAPERSONAL	PRE	2.55	.638	.058	.130
	POST	2.51	.602	.011	-.531

M=media; DT=desviación típica; CAF=asimetría; C_{me}=curtosis.

Según lo establecido en la tabla 6, se observan diferencias estadísticamente significativas en las dimensiones de estado de ánimo general y en el manejo del estrés. En la primera dimensión, los valores son superiores en las medidas pretest y en la segunda dimensión es superior en las medidas postest.

TABLA 6. T de Student para muestras dependientes.

	t	gl	Sig.
ESTADO ÁNIMO GENERAL	2.518	113	.013
ADAPTABILIDAD	-.252	113	.801
MANEJO ESTRÉS	-2.490	113	.014
COMPETENCIA INTERPERSONAL	.464	113	.643
COMPETENCIA INTRAPERSONAL	.544	113	.588

t=t de Student; gl=grado de libertad; Sig.=significatividad.

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4. DISCUSIÓN Y CONCLUSIONES

No cabe duda de que en la sociedad actual la lectura sigue siendo una de las principales formas de percibir toda la ingente cantidad de información que discurre por distintos medios. Medios que han proliferado con el avance de la tecnología y de los cambios que ha producido en la sociedad el impacto de la COVID-19, en el que se han digitalizado numerosas acciones que anteriormente se efectuaban más tradicionalmente, como el soporte en papel o la presencialidad (Corell-Almuzara *et al.*, 2021).

Los centros educativos no son ajenos a la situación actual a la que se enfrentan los estudiantes, como futuros agentes activos de una sociedad que se encuentra en constante transformación. Por lo que los discentes deben estar preparados y formados para desenvolverse con eficacia en un mundo cambiante (López-Belmonte *et al.*, 2022). En este sentido, para lograr que el alumnado alcance niveles competenciales adecuados en la lectura, los centros educativos deben incentivar el fomento de proyectos innovadores que lleven a cabo distintas propuestas formativas para motivar a los estudiantes en lo concerniente a la lectura (Schiefele *et al.*, 2012).

Asimismo, resulta fundamental, como se ha efectuado en este estudio, la puesta en práctica desde edades tempranas de proyectos escolares vinculados al desarrollo de la lectura en sus diferentes vertientes (comprensión y fluidez lectora), así como el gusto por ella y el trabajo de la inteligencia emocional (Watkins, & Coffey, 2004).

A la vista de los hallazgos alcanzados, en consonancia con Pearson y Cervetti (2017), el diseño e implantación de proyectos lectores en centros educativos, contribuye al desarrollo de la comprensión y fluidez lectora en los estudiantes, como se ha vislumbrado en esta investigación. En esta línea juega un papel fundamental la motivación, tal y como expone Miyamoto *et al.* (2019), quien defiende la teoría de que la motivación resulta fundamental para mejorar todo el proceso y ello se consigue mediante prácticas novedosas e innovadoras para el alumnado, con la finalidad de captar su atención y desarrollar el gusto por la lectura (Ahmadi *et al.*, 2013). En cambio, los resultados revelan que, en este caso, la motivación no ha incidido en la mejora de la comprensión y fluidez lectora, sino que estas se han visto incrementadas con unos índices de motivación constantes, tanto en la medición pretest como en la postest. Igualmente ocurre con la inteligencia emocional. Resmisari y Sitepu (2022) recientemente postularon la relación directa y positiva entre la inteligencia emocional y la comprensión y fluidez lectora. Sin embargo, en este estudio, no se han obtenido los mismos resultados, no habiendo relación entre ellas.

Se concluye que los estudiantes analizados, después de desarrollar las acciones aplicadas en el Plan Lector, han mejorado en la fluidez y en la comprensión lectora. En cambio, la motivación y la inteligencia emocional mantienen valores semejantes en las medidas pretest y postest.

El estudio realizado presenta como principal limitación la especificidad de la muestra. Es por ello que los resultados alcanzados en esta investigación deben tomarse con cautela. Se trata de un estudio de caso focalizado en un centro educativo con unas determinadas peculiaridades socioculturales de los participantes. No obstante, este aspecto contribuye al enriquecimiento de las características de los discentes, al tener cabida distintas culturas y religiones en la investigación. Como futura línea de estudio, se pretende abarcar

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una población más amplia de estudiantes, contando con la participación de diversos centros educativos de España y, a su vez, abarcando distintas etapas educativas.

Del mismo modo, esta investigación refleja una serie de implicaciones, tanto teóricas como prácticas. A nivel teórico, este trabajo ha supuesto el aumento del interés por ahondar en el estado de la cuestión, reflejando el estado de arte actual y mostrando a los lectores interesados en este foco temático cuales son las nuevas bases de conocimiento con los que apoyar futuras investigaciones. A nivel práctico, los hallazgos han mostrado como han influido las distintas propuestas del Plan lector en las dimensiones tenidas en cuenta en este trabajo, marcando un primer paso y dejando la puerta abierta a que miembros de la comunidad científica puedan seguir con la senda iniciada en este estudio, con la finalidad de discutir y contrastar los resultados aquí expuestos, así como incorporar otras dimensiones que puedan resultar pertinentes en todo Plan lector. Del mismo modo, este estudio ha derivado en la creación de un manual con diversas propuestas para fomentar las distintas dimensiones aquí analizadas, con el propósito de aumentar los recursos disponibles al alcance del profesorado sobre el estado de la cuestión.

