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Conceptualizing the future of e-Learning: examining students' readiness, satisfaction, and intention to continue employing remote learning in higher education landscape

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Abstract

Online learning is a flexible education environment in which instructions and learning activities are delivered through the internet. This quantitative research study seeks to explore students' readiness to continue employing e-Learning whilst also measuring students' satisfaction with the e-Learning platform/system among higher education students in a Middle Eastern country, United Arab Emirates (UAE). Furthermore, the paper discovers the factors that predict students' intention to continue utilizing e-Learning in the future. Liaw's model (2008) was employed to report students' readiness, satisfaction with e-Learning system quality, multimedia integrated into instructions, interactive learning activities, and students' intention to continue using online learning. A sample consisting of 476 higher education students from multiple backgrounds and different majors volunteered to take part in the study. *Descriptive analysis* and Multivariate analysis techniques including *Correlation Coefficient, and Stepwise Linear Regression* were chosen to achieve the study objectives. Data analysis demonstrated that higher education students showed a high readiness level (82%) towards e-Learning and were found with a medium satisfaction level (77%) with the e-Learning system that they are using. Moreover, students' *satisfaction with e-Learning*, the *e-Learning system quality*, and *students' perceived usefulness* were found to be significant contributors to students' behavioral intention to keep on utilizing the e-Learning platform potentially. The findings recommend examining students' readiness for e-Learning at the beginning of each semester before starting teaching to set up academic plans that promote the effectiveness of e-Learning.

KEYWORDS: e-Learning, Students' Satisfaction, Self-efficacy, e-System Quality.

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1. Introduction

At the beginning of spring 2020, the Coronavirus epidemic was announced by the World Health Organization (WHO) as a worldwide pandemic, hence, necessitating the initiation of a global task force to relieve this crisis. The increased prevalence of the Coronavirus disease mandated an immediate transition to e – lifestyle. One of the solutions that appeared as a relief to the pandemic was the closure of schools and shifting to e-Learning as an alternative delivery method of learning where learners and educators are separated by physical distance, which obliged activating e-Learning through most grade levels worldwide. Although the advantages of e-Learning and its wide implications in many educational settings, some researchers (e.g., Wijaya et al., 2020; Farmer and West, 2019; Peytcheva-Forsyth et al.,2018; Ullah et al., 2017) discussed many issues and concerns related to e-Learning. These issues are associated with the students' e-self-efficacy, students' satisfaction with e-Learning, students' interaction during e-classes, and the quality of the e-system. Students were pushed to adapt to e-Learning to pursue their degrees. The inquiry now is related to the future of online learning, and the students' continuation to use it. Are students satisfied with it and intend to continue virtual learning even after the pandemic? The unanticipated transition to e-Learning required identifying the factors that could influence the dynamics of the e-Learning process. Furthermore,

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discovering the probability of e-Learning continuation as an existing alternate learning environment even after Coronavirus.

This research article proposes measuring some variables such as students' readiness, satisfaction, and intention to continue retaining learning remotely within higher education settings. Hence, measuring these factors will report on students' intent to continue utilizing e–learning.

Ever since the proclamation of the Coronavirus epidemic, the UAE, like many other countries, devotedly employed e-Learning not only as a learning environment but a reliable teaching method throughout the education sectors to provide a safe learning environment for both public and private education sectors. As the UAE is concerned about the success of e-Learning as a teaching platform, countless professional training sessions were offered for teachers and instructors to assist them to manage teaching duties and classroom management in their e-Learning environment (UAE gov, 2021). As e-Learning is still adopted by many universities all over the globe, there is a need to examine factors that could predict the continuation of embracing e-Learning. However, the research on the dynamics that affect e-Learning in the UAE has not been investigated furtherly. This makes it an essential goal to research it to fill this gap and determine these dynamics, and answer all concerns related to online learning as a teaching context.

The conclusions of this research paper will clarify the picture and explain several concerns associated with the dynamics of e-Learning in the UAE. Examining students' satisfaction with e-Learning is considered a measurement of the e-Learning structure's quality and effectiveness. Discovering students' behavioral intentions towards e-Learning will determine the students' willingness to continue pursuing their academic degrees through e-Learning. Thus, this research study will benefit the higher education sector in the UAE as well as the global readership in terms of discussing the future of embracing online learning as a parallel learning and teaching platform within a multicultural environment where people from more than 200 different nationalities live and educate (UAE gov, 2021).

2. Research questions

Achieving the study aims depends on answering the following proposed questions:

1. What is the readiness level of higher education students to adapt to e-Learning?
2. How satisfied are higher education students with e-Learning?
3. What is the behavioral intention toward e-Learning of higher education students?
4. What are the predicting factors of students' behavioral intention to continue utilizing e-Learning?

2.1 Research Hypothesis/ Assumptions

This research paper proposes the following assumptions that are related to the study objectives.

H1: Higher education students have an upstanding level of readiness to adapt to e-Learning.

H2: Higher education students in the UAE are pleased with the e-Learning system.

H3: Higher education students in the UAE are expected to show positive behavioral intentions toward continuing to use the e-Learning system.

H4: Several variables are anticipated to affect students' intent to use e-Learning potentially such as students' e-self – efficacy, students' satisfaction with e-Learning, the perceived usefulness, e-Learning system feature, and effectiveness. In addition to interactive learning activities, and multimedia instruction.