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Personalidad, *Burnout* y Competencia Digital en el profesorado universitario. Un acercamiento a la realidad actual

Personality, Burnout and Digital Competence in University Professor, an Approach to the Current Reality

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RESUMEN

La investigación sobre docentes universitarios, requiere a día de hoy una mayor profundidad con respecto a la relación entre la personalidad, la docencia y el *burnout*. Este último es un fenómeno muy estudiado en docentes de otras etapas educativas. Son muchas las investigaciones que han profundizado en el efecto del *burnout* en el profesorado, dado que esta población es especialmente vulnerable a desarrollarlo debido a los componentes afectivos y emocionales inherentes al perfil profesional. Por otro lado, la competencia digital es otro fenómeno que se ha visto expuesto durante estos últimos años. En este sentido, distintos estudios hacen referencia a las diferentes destrezas relacionadas con el uso de las herramientas y tecnologías en el contexto del aula. Para el desarrollo del estudio se ha utilizado una batería de cuestionarios entre los que se incluyen; el Cuestionario de Personalidad 16 PF, el Maslach Burnout Inventory (MBI) y Cuestionario sobre la Competencia Digital del Profesorado de la Educación Superior Española. Los resultados a partir del análisis de datos mediante el programa estadístico SPSS mostraron que no existen diferencias significativas en cuanto a sexo y *burnout* se refiere. Por otro lado, se ha observado una relación positiva entre la despersonalización y el cansancio emocional con el sentimiento de autosuficiencia. Además, se observa una relación positiva entre la escala de tensión nerviosa con la despersonalización. En cuanto a la competencia digital, se ha encontrado una relación también positiva entre la realización personal con el uso de las TIC en el aula y también con una actitud positiva hacia las TIC. Se observa la necesidad de ampliar la investigación en cuanto a la personalidad en el docente universitario. Del mismo modo que el estudio del *burnout* en esta etapa educativa y la importancia de una buena competencia digital en el profesorado de educación superior actual.

PALABRAS CLAVE Personalidad; *burnout*; competencia digital; profesorado universitario; cansancio emocional.

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ABSTRACT

Research on university teachers today requires greater depth regarding the relationship between personality, teaching and burnout. The latter is a well-studied phenomenon in teachers of other educational stages. There are many investigations that have delved into the effect of burnout in teachers, given that this population is especially vulnerable to developing it due to the affective and emotional components inherent to the professional profile. On the other hand, digital competition is another phenomenon that has been exposed in recent years. In this sense, different studies refer to the different skills related to the use of tools and technologies in the classroom context. For the development of the study, a battery of questionnaires has been used, including; the 16PF Personality Questionnaire, the Maslach Burnout Inventory (MBI) and the Digital Competence Questionnaire of Spanish Higher Education Teachers. The results from the data analysis using the statistical program SPSS showed that there are no significant differences in terms of gender and burnout. On the other hand, a positive relationship has been observed between depersonalization and emotional exhaustion with the feeling of self-sufficiency. In addition, a positive relationship is observed between the nervous tension scale with depersonalization. Regarding digital competence, a positive relationship has also been found between personal fulfillment with the use of ICT in the classroom and also with a positive attitude towards ICT. The need to expand research regarding personality in university teachers is observed. In the same way as the study of burnout in this educational stage and the importance of good digital competence in current higher education teachers.

KEYWORDS Personality; burnout; digital competence; university teachers; emotional exhaustion.

1. INTRODUCCIÓN

1.1. Personalidad y profesorado universitario. Variables que influyen en el trabajo docente

El mundo educativo actual está en continuo cambio y, a diferencia de etapas anteriores, actualmente el alumnado requiere de sus docentes ya no solo conocimientos, sino también, nuevos métodos, contenidos, y espacios de aprendizaje (UNESCO, 2015). Concretamente, se precisa un modelo de profesional que sirva de modelo en ciertos aspectos ya no solo cognitivos, sino también de competencias y características de personalidad (Pastor, 2016).

Cattell *et al*. (2011) entienden la personalidad como aquello que nos dice lo que una persona hará cuando se encuentre en una situación determinada. Lo que una persona hace (R o respuesta) es función de la situación (S) y de su personalidad (P). Para estos autores, el elemento estructural básico de la personalidad es el rasgo que indica nuestras tendencias reactivas generales y hace referencia a características relativamente permanentes. En su teoría, Cattell *et al*. (2011) explicaba que era necesario realizar una descripción y taxonomía sistemática de las diferencias individuales. El test más conocido y usado de Cattell *et al*. (2011) es el de los 16 factores de personalidad, con el que se miden las diferencias de la personalidad de la población en su conjunto. Según Páramo *et al*.(2019), estudiar los rasgos de personalidad asociados a los docentes universitarios puede tener un valor terapéutico, pues utilizando las herramientas de evaluación adecuadas se podría favorecer un diagnóstico más preciso y un tratamiento más eficaz, en orden a la producción de mayores niveles de satisfacción en la tarea docente universitaria, ya que además existe suficiente evidencia empírica que muestra que el constructo de personalidad constituye un importante predictor del desempeño en todo tipo de ocupaciones (Barrick *et al*., 2001).