2.2 Theoretical framework

This current study is implementing the theoretical framework suggested by Liaw and Huang (2006). Liaw and Huang proposed a four-component model that discussed the e-Learning environment. The model comprises the following:

1. *environmental characteristics*, which describes the characteristics of e-Learning, referring to the structure of the system and multimedia instruction, synchronous or asynchronous interaction to communicate effectively*;*
2. *environmental satisfaction,* which concerns about students' satisfaction about the e-Learning environment and the students' understandings of technological aspects that could boost their contribution to the learning activities;
3. *learning activities* refer to a set of educational tasks created to help students interact and engage in the e-Learning environment, boosting sharing knowledge between teachers and students;
4. *learners' characteristics* means learners' self-efficacy, the student's ability to utilize the e – system sufficiently.

Based on Liaw and Huang's (2006) proposal, learners who are identified with insufficient competency, or less self-confidence towards the e – environment, are anticipated to show less positive feelings towards e-Learning.

The current study is structured to adopt Liaw's model, hence, its framework is proposing to measure the following variables.

1. *Students' readiness: measured through* students' self-efficacy and experience in using the e-system.

2. *Students' satisfaction*: measured through students' perceived satisfaction and students' assessment of e-Learning system quality and e-Learning effectiveness.
3. *Predicting factors of students' behavioral intention:* measured through discovering the factors that are associated with students' behavioral intention and willingness to continue using the e-Learning after the pandemic as indicated in Liaw's model, the factors include the following: *students' self-efficacy*, *perceived satisfaction, perceived usefulness, e-Learning system quality, interactive learning activities, e-Learning effectiveness, and multimedia instruction.* All variables will be examined by Liaw (2008) model, which includes 8 domains.

3. Literature review

3.1 Online Learning During Coronavirus Pandemic

Distance learning and online learning present two common terms that describe the notion of e-Learning. The term e-Learning exemplifies the online educational environment where learners are disconnected from their educators by distancing. In addition, e-Learning describes teaching techniques and a platform to deliver the teaching content to students via e-platform. The proposal of McAndrew and Johnston suggested that "E-Learning and online learning adoption and implementation are no longer in question, as e-Learning is the platform for education in the coming era" (McAndrew & Johnston, 2012, p. 1475). Online learning was found as an advantageous platfor3m that enables students to interact and communicate, nevertheless any geographical constraints. There is an argument among researchers regarding the effectiveness of e-Learning; Adnan and Anwar (2020) indicated that undeveloped countries face challenges in the online learning environment to achieve positive results, due to the lack of internet accessibility. Al Salman et al. (2021) conducted a research study in Jordan, it was revealed that Jordanian participants showed mild level of attitude towards virtual learning during

Coronavirus. A study was conducted by (Rouadi & Anouti, 2020) in Lebanon to explore the students' experience in online learning within young adolescents, middle and high school students during the epidemic. The results highlighted challenges of online learning such as weak interaction between students and instructors and lack of students' contribution to online class activities.

On the higher education settings, a research study by (Muftahu, 2020) investigated the consequences of the Coronavirus epidemic on students by distinguishing the faced problems and challenges in the academic programs in advancing universities from the African perspective. The results demonstrated that the pandemic enabled higher education institutions to exceed their limits and develop an alternative mode of delivery to encourage students to pursue their education, by coping with the unforeseen transformation to online learning.

3.2 Attitudes and Satisfaction Towards Online learning

The embracement of e-Learning in many educational settings and the continuation of its use raises the demand for further investigation to focus on students' readiness and attitude towards online learning. In addition to examining students' satisfaction about the e – system's effectiveness. As a response, numerous research studies were conducted to examine this issue (Jogezai et al., 2021; Martin et al., 2020; Dong et al.,2020). In the UAE, researchers demonstrated their interest in studying issues related to the e-Learning before Coronavirus from different perspectives such as (Ati et al., 2010) and (Bawa'aneh, 2021 and Hussein et al, 2020) examined e-Learning post the current epidemic.

Investigating the literature on readiness levels towards using e-Learning among students discovered that readiness for e-Learning as a concept is well-known and recognizable that has been in use previously. The term readiness to e-Learning was suggested years ago in Australia when a group of educators (Warner et al, 1998) studied the vocational education and training division. A few decades ago, a group of researchers (Warner et al., 1998) proposed that students' readiness for using e-Learning can be explained by three facets: (1) students' predilections or preferences for the mode of material ad instructional conveyance; (2) student self-confidence, competence in utilizing online for learning; and (3) students' capability to take part in a self-directed mode of learning.

Many issues related to e-Learning have been discussed in several research studies concerning students' satisfaction. On a large sample of 2196 students, Paechter et al., (2010) investigated students' academic achievement from 29 universities in Austria in addition to examining students' satisfaction with e-Learning. Paechter's work revealed an explicit correlation between instructors' experiences and academic achievements as well as students' satisfaction.

In Saudi Arabia, a research study was conducted by Linjawi and Alfadda (2018) to assess some variables including students' readiness, attitudes, and satisfaction with the e-Learning approach. The conclusions indicated that Saudi students are highly satisfied with e-Learning and have high computer skills, which indicates students' satisfaction and readiness to use online learning (Linjawi and Alfadda, 2018). Students' perception of online learning in Indonesia was investigated by Bali and Liu (2018). Results disclosed that some students preferred e-Learning because they

feel more interactive and engaged in e-Learning. In the United States, Fortune et al., (2011) examined students' perception of online learning, the results uncovered students' satisfaction with e-Learning and readiness to use it.