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El profesorado universitario desempeña varias funciones dentro de su ámbito, para las cuales, ciertos rasgos de personalidad pueden actuar como facilitadores o todo lo contrario. Las funciones en las que se van a desenvolver los profesores giran alrededor de cuatro ejes: docencia (actividades relativas al intera-prendizaje), investigación (actividades que conducen a la búsqueda del saber teórico o práctico), extensión (actividades que tienden a la proyección social) y de gestión académica. Entendemos entonces que las ha-bilidades que están detrás de un buen desempeño en el área de docencia no necesariamente van a ser las mismas que las necesarias para ser un buen investigador. A pesar de la importancia que supone, conocer y reconocer las habilidades necesarias para un correcto desempeño, se puede encontrar en la revisión de la literatura poco material y no muy reciente, que explore la relación entre los rasgos de personalidad y el desempeño del profesorado, a la tolerancia al estrés o capacidad de adaptación a las nuevas tecnologías y lo que ello le supone. Schnitzius *et al*. (2019) afirmaron que la personalidad es una de las cuestiones más im-portantes por las que los estudiantes deciden quien es un buen docente. También el profesorado considera que algunos rasgos de personalidad pueden mejorar la enseñanza, como por ejemplo, las personas que se consideran con alta autoeficacia, esperanza, optimismo y personas capaces de adaptarse a situaciones complicadas (Huang *et al*., 2015).

Shaughnessy *et al*. (1995) encuentran en su trabajo que los rasgos de autosuficiencia y creatividad son identificados como características de personalidad de los profesores exitosos. Cuando hablamos de autosu-ficiencia, nos estamos refiriendo a personas individualistas que prefieren estar solas y tomar las decisiones por su cuenta, siendo el polo contrario aquella persona social o gregaria que prefiere estar rodeada de gente y que le gusta hacer las cosas con otros. Más recientemente, Cabezas y Mancheno (2008) concluyen en su trabajo que los profesores de alto rendimiento tienen las siguientes características en sus factores de per-sonalidad: presentan un pensamiento abstracto, son más aventureros (extrovertidos) que conservadores, y son más emotivos que prácticos. Por otro lado, los profesores de bajo rendimiento presentan un pensa-miento concreto, son más conservadores que aventureros y son más prácticos que emotivos.

En cuanto al *burnout*, cuya traducción sería "estar quemado", y ha sido reconocido por la OMS e incluido en el (CIE-11) como un fenómeno específicamente ocupacional. Además, fue introducido por Freudenber-ger a mediados de los años setenta para dar una explicación al proceso de deterioro en el trabajo de los profesionales en organizaciones de servicios (Freudenberger, 1974) y se lo asocia a diferentes consecuen-cias como el absentismo, problemas de salud, incremento de accidentes laborales, bajo rendimiento en el desempeño laboral y depresión (Bottiani *et al*., 2019; Herman *et al*., 2018). Para Maslach y Jackson (1997), el síndrome del quemado es un proceso de estrés crónico, el cual podemos dividir en tres grandes aspectos:

- Cansancio emocional, caracterizado por la pérdida progresiva de energía, de recursos personales de adaptación, desgaste y agotamiento.
- Despersonalización, manifestada por un cambio negativo de actitudes que lleva defensivamente a adoptar un distanciamiento frente a los problemas.
- Sensación de falta de realización profesional, donde se dan respuestas negativas hacia sí mismos y hacia el trabajo en el que se muestra como una fuerte insatisfacción interna, baja autoestima y fuerte autocuestionamiento.

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Todo ello provoca un círculo vicioso en la persona en forma de retroalimentación negativa: agotamiento físico y psíquico, despersonalización en el sentido de la deshumanización y una visión negativa, escéptica o cínica de sí mismos y los propios logros, con una moral baja, un detrimento y descenso de la productividad en el trabajo y sentimientos de fracaso y frustración, percibiendo escasa o nula realización personal (Bencomo *et al*., 2004).

Son muchas las investigaciones que han estudiado el efecto del *burnout* en el profesorado, dado que esta población es especialmente vulnerable a desarrollar el síndrome de *burnout* debido a los componentes afectivos y emocionales inherentes al perfil profesional. En el estudio de Vicente y Garabi (2019), concluyen que existen factores protectores frente al *burnout* como la resiliencia, el positivismo, las estrategias de afrontamiento constructivas, la tolerancia a la frustración, el locus de control interno y la autoeficacia, además está asociado a acontecimientos externos (Casali, & Torres, 2021). En este sentido, la enfermedad del coronavirus denominada COVID-19 ha sido considerada un estresor potencial, capaz de provocar una crisis de salud mental pública global de dimensiones sin precedentes (Pfefferbaum, & North, 2020). Esto ha requerido de la adaptación de todos los docentes y alumnos a la nueva realidad, provocando cambios educativos drásticos, que tanto los docentes como los alumnos debieron enfrentar sin estar adecuadamente preparados. Esta situación les causó numerosas dificultades (Gupta, & Pathania 2021) y son muchos los docentes que interpretan esta transmisión como una carga adversa y estresante (Quezada *et al*., 2020).