3.3 Integrating Online Learning in the UAE

Following the Coronavirus occurrence in the UAE, the Ministry of Education (MoE) has established a solid infrastructure e-Learning system to encourage the continuation of distance education in case of continuing the usage of e-Learning. The MoE in the UAE has provided numerous educational resources and platforms to promote the utility of distance learning. After shifting to e-Learning, the UAE provides both synchronous and asynchronous to ensure the inclusion of all students in the e-Learning environment. According to Gilbert (2000), Synchronous online learning refers to a direct online learning environment led by the instructor where learners and teachers meet at the same time, which enables direct interaction. Synchronous classes operate like traditional face–to–face classes, it enables learners to take part in class learning activities and discussions with their classmates simultaneously. In the UAE, higher education institutions provide synchronous online learning including live-streamed sessions where students present virtually through MS Teams, Zoom, Blackboard channels, or any other convenient platform. Using the webcam and the microphone enables active participation and communication between learners and teachers. Synchronous online learning is a student–centered learning environment, which requires students to participate actively in all classwork.

Asynchronous online learning describes a learning experience where instructors and learners interact sporadically whilst time is flexible (Garrison and Henderson, 2003). While synchronous requires all participants to meet at the same time, asynchronous online learning enables a flexible schedule where students can access the class materials based on their convenient time. Asynchronous online learning enables instructors to post organized materials and discussion boards to keep students connected to the class, whilst students can share their responses as well. Whether the education system considers synchronous or asynchronous, learning preferences of students, personalities, and interests. In the UAE, online learning embraces both synchronous and asynchronous online learning classes. While synchronous in UAE operates in real-time, where instructors and students join classes at the same time regardless of any geographical separation, instructors record all sessions and post them to students. Recording the synchronous classes enables students to access them and retrieve any missed learning experiences.

Several research studies were published to discuss some issues related to online learning in the UAE (e.g., Elnour et al., 2023; Islam et al., 2023; Fidalgo et al., 2020; Ati et al., 2010). The study by Elnour et al., (2023), revealed that college students in the UAE supported utilizing e-Learning in pharmacy education, and showed their readiness for integrating technology in learning in the future. Islam and a group of researchers conducted a research study to examine students' perceptions and satisfaction with virtual classrooms in the UAE. Their results showed a positive perception of virtual classrooms. Fidalgo and a group of researchers (2020) studied undergraduate students' attitudes, intent, and perceptions to adopt e-Learning in the UAE. The results demonstrated that students' language competencies, motivations, and time management were the major matters that cause students' dissatisfaction. Malkawi's collaborative work examined the level of satisfaction and attitudes toward e-Learning among undergraduate students in the UAE during the Coronavirus epidemic. The findings showed a highly positive attitude and satisfaction with e-Learning (Malkawi et al., 2021).

The MoE does its best to provide training programs for teachers to ensure effective teaching and assessment. Thus, the education system in the UAE was recognized as a well-equipped structure to implement online learning environments, compared to other countries where students are faced with technical issues or financial issues (Adnan, 2020; Mailizar, 2020; Rose, 2020). The literature review about e-Learning in the UAE mainly focused on students' satisfaction with e-Learning and students' attitudes towards it; however, there is a gap in the research concerning students' intention to continue utilizing e-Learning as an alternative learning environment. Consequently, students' intent to continue learning virtually needs further investigation.

4. Methodology

4.1 Sample

The sample of this research study contains 476 undergraduate students distributed as (n= 284 (59.7%) females; n= 192 (40.3%) males) enrolled in different higher education institutions in the UAE (see Figure 1) and all of them are enrolled in e-Learning environments. The sample aged from 18 – 23 years with (M= 19.67, *Mode*= 19, SD= 1.2786) participants' age categories are shown in (Table 1).

The sample includes undergraduate students from varied education levels from undergraduate freshmen (first year) to undergraduate senior students (fourth year). Student's e-Learning experience was determined by participants' responses to a *Likert scale* designed to include 7 - points varying from 1 which indicates ''no experience'' to 7 which indicates ''well experienced'' (see Figure 2). The participants are a representative

sample of different backgrounds; however, the majority of participants are UAE locals as shown in (Table 2).

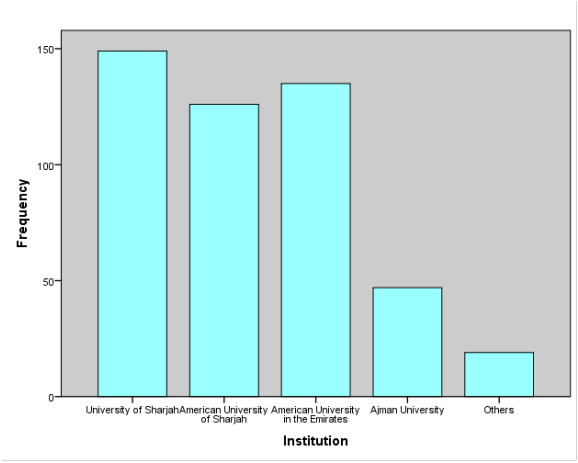

Figure 1 - Sample spreading by the institution.

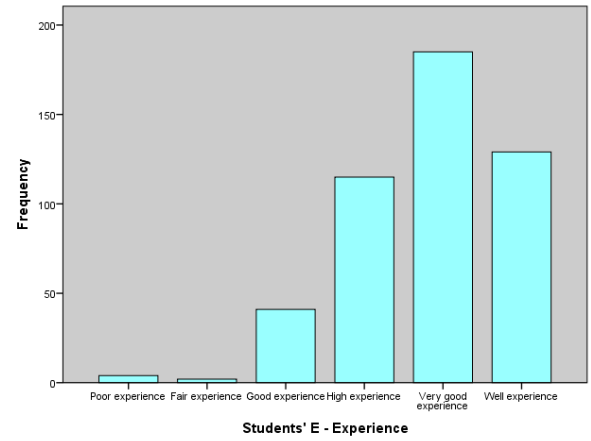

Figure 2 - Sample description by e-experience.

Table 1 - Sample's spreading by age category.

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
18.00	64	13.4	13.4	13.4
19.00	184	38.7	38.7	52.1
20.00	150	31.5	31.5	83.6
21.00	35	7.4	7.4	91.0
22.00	7	1.5	1.5	92.4
23.00	36	7.6	7.6	100.0
Total	476	100.0	100.0	

Table 2 - Distribution of participants by nationality

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
UAE	222	46.6	46.6	46.6
Iraq	15	3.2	3.2	49.8
Egypt	50	10.5	10.5	60.3
Syria	16	3.4	3.4	63.7
Jordan	53	11.1	11.1	74.8
KSA	20	4.2	4.2	79.0
Algeria	18	3.8	3.8	82.8
USA	13	2.7	2.7	85.5
India	21	4.4	4.4	89.9
Pakistan	10	2.1	2.1	92.0
Sudan	14	2.9	2.9	95.0
Iran	8	1.7	1.7	96.6
Others	16	3.4	3.4	100.0
Total	476	100.0	100.0	

4.2 Instrumentation

Liaw's (2008) model contains 26 questions disseminated over 8 domains including *Perceived self-efficacy* (3 questions), *Perceived satisfaction* (4 questions), *Perceived usefulness* (3 questions), *Behavioral intention* (3 questions), *e-Learning system quality* (4 questions), *Interactive learning activities* (3 questions), *E-Learning effectiveness* (3 questions), and *Multimedia instruction* (3 questions). Liaw's model's domains are measured by a 7 – point Likert scale indicating students preferred responses vary from *strongly disagree =1* to *strongly agree =7*. The scores of each individual domain represent students' perception of the corresponding domain and of the e-Learning system. Determining the sum of each domain simply can be achieved by computing the sum of each domain and then calculating the mean score for that domain. Since the scale is a 7 – point Likert scale, a score higher than 4 informs a positive attitude. As English is the common language of teaching and communication in higher education institutions in the UAE, the survey was delivered to participants in English for more accurate responses.

4.3 Results

Based on the study of Liaw (2008), the model with its 8 domains showed high reliability, exemplified by Cronbach's $\alpha = 0.97$ for the model entirely and α varied between 0.57 to 0.80 for the model's items, which suggests satisfactory reliability of the measurement scales. Analysis was conducted for the current study to discover the internal consistency of the scale. The internal consistency was assessed by calculating *Cronbach's α.* Findings suggested high reliability as α ranged from .653 to .897 for the scale domains and the reliability for the entire scale $\alpha = .926$. According to Nunnally (1978), achieving α values that exceed 0.7 signifies a satisfactory level of reliability (see Table 3). Regarding the validity of the scale, the instrument was sent to a panel of experts in assessment

and measurement in addition to experts in online learning to ensure its validity for use within the higher education settings in the UAE. The scale obtained experts' acceptance for use.

Table 3 - The internal consistency of the scale.

Item	*Cronbach's Alpha*	*Cronbach's Alpha Based on Standardized Items*	*N of Items*
Perceived self-efficacy	.897	.899	3
Perceived satisfaction	.855	.855	4
Perceived usefulness	.791	.796	3
Behavioral intention	.856	.857	3
e-Learning system quality	.768	.773	4
Interactive learning activities	.653	.647	3
E-Learning effectiveness	.771	.775	3
Multimedia instruction	.783	.784	3
Entire scale	.926	.930	26

4.4 Data Collection

A year after the transition to e-Learning, early in Spring 2021, the researcher started the data collection process. The data collection process continued for 8 weeks. Liaw's Questionnaire was modelled on *Google forms* including e-consent informed and a detailed explanation of the study goals and objectives. Participants were reached via their instructors. On a Zoom channel, the study took place. Students were allowed 45 minutes: 15 mins for explaining the study and getting them to sign the consent form and 30 mins for responding to the questionnaire. As the study was achieved synchrony, the researcher was available during administrating the study for any further help. All data were collected anonymously and uploaded to SPSS version 24.0 for analysis and to portray the conclusion.

5. Results

Answering *RQ 1* and finding out the student's *readiness* for the e-Learning system (students' readiness for the e-Learning system is measured by the mean score of *self-efficacy* and *e-experience domains/subscales – Liaw's model*), the descriptive analysis revealed a medium to high self–efficacy level among students (*M*= 5.72, *SD*= 1.040) and the results from the e-experience scale showed that most of the students have high scores in e- experience, which ranges between "very good" and "well experience" as shown in (Figure 2 and Table 4).

Table 4 - The sample distribution by experience in the e-Learning management system.