La pandemia derivada de la COVID 19, y las posteriores medidas de contención y limitaciones, hicieron evidente la gran necesidad, hoy en día, de aplicar las tecnologías en la docencia y en el proceso de enseñanza – aprendizaje (Nicola *et al*., 2020). Así pues, la innovación en educación se asocia a ciertos recursos tecnológicos (p.e: pizarras digitales, ordenadores, *tablets*, etc.), que en numerosas ocasiones se relacionan con las nuevas metodologías (plataformas virtuales, e-learning) y su uso también está marcado por las características de la personalidad de los docentes que las vayan a emplear, y viceversa (Ortega *et al*., 2007; Ortega *et al*., 2021).

Diferentes estudios, como los de Ríos (2004; 2006a; 2006b; 2009) muestran cuáles son las características de personalidad que en mayor medida se hallan en personas docentes innovadoras:

- Persistentes, resistentes, metódicas y planificadoras (2004).
- Con alta motivación pedagógica y social (2006a).
- Realistas, prácticas, no interesadas en lo que no creen que es útil, les encanta organizar y dirigir actividades y emplean más el pensamiento para su vida exterior y la sensación de su vida interior (2006b).
- Cercanas y afectuosas, cariñosas y alegres, sobreprotectoras, y consecuentes y honestas (2009).

Otros autores, como Mongue *et al*. (2015), plantean desde la teoría del rasgo de Cattell que los docentes innovadores puntúan, por un lado, bajos en dominancia y en autosuficiencia y, por otro lado, puntúan altos en atrevimiento, abstracción, y que son especialmente abiertos al cambio.

1.2. Competencia digital y profesorado universitario

Levis (2011) y Prendes (2011) afirmaron que uno de los retos de las universidades en vías de transformar el viejo paradigma educativo, era lograr una efectiva integración de las TIC en los procesos de enseñanza y de

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aprendizaje. En este sentido, a través de la revisión de la literatura se han confirmado ciertas necesidades en cuanto a la formación de los docentes universitarios con relación a las TIC, pero también es un hecho fehaciente la actitud positiva que existe hacia ellas y como a lo largo de los años se ha ido mejorando la integración en la labor docente (Agreda *et al.,* 2016).

Resulta fundamental diferenciar entre la alfabetización digital y la competencia digital. Muchos son los autores que han desarrollado ambos conceptos. Según Biel y Álvarez (2019), la competencia digital docente es el objetivo que debería lograr todo profesor, mientras que la alfabetización digital es el camino que hay que seguir para lograr llegar al objetivo. Incluyendo la alfabetización digital desde los niveles curriculares más bajos, tanto en la formación docente como en la de los discentes, será más viable alcanzar la meta de adquirir una competencia digital alineada a la sociedad actual.

En el caso que nos ocupa, la Competencia Digital puede entenderse como una forma de usar las tecnologías, así como comprender el impacto de ellas en el mundo digital, promoviendo su integración óptima (S.A. NMC, 2017). Según Guillén-Gámez *et al*. (2022), la Competencia Digital Docente, hace referencia a las diferentes destrezas relacionadas con el uso de las herramientas y tecnologías en el contexto de aula. Está relacionada con todas aquellas habilidades, actitudes y conocimientos requeridos por los docentes en un mundo digitalizado. Autores como Amador *et al*. (2017) confirman a través de sus investigaciones que en el contexto actual de formación, el profesorado universitario se encuentra con el gran desafío de afrontar su cambio de rol, asumiendo que, además de la función docente vinculada al contenido, ha de desarrollar sus competencias para "guiar, asesorar y crear espacios y oportunidades para que el alumnado pueda desarrollar las competencias profesionales", estando así "inmerso en un proceso de reflexión y análisis de sus propias prácticas docentes" (pp. 13-14).

Según Moreno (2020) y Zubillaga y Gortazar (2020), esta nueva situación derivada de la COVID- 19 ha magnificado cuatro brechas:

- La brecha de acceso por la escasa universalización de la tenencia de dispositivos electrónicos y/o conectividad a internet.
- La brecha de uso está relacionada con la calidad y el tiempo de uso de dispositivos e Internet, puesto que existen hogares que a pesar de contar con los dispositivos, estos son compartidos por los miembros de la unidad familiar.
- La brecha de competencias, relacionada con las competencias digitales del profesorado y del alumnado para saber utilizar de forma óptima las plataformas digitales con fines educativos, así como la capacidad de creación de contenidos y acciones educativas a través de estas. Los docentes en activo y también en formación, tienen en general mejor establecidas las metas de funciones básicas como la comunicación o la alfabetización digital, pero no es así con las funciones de creación de contenidos o la resolución de problemas, en las que se puede observar una mayor dificultad general (Gabarda *et al.*, 2021).

Y según Ortega *et al*. (2021), además una cuarta: la brecha de género, que tiene que ver con las desigualdades que sufren históricamente las mujeres a la hora de acceder a diferentes profesiones y cargos de responsabilidad.