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Poor experience	4	.8	.8	.8
Fair experience	2	.4	.4	1.3
Good experience	41	8.6	8.6	9.9
High experience	115	24.2	24.2	34.0
Very good experience	185	38.9	38.9	72.9
Well experienced	129	27.1	27.1	100.0
Total	476	100.0	100.0	

Regarding *RQ 2*, high satisfaction with e-Learning among students was found in the descriptive analysis, which indicated by Liaw's domain *perceived satisfaction* (*M*= 5.367, *SD* = 1.083).

For *RQ 3*, to discover students' intention to continue utilizing e-Learning, Liaw's domain of *Behavioral Intention*, students declared a positive intention to continue the usage of e-Learning (*M*= 5.417, *SD* = 1.1035). The mean score of students and the standard deviation of the rest of the domains are shown in Table 5.

Table 5 - Mean and standard deviation of Liaw's model domains.

Item	*M*	*SD*	*Percentage*
Perceived self-efficacy	5.721	1.0404	81.73%
Perceived satisfaction	5.367	1.0832	76.67%
Perceived usefulness	5.193	1.2002	74.19%
Behavioral intention	5.417	1.1035	77.39%
e-Learning system quality	5.116	1.0879	73.09%
Interactive learning activities	4.962	1.1893	70.89%
E-Learning effectiveness	4.980	1.3353	71.14%
Multimedia instruction	4.978	1.2214	71.11%

To answer *RQ 4* and discover the factors that predict students' intention to keep on utilizing online learning, the statistical analysis *Stepwise Multiple Regression* was selected to indicate only the "significant" predictors in the regression model. The researcher

performed the *Stepwise* analysis to assess the effect of 7 domains from Liaw's model on students' behavioral intention. The 7 domains included *self-efficacy*, *satisfaction*, *perceived usefulness*, *e-Learning effectiveness*, *multimedia instruction*, *interactive learning activities*, and *e-Learning system quality*. Data analysis indicated the existence of four significant variables that can predict students' behavioral intention to continue using e-Learning. The domains are *perceived satisfaction*, *e-Learning system quality*, *perceived usefulness*, *and interactive activity*. A significant regression equation was found as follows: Model 1 showed (F (1, 474) = 377.020, $p < .001$), associated with R^2 of .443. For model 2 (F (2, 473) = 259.594, $p < .001$), and R^2 of .523. (F (3, 472) = 200.934, $p < .001$), with an R^2 of .561 revealed by model 3. Model 4 showed (F (4, 471) = 154.055, $p < .001$), with an R^2 of .567 (see Table 7 – a comparison of the four models resulting from the regression with coefficient b, significance, F, and R2.)

The regression model generated from the results is as follows:

$$Y' = \beta_0 + \beta_1 * x1 + \beta_2 * x2 + \beta_3 * x3 + \beta_4 * x4 + \epsilon$$

Behavioral Intention = 0.845 + 0.280*Satisfaction + 0.278* E-Systems Quality + 0.238* Usefulness + 0.082* Interactive Activity

The majority of the independent variables were found to be significant predictors of behavioral intention. The output of Table 6 shows that students' *satisfaction*, *e-Learning system quality,* and *perceived usefulness* are highly correlated with behavioral intention, whereas self-efficacy and e-Learning effectiveness showed a medium correlation with behavioral intention. Moreover, two variables; e-Learning effectiveness and multimedia instructions report a weak correlation with the dependent variable (behavioral intention). Based on the *Stepwise* results, multicollinearity does not form a problem as VIF was found <5. Figure 4 shows the scatterplot with predicted values (behavioral intention) on the x-axis and residuals on the y-axis. From Figures 3 and 4 (Q – Q plot), there are no violations of the independence, homoscedasticity, and linearity assumption.

6. Discussion

The present research paper discusses the UAE's higher education students' satisfaction with, their readiness for e-Learning practices, and their intention to remain to utilize e-Learning in the future. Outcomes indicated that higher education students showed high readiness levels to learn and continue studying in an e-Learning environment. These findings could be interpreted as

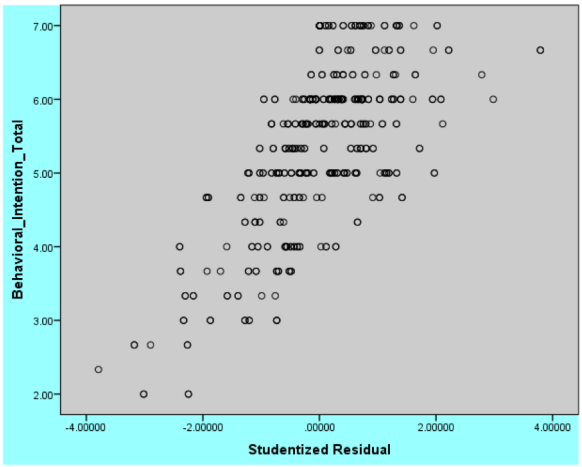

Figure 3 - The Relationship between predictors and behavioral intention.

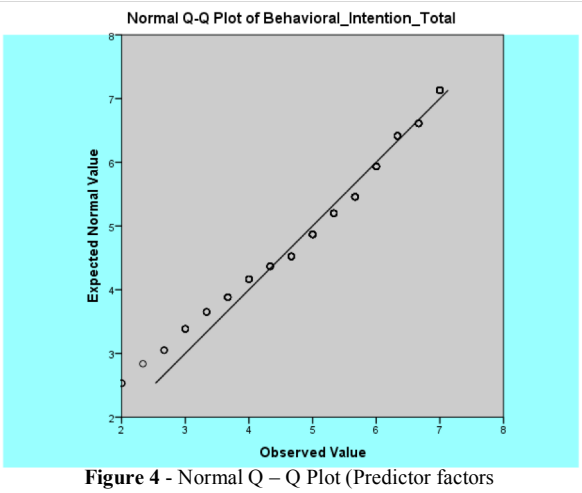

Figure 4 - Normal Q – Q Plot (Predictor factors and behavioral intention).

students' high technical abilities and skills increase their readiness levels towards the e-Learning platforms. Regarding students' readiness, this can be explained as undergraduate students with ages ranging from 18 – 24, meaning they are digital natives (Prensky, 2001) who are expected to show high readiness toward e-Learning systems. Moreover, students demonstrated a positive moderate level of satisfaction with the e-Learning environment; this needs to be increased. This result can be interpreted as students have some demands regarding the e-Learning system that need to be integrated to increase their acceptance and satisfaction. These findings are consistent with (Liaw, 2008; Linjawi and Alfadda, 2018; Elnour et al., 2023; Islam et al., 2023), who revealed that college students are recognized with positive attitudes towards online learning and are satisfied with e-Learning, which could be practically implemented by offering hybrid courses even after reverting to classrooms physically. The result of behavioral intention (77%) explains students' willingness to embrace e-Learning in the future as an

alternate learning platform. The findings related to the predicting factors indicated that students' satisfaction, perception of usefulness, e-Learning structure quality, and multimedia instruction can significantly predict students' intention to continue using e-Learning. However, these significant predictors were found to range from 71% - 77% as scored by students' responses, indicating that there is a need to increase students' attitudes towards these factors as they predict students' behavioral intention. The other factors that showed weak predicting of behavioral intention such as multimedia instruction and e-Learning effectiveness, showed medium acceptance from students. These findings can be interpreted as students continuing learning remotely; however, the multimedia instruction does not keep students engaged effectively, so further research is needed here to discover the meaningful multimedia aspect that could enhance students' behavioral intention. Moreover, e-Learning effectiveness as a weak predictor of variable behavioral intention can be explained in relation to learning quality, so students do not identify the effectiveness of the e-Learning, or students distinguish it as it needs improvement to reach the maximum level of student satisfaction, which is expected relatively to the medium level of satisfaction. E–effectiveness as a weak predictor of students' intention may be explained as students' weak commitment to the e-Learning activities causes them to perceive it as a weak factor that could impact their future intention. This result coincides with (Robinson & Hullinger, 2008), who revealed that students show limited engagement in online activity compared to their engagement in on–campus learning.

Nevertheless, perceived usefulness showed a higher level of significance that could be interpreted as

		Behavioral_Intention	Self_efficacy	Perceived atisfaction	ELearning_SysQuality	ELearning_Effectiveness	Interactive_Activity	Multimedi	Perceived Usefulness
Pearson Correlation	Behavioral_Intention	1.000	.445	.666	.663	.318	.418	.331	.637
	Self_efficacy	.445	1.000	.614	.454	.219	.300	.243	.441
	PerceivedSatisfaction	.666	.614	1.000	.686	.287	.375	.357	.653
	ELearning_SysQuality	.663	.454	.686	1.000	.407	.484	.349	.605
	ELearning_Effectiveness	.318	.219	.287	.407	1.000	.672	.403	.259
	Interactive_Activity	.418	.300	.375	.484	.672	1.000	.446	.362
	Multimedi	.331	.243	.357	.349	.403	.446	1.000	.276
	PerceivedUsefulness	.637	.441	.653	.605	.259	.362	.276	1.000
Sig. (1-tailed)	Behavioral_Intention	.	.000	.000	.000	.000	.000	.000	.000
	Self_efficacy	.000	.	.000	.000	.000	.000	.000	.000
	PerceivedSatisfaction	.000	.000	.	.000	.000	.000	.000	.000
	ELearning_SysQuality	.000	.000	.000	.	.000	.000	.000	.000
	ELearning_Effectiveness	.000	.000	.000	.000	.	.000	.000	.000
	Interactive_Activity	.000	.000	.000	.000	.000	.	.000	.000
	Multimedi	.000	.000	.000	.000	.000	.000	.	.000
	PerceivedUsefulness	.000	.000	.000	.000	.000	.000	.000	.

Table 6 - The Correlation between the independent variables and the dependent variable _RQ 4.

Model Summary[e]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.666[a]	.443	.442	.82438	.443	377.020	1	474	.000	
2	.723[b]	.523	.521	.76349	.080	79.628	1	473	.000	
3	.749[c]	.561	.558	.73356	.038	40.384	1	472	.000	
4	.753[d]	.567	.563	.72936	.006	6.453	1	471	.011	1.996

Table 7 - A Comparison between the four models with significance F.

students' perception of the importance and benefits of e-Learning plays a crucial part in indicating the students' intent to adapt to the online learning environment. These results are supported with (Paechter et al., 2010).

Limitations underlie the nature of the stepwise multiple regression which could include *bias in parameter estimation* and *discrepancies* among model selection algorithms, as well as any latent elements that could impact students' responses to the questionnaire.