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Un estudio realizado por Guillén-Gámez *et al*. (2021) con una muestra de 867 profesores de Educación Superior de todo el territorio español arroja que los docentes cuentan con un nivel competencial medio respecto al uso de tecnologías digitales en las prácticas de enseñanza-aprendizaje. En este sentido, tal y como indican los autores de la investigación, resulta significativo por los momentos que se están viviendo a raíz de la crisis generada por el COVID19 que el uso de plataformas de contenidos fuera bajo. Según Saez (2010), "las actitudes de los docentes hacia un uso de las tecnologías, se convierten en un factor esencial para la inclusión de las TIC en los contextos educativos" (p.40). Tal y como indica Echeverría (2000), es necesario que el docente esté capacitado, no sólo para aplicar las tecnologías a los procesos educativos, sino también para diseñar nuevos escenarios donde los alumnos puedan aprender a moverse e intervenir con las TIC, además es necesario que el profesorado adquiera estrategias para que los estudiantes desarrollen sus habilidades a través de las TIC (Colás *et al*., 2019).

Autores como Finley y Hartman (2004) exponen esta idea:

los profesores experimentan con la integración de la tecnología si creen si es coherente con su estilo de enseñanza, si sienten que están bien cualificados y se sienten competentes, si son apoyados y recompensados por hacerlo, y si pueden ver que es pedagógicamente útil (p. 328-329).

Por otra parte, Badia *et al*. (2016), afirman que "la influencia positiva de la percepción del profesor de los beneficios instruccionales de las tecnologías y la frecuencia de su uso en las aulas ha sido probada por investigaciones específicas" (p. 96). No siendo fácil el buen uso de las tecnologías en el aula, ya que se requiere que el docente sea capaz de saber acceder a los datos, saber explotar datos de calidad y también analizar, trabajar y reutilizar los datos (Rivas *et al*., 2019). Además, Zempoalteca *et al*. (2016) subrayan que puede haber una relación entre la edad de los docentes y la forma en que se favorece el desarrollo de estas competencias. En su estudio indican que los docentes mayores de 55 años son más dependientes de la educación formal para el desarrollo de estas competencias tecnológicas. Además, Zempoalteca *et al*. (2016) también observaron que hay una potencial relación entre el grado académico y el desarrollo de las competencias digitales. Atendiendo a este extremo, Perdomo *et al*. (2020) llevaron a cabo una revisión sistemática siguiendo los protocolos metodológicos recomendados con el objetivo de describir el tratamiento que los diferentes autores han dado al estudio durante estos años sobre las competencias digitales en docentes universitarios en la última década.

2. MATERIAL Y MÉTODO

2.1. Método

Se trata de un estudio cuantitativo, ex post facto y de estrategia prospectiva, con un solo tiempo de medida. La muestra se extraerá mediante muestreo por conveniencia entre la población docente universitaria de diversas universidades españolas y diversas titulaciones. La recogida de datos se llevará a cabo mediante una encuesta online.

Se llevaron a cabo análisis descriptivos/exploratorios de las principales variables, también se llevaron a cabo análisis correlacionales y comparación de medias mediante pruebas T. Se utilizaron para los cálculos estadísticos necesarios el programa SPSS versión 25.

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El presente proyecto se rige por los principios de la Declaración de Helsinki, recogiendo el consentimiento informado de los participantes. El protocolo de evaluación ha sido validado por el comité de ética de la Universidad Internacional de Valencia.

2.2. Muestra

La muestra está compuesta por 100 profesores y profesoras de universidad de distintas áreas de conocimiento (educación, salud, empresa, humanidades y ciencias). En cuanto al sexo, la muestra está compuesta por 68 mujeres y 32 hombres, la edad de los profesores y profesoras oscila entre 22 y 69 años, con una media de 41.67 años (DT: 9.14).

2.3. Instrumentos

La batería de preguntas estaba compuesta por un cuestionario con preguntas para conocer las principales características en cuanto a sexo, experiencia profesional, formación previa, etc., y tres cuestionarios específicos que se explican a continuación.

Cuestionario de personalidad 16PF5

Está compuesto por 185 ítems con tres alternativas de respuesta. Como medida de personalidad de amplio espectro es un instrumento útil para predecir las conductas de las personas en situaciones y actividades diferentes. Ofreciendo puntuaciones sobre 3 índices de estilo de respuesta, 5 dimensiones globales de personalidad y 16 escalas primarias: afabilidad, razonamiento, estabilidad, dominancia, animación, atención a las normas, atrevimiento, sensibilidad, vigilancia, abstracción, privacidad, aprensión, apertura al cambio, autosuficiencia, perfeccionismo y tensión. El modo de aplicación puede ser individual o colectiva, siempre a individuos mayores de 16 años, dándose los resultados baremados en decatipos. Las cinco dimensiones globales resumen las correlaciones entre las escalas primarias y permiten una interpretación amplia de la personalidad. Las escalas son definidas, en polo positivo y negativo, por un adjetivo. Composición de las dimensiones globales: Extraversión, Ansiedad, Dureza, Independencia y Autocontrol.

Maslach Burnout Inventory (MBI)

Está constituido por 22 ítems en forma de afirmaciones, sobre los sentimientos y actitudes del profesional en su trabajo. Su función es medir el desgaste profesional. Este test pretende medir la frecuencia y la intensidad con la que se sufre el *Burnout*. Mide los 3 aspectos del síndrome de *Burnout*:

- Subescala de agotamiento o cansancio emocional. Valora la vivencia de estar exhausto emocionalmente por las demandas del trabajo. Consta de 9 preguntas (1, 2, 3, 6, 8, 13, 14, 16, 20). Puntuación máxima 54.
- Subescala de despersonalización. Valora el grado en que cada uno reconoce actitudes de frialdad y distanciamiento. Está formada por 5 ítems (5, 10, 11, 15, 22). Puntuación máxima 30.
- Subescala de realización personal. Evalúa los sentimientos de autoeficiencia y realización personal en el trabajo. Se compone de 8 ítems (4, 7, 9, 12, 17, 18, 19, 21). Puntuación máxima 48.

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Altas puntuaciones en las dos primeras subescalas y bajas en la tercera en el síndrome de *Burnout*. Hay que analizar de manera detallada los distintos aspectos para determinar el Grado del Síndrome de *Burnout*, que puede ser más o menos severo dependiendo de si los indicios aparecen en uno, dos o tres ámbitos; y de la mayor o menor diferencia de los resultados con respecto a los valores de referencia que marcan los indicios del síndrome. Este análisis de aspectos e ítems puede orientar sobre los puntos fuertes y débiles de cada uno en su labor docente.

Cuestionario sobre la Competencia Digital del Profesorado de la Educación Superior Española

Con el fin de conocer la Competencia Digital del Profesorado hemos utilizado un instrumento compuesto de 112 ítems, distribuidos en cuatro dimensiones con un alfa de Cronbach de .982

En este sentido, los coeficientes del alfa de Cronbach son >.80, por lo tanto, todos superan el valor aceptable establecido por Nunnally (1978) que es de .70, por lo que el cuestionario tiene una consistencia interna aceptable para la investigación.

Por último, si atendemos a las dimensiones del cuestionario las podemos clasificar en uso y alfabetización tecnológica, compuesta por seis factores: la competencia y alfabetización digital del sistema operativo y herramientas básicas de la web; competencia y alfabetización digital en el manejo y uso de las herramientas y aplicaciones de la web social o 2.0; competencia digital búsqueda de conocimiento y software para la investigación y desarrollo profesional docente y distribución de recursos; alfabetización digital en protección de datos y propiedad intelectual y herramientas para la investigación; alfabetización digital en el uso de los elementos básicos de las TIC; y alfabetización digital en el uso de herramientas de entornos de enseñanza-aprendizaje colaborativos (Alpha de Cronbach .958).

2.4. Análisis de datos

En esta investigación, dada la naturaleza cuantitativa y el tamaño muestral, en primer lugar, se realizó una prueba T para estudiar las diferencias entre hombres y mujeres respecto a los niveles de *burnout*. Para establecer las relaciones entre personalidad y el *burnout*, se analizaron los datos mediante correlaciones de Pearson. Los análisis estadísticos de los datos obtenidos se llevaron a cabo mediante el programa informático SPSS.

2.5. Procedimiento

El procedimiento seguido en esta investigación ha sido, en primer lugar, el desarrollo del protocolo de evaluación. En segundo lugar, el envío de la propuesta al Comité de Ética de la Universidad Internacional de Valencia. Seguidamente se realizó el envío masivo del cuestionario mediante redes sociales y correo electrónico. La participación ha sido completamente voluntaria y anónima. Tras la recogida de muestra se realizaron los análisis necesarios a través de Excel y SPSS.

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3. RESULTADOS

La tabla 1 presenta las puntuaciones medias y desviaciones estándar en las 3 escalas de *burnout* en ambos sexos. No se detectaron diferencias entre sexos.

TABLA 1. Medias y desviaciones estándar entre grupos de las escalas del MBI.

Escala	Mujeres (n= 68)		Hombres (n = 32)		
	Media	sd	Media	sd	p
CE	1.43	0.719	1.47	0.718	1.11 NS
DP	1.31	0.629	1.59	0.756	0.07 NS
RP	2.54	0.584	2.28	0.729	0.87 NS

En la tabla 2 se muestra el número de personas que presentaban altos niveles de *burnout* en alguna de las 3 escalas. En ambos sexos, más de un 40% de los sujetos presentaba niveles elevados de realización personal. Considerando las 3 agrupaciones realizadas a partir de los puntos de corte comentados, los sujetos que más ocupan puntuaciones altas son las mujeres en un porcentaje alto en realización personal (58.8%).

Considerando las 3 agrupaciones realizadas a partir de los puntos de corte comentados, los sujetos se distribuyen mayoritariamente en las bandas de puntuación baja o alta. Pocos sujetos se ubican en las posiciones intermedias.

Respecto a rasgos de personalidad podemos observar que la autosuficiencia se mostró asociada positivamente a la despersonalización y al cansancio emocional. La tensión se relaciona positivamente con la despersonalización. También podemos observar que la afabilidad aparece relacionada positivamente con la despersonalización. Además, la tensión se correlaciona positivamente con la despersonalización.