7. Conclusion and recommendation

This research paper was achieved to explore students' readiness, satisfaction about e-Learning, and the predicting factors of students' behavioral intention within higher education institutions in the UAE. Higher education students in the UAE were ready for implementing e-Learning in the future, which reflects their adequate technical skills. Furthermore, students showed moderate satisfaction about e-Learning system implemented in their institutions, which indicates the need for improving e-Learning structure in the UAE over higher education to increase students' satisfaction. Higher education students are willing to endure utilizing e-Learning in the forthcoming if it is an alternative education mode; however, their intention is influenced by some variables such as their perception of the e-Learning usefulness, the multimedia instruction, and their overall satisfaction with the e-Learning platform.

The outcomes of the present paper suggest the following recommendations to educators, higher education policymakers, stakeholders, and decision-makers to consider when offering e-Learning as an alternative learning environment.

1. Assessing students' readiness to e-Learning by using robust measurement tools at the beginning of each semester or academic year.
2. Integrating up-to-date Web 2.0 aspects to improve the e-Learning effectiveness
3. Offering pre–distance learning sessions and training based on the student's feedback and concerns.
4. Organizing different learning activities to train and develop students' skills to overcome distance learning difficulties in terms of engagement, motivation, and time management.

Future research should concentrate on examining the factors that promote e-Learning efficiency and examining the influence of integrating meaningful multimedia instruction to increase the efficiency of e-Learning. In addition, more research is needed to discover new aspects that could be integrated into e-Learning to keep students engaged.

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References

Adnan, M., & Anwar, K. (2020). Online Learning amid the COVID-19 Pandemic: Students' Perspectives. *Online Submission*, 2(1), 45-51. https://doi.org/10.33902/JPSP.2020261309

Almanthari, A., Maulina, S., & Bruce, S. (2020). Secondary school mathematics teachers' views on e-Learning implementation barriers during the COVID-19 pandemic: The case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(7), p.em1860.https://doi.org/10.29333/ejmste/8240

Alsalman, A., Assi, L.N., Ghotbi, S., Ghahari, S., & Shubbar, A. (2021). Users, planners, and governments perspectives: A public survey on autonomous vehicles future advancements. *Transportation Engineering*, 3, p.100044.

Ati, M., Guessoum, N., Demiray, L.V.U., Sahin, M.C., Kurubacak, G., Lounaskorpi, P.T., & Rao, S.R. (2010). E-Learning in United Arab Emirates. E-Learning practices. Cases on challenges facing e-Learning and national development: Institutional studies and practices, 2, pp.1009-1028.

Bali, S., & Liu, M.C. (2018, November). Students' perceptions toward online learning and face-to-face learning courses. In *Journal of Physics: Conference Series*, 1108 (1), p. 012094. IOP Publishing.

Bawa'aneh, M.S. (2021). Distance Learning during COVID-19 Pandemic in UAE Public Schools: Student Satisfaction, Attitudes and Challenges. *Contemporary Educational Technology*, 13(3). https://doi.org/10.30935/cedtech/10872

Dong, C., Cao, S., & Li, H. (2020). Young children's online learning during COVID-19 pandemic: Chinese parents' beliefs and attitudes. *Children and youth services review*, 118, p.105440.

Elnour, A., Abou Hajal, A., Goaddar, R., Elsharkawy, N., Mousa, S., Dabbagh, N., & Sadeq, A. (2023). Exploring the pharmacy students' perspectives on off-campus online learning experiences amid COVID-19 crises: A cross-sectional survey. *Saudi Pharmaceutical Journal*, 31(7), 1339-1350. https://doi.org/10.1016/j.jsps.2023.05.024

Farmer, T., & West, R., 2019. Exploring the concerns of online K-12 teachers. *Journal of online learning research*, 5(1), 97-118.

Fidalgo, P., Thormann, J., Kulyk, O., & Lencastre, J.A. (2020). Students' perceptions on distance education: A multinational study. International *Journal of Educational Technology in Higher Education*, 17, 1-18. https://doi.org/10.1186/s41239-020-00194-2

Fortune, M.F., Spielman, M., & Pangelinan, D.T. (2011). Students' perceptions of online or face-to-face learning and social media in hospitality, recreation and tourism. MERLOT *Journal of Online Learning and Teaching*, 7(1).

Garrison, D.R. (2011). *E-Learning in the 21st century: A framework for research and practice*. Routledge.

Gilbert, S.W. (2000). A new vision worth working toward: Connected education and collaborative change. on-line] at http://www.tltgroup. org/images/gilbert/NewVWWT2000/^ NewVwwt2000--2-14-00.htm

Hussein, E., Daoud, S., Alrabaiah, H., & Badawi, R. (2020). Exploring undergraduate students' attitudes towards emergency online learning during COVID-19: A case from the UAE. *Children and youth services review*, 119, p.105699. https://doi.org/10.1016/j.childyouth.2020.105699

Islam, M., Mazlan, N. H., Al Murshidi, G., Hoque, M, Karthiga, V., & Reza, M. (2023). UAE university students' experiences of virtual classroom learning during Covid 19. *Smart Learning Environments*, 10(1), 5. https://doi.org/10.1186/s40561-023-00225-1