Así mismo, la escala de realización personal mostró una correlación negativa significativa con la escala de despersonalización y de modo contrario, la despersonalización mostró una correlación positiva significativa con el cansancio emocional. Por último, se observa también una correlación negativa significativa entre el cansancio emocional y la realización personal.

TABLA 2. Porcentajes de burnout según los niveles altos de las escalas del MBI.

Escala	Mujeres	Hombres
CE	9 (13.2%)	4 (12.5%)
DP	5 (15.6%)	5 (15.5%)
RP	40 (58.8)	14 (43.8)

TABLA 3. Porcentajes de burnout según los niveles bajos de las escalas del MBI.

Escala	Mujeres	Hombres
CE	48 (70,6%)	21 (65.5%)
DP	53(77.9%)	18 (65%)
RP	3(4.4%)	5 (15.6%)

TABLA 4. Correlaciones de Pearson entre factores 16PF y escalas MBI.

	RP(MBI)	DP(MBI)	CE(MBI)
Apertura Q1	-0.105	0.000	0.062
Autosuficiencia Q2	-0.195	0.287**	0.275**
Perfeccionismo Q3	0.051	-0.007	-0.146
Tensión Q4	-0.117	0.213*	0.075
Sensibilidad I	-0.049	-0.076	0.177
Afabilidad A	0.137	-0.205*	-0.079
RP	1	-0.378**	-0.247*
DP	-0.378**	1	0.298**
CE	-0.247*	0.298**	1

* La correlación es significativa al nivel 0.01 (bilateral).
** La correlación es significativa al nivel 0.05 (bilateral).

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En la tabla 5 podemos visualizar los resultados de las correlaciones de Pearson entre las escalas del *burnout* y las escalas del cuestionario sobre competencia digital. Concretamente se observa una correlación positiva significativa entre la realización personal y metodología educativa a través de las TIC en el aula. También encontramos una correlación significativa entre la realización personal y la actitud ante las TIC. En cambio, no encontramos significación en las correlaciones entre el uso de las metodologías en el aula a través de las TIC y la actitud ante las TIC con las escalas de cansancio emocional y despersonalización.

TABLA 5. Correlaciones de Pearson entre escalas MBI y escalas del CD.

	ME	ATIC
RP	0.302**	0.315**
DP	-0.011	-0.168
CE	-0.179	-0.142
ME	1	0.150
ATic	0.150	1

*correlación es significativa al nivel 0.01 (bilateral).
** La correlación es significativa al nivel 0.05 (bilateral).

4. DISCUSIÓN

Teniendo en cuenta que el *burnout* es un efecto comúnmente asociado con la docencia, no ha tenido la suficiente investigación en el ámbito del profesorado universitario (Kuimova *et al.*, 2016). Las causas de esta falta de focalización en el profesorado de universidad es que se ha considerado que estos docentes disfrutan de mayor libertad y autonomía en el día a día laboral, que generalmente sus alumnos están más motivados y una mayor facilidad de promoción y reconocimiento. La evidencia empírica, en cambio, muestra la existencia de *burnout* en el docente universitario (Rodríguez *et al.,* 2017). Por ello, es importante investigar al respecto ya que ciertamente la docencia universitaria tiene parámetros distintos a la docencia de Formación Profesional, Educación Secundaria Obligatoria, Educación Primaria y también Educación Infantil, como por ejemplo la parte investigadora que conlleva el ser docente universitario. No obstante, también existen características que se comparten, como por ejemplo el trato con el alumnado, la preparación de clases y la corrección de trabajos y exámenes.

Con relación a las diferencias entre sexos en las distintas escalas o tipos de *burnout*, diversos estudios han mostrado que las mujeres generalmente presentan mayor agotamiento emocional en general, en muchas ocasiones debido a peores condiciones laborales y una mayor necesidad de conciliación familiar, entre otras razones (Arquero, & Donoso, 2013; Barbosa *et al.*, 2009; Ghorpade *et al.*, 2007; Henny *et al.*, 2014). En el caso de nuestro estudio en población de profesorado universitario, los datos indican que no existen diferencias entre sexos en cuanto a las distintas escalas de *burnout*, cansancio emocional, despersonalización y realización personal. Otros trabajos anteriores tampoco encontraron diferencias significativas (Adekola, 2010; Malinauskas *et al.*, 2010). Son datos que nos marcan una posible esperanza hacia una mejora en cuanto a las diferencias entre sexo y oportunidades laborales.

En cuanto a las diferentes escalas de *burnout* y su relación con las escalas de personalidad, en nuestro estudio observamos que existe una relación positiva entre la despersonalización, es decir, un mayor grado de frialdad y distanciamiento, y también el cansancio emocional, con una mayor autosuficiencia, en referencia a las personas que se integran poco en el grupo. Esto nos lleva a pensar que el no integrarse en el grupo de compañeros puede generar sensación de distanciamiento y también un mayor cansancio a nivel

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emocional por las demandas del trabajo. Todo ello causa malestar personal al profesorado y también un impacto negativo en el alumnado universitario (Brito, 2018).

Por otro lado, los profesores y profesoras de universidad que tienen altos niveles de tensión nerviosa muestran relación con la despersonalización. En este sentido, en muchas ocasiones el profesorado de universidad trabaja solo, este hecho puede aumentar la tensión vivida en momentos concretos de exigencia laboral. Se observan altos niveles de despersonalización, siguiendo la misma línea que comentaban Maslach y Jackson (1997) cuando afirmaron que los profesores y profesoras de universidad presentan mayor sentimiento de despersonalización que los profesores de educación primaria y secundaria. Sería importante una revisión exhaustiva del trabajo en equipo dentro de las universidades y cuál sería la causa de esta despersonalización.

Para considerar que una persona padece *burnout*, se supone que debe tener una alta despersonalización, alto cansancio emocional y baja realización personal. En este sentido, encontramos en nuestro estudio que existe una relación negativa entre la realización personal y la despersonalización y el cansancio emocional. En cambio, se observa una correlación positiva entre cansancio emocional y despersonalización lo que indica que, a mayor actitud de frialdad y distanciamiento social, mayor agotamiento emocional en el trabajo y viceversa. En un estudio realizado en Lima (Rodríguez, & Sánchez, 2018) se concluye que aquellos docentes universitarios que llevan más tiempo en la docencia son los que mayor realización personal sienten y afirman que es probable que el hecho de que su trabajo y su vida personal sean más estables puede influir en esta realización.

5. CONCLUSIONES

La realización personal y profesional del docente, proviene de la satisfacción dentro de su labor como docente y esta realización personal, tiene una gran influencia en la calidad de la enseñanza y, por lo tanto, en el aprendizaje de los alumnos. De modo contrario, las malas experiencias pueden llevar al docente a una insatisfacción personal y profesional, llegando a afectar al bienestar del profesional y, por ende, a su labor docente (Such, & Suizo, 2015).

Durante estos últimos años, estamos viviendo un gran cambio hacia la digitalización a nivel social, algo que el profesorado universitario vive en su día a día. Por ello, resulta importante conocer qué relación puede existir entre el *burnout* visto anteriormente y la competencia digital del profesorado.

La competencia digital, es definida como el conjunto de conocimientos, capacidades, actitudes y estrategias que el docente, mediante las TIC, puede ser capaz de gestionar para facilitar el aprendizaje de sus estudiantes. Teniendo en cuenta que la sociedad ha avanzado hacia un punto en el que las TIC son parte de las tareas cotidianas de la mayoría de las personas, sería un error dejar de lado esta transformación social, en el ámbito educativo. Algunos estudios afirman que existe una correlación negativa entre el *burnout* y la competencia digital en docentes universitarios (García, 2022). Esto además se vio con mayor claridad durante el periodo más complicado de la pandemia causada por la COVID-19 (Velázquez *et al*., 2020).

Consideramos de gran importancia que el profesorado se adapte a las nuevas tecnologías de la información y comunicación para también así adaptarse a las nuevas metodologías de transmisión de conocimiento. En nuestro estudio, encontramos la existencia de una correlación positiva entre la realización personal y el uso de metodologías educativas a través de las TIC en el aula. Algo que va en la línea de lo

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comentado por García (2022). Del mismo modo, se observa una correlación positiva entre la actitud positiva ante las TIC y la realización personal.

Relacionado con nuestros resultados, Padilla (2018) expuso que las percepciones negativas hacia las TIC, se puede organizar en dos tipos: aquellas causadas con los problemas técnicos que la persona pueda tener; y las relacionadas con las características pedagógicas. En cuanto a estas últimas, el profesorado más constructivista integra mejor las TIC en el aula y aquellos profesores y profesoras más tradicionales, prefieren el contacto directo entre docente y discente, obviando en mayor medida la inclusión de las TIC en sus clases. Por otro lado, con respecto a los aspectos técnicos, Córica (2020) señala que una actitud positiva hacia los cambios, permiten superar las barreras percibidas.

5.1. Limitaciones y prospectiva

En conclusión, encontramos que en general, se necesita de una mayor profundización en el estudio del *burnout* en profesorado universitario, y también en un plan de acción firme que ayude a los docentes a no sentirse despersonalizados ni cansados emocionalmente por su trabajo. Al mismo tiempo, es importante dar visibilidad a esta problemática para trabajar en equipo en una solución. Sabemos que en comparación con la docencia en otras etapas educativas el profesorado de universidad siente una mayor despersonalización, causando malestar. Además, es algo que acaba repercutiendo en el input que recibe el alumnado y por ende no beneficia a ninguna de las dos partes implicadas.

También de gran relevancia ha sido el no encontrar muchos trabajos científicos con respecto a las características de personalidad en el profesorado de universidad, por lo que consideramos otra posible línea de investigación futura en esta línea, ya que como hemos podido observar en este estudio, si existen correlaciones entre algunos factores de personalidad, como la tensión y la autosuficiencia con el *burnout*. Estos datos podrían implicar una importante influencia de la personalidad previa con el estrés percibido en la docencia en educación superior.

Finalmente, nuestro estudio, tiene como principal limitación el número de participantes, que debe ser ampliado en un futuro para conseguir unos resultados más robustos. Además, sería interesante analizar en el mismo estudio, docentes de las distintas etapas educativas e incluir también la docencia en universidad pública o privada.

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