Jogezai, N.A., Baloch, F.A., Jaffar, M., Shah, T., Khilji, G.K., & Bashir, S. (2021). Teachers' attitudes towards social media (SM) use in online learning amid the COVID-19 pandemic: the effects of SM use by teachers and religious scholars during physical distancing. *Heliyon*, 7(4), p.e06781. https://doi.org/10.1016/j.heliyon.2021.e06781

Liaw, S.S., & Huang, H.M. (2006, May). Developing a collaborative e-Learning system based on users' perceptions. In *International Conference on Computer Supported Cooperative Work in Design* (pp. 751-759). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-72863-4_76

Liaw, S.S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-Learning: A case study of the Blackboard system. *Computers and education*, 51(2), 864-873. https://doi.org/10.1016/j.compedu.2007.09.005

Liaw, S.S., Huang, H.M., & Chen, G.D. (2007). An activity-theoretical approach to investigate learners' factors toward e-Learning systems. *Computers in Human Behavior*, 23(4), 1906-1920. https://doi.org/10.1016/j.chb.2006.02.002

Linjawi, A.I., & Alfadda, L.S. (2018). Students' perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: a cohort study. *Advances in medical education and practice*, 9, p.855. doi: 10.2147/AMEP.S175395

Malkawi, E., Bawaneh, A.K., & Bawa'aneh, M.S. (2020). Campus Off, Education On: UAEU Students' Satisfaction and Attitudes Towards E-Learning and Virtual Classes During COVID-19 Pandemic. *Contemporary Educational Technology*, 13(1), pp.ep283.. https://doi.org/10.30935/cedtech/8708

Martin, F., Stamper, B., & Flowers, C. (2020). Examining Student Perception of Readiness for Online Learning: Importance and Confidence. *Online Learning*, 24(2), pp.38-58. https://doi.org/10.24059/olj.v24i2.2053

McAndrew, M., & Johnston, A.E. (2012). The role of social media in dental education. *Journal of dental education*, 76(11), 1474-1481. https://doi.org/10.1002/j.0022-0337.2012.76.11.tb05409.x

Muftahu, M. (2020). Higher education and Covid-19 pandemic: matters arising and the challenges of sustaining academic programs in developing African universities. *International Journal of Educational Research Review*, 5(4), 417-423. https://doi.org/10.24331/ijere.776470

Nunnally, J.C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill. http://hdl.handle.net/123456789/11061

Paechter, M., Maier, B., & Macher, D. (2010). Students' expectations of, and experiences in e-Learning: Their relation to learning achievements and course satisfaction. *Computers and Education*, 54(1), 222-229. https://doi.org/10.1016/j.compedu.2009.08.005

Peytcheva-Forsyth, R., Yovkova, B., & Aleksieva, L. (2018, December). Factors affecting students' attitudes towards online learning-The case of Sofia University. In *AIP conference proceedings* (Vol. 2048, No. 1, p. 020025). AIP Publishing LLC. https://doi.org/10.1063/1.5082043

Prensky, M. (2001). Digital natives, digital immigrants part 2: Do they really think differently?. *On the horizon*. DOI: 10.1108/10748120110424843

Robinson, C.C., & Hullinger, H. (2008). New benchmarks in higher education: Student

engagement in online learning. *Journal of Education for Business*, 84(2), 101-109. https://doi.org/10.3200/JOEB.84.2.101-109

Rose, S. (2020). Medical student education in the time of COVID-19. *Journal of American Medical Association*, 323(21), 2131-2132. .https://doi.org/10.1001/jama.2020.5227

Rouadi, N.E.,& Anouti, M.F. (2020). The online learning experiment in the intermediate and secondary schools in Lebanon during the coronavirus (COVID-19) crisis. *Online learning*, 7(7), 14466-14485.

UAE gov (2021). Fact sheet. [online] available at: https://u.ae/en/about-the-uae/fact-sheethttps://u.ae/en/information-and-services/education/distance-Learning-in-times-of-covid-19 [Accessed 10 November 2021]

Ullah, O., Khan, W., & Khan, A. (2017). Students' attitude towards online learning at tertiary level. *PUTAJ–Humanities and Social Sciences*, 25(1-2), pp.63-82.

Warner, D., Christie, G., & Choy, S. (1998). *Readiness of VET clients for flexible delivery including on-line learning*. Brisbane: Australian National Training Authority. http://hdl.voced.edu.au/10707/33256

Wijaya, T.T., Zhou, Y., Purnama, A., & Hermita, N. (2020). Indonesian students' learning attitude towards online learning during the coronavirus pandemic. *Psychology, Evaluation, and Technology in Educational Research*, 3(1), 17-25. http://petier.org/index.php/PETIER/article/view/56/27

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A survey research for e-learning readiness of faculty members during the COVID-19 pandemic: Technological, Pedagogical, and Content Knowledge Solution for e-Learning improvement from the viewpoint of faculty members

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Abstract

This study aimed to evaluate the e-readiness of faculty members during the pandemic COVID-19. It also identified the technological, pedagogical, and content knowledge solutions influencing the success of e-learning in medical education from the viewpoint of faculty members. Hundred faculty members working at Abadan University of Medical Sciences, Abadan, Iran participated in a mixed-method study including quantitative and qualitative phases. In the quantitative arm, the Likert-based Archambault & Crippen questionnaire was applied to measure the e-readiness of faculty members. In the qualitative arm, participants answered the 4 online open-ended questions consisting of three domains (pedagogical, technical, and content), and several themes were constructed from the gathered qualitative data. In quantitative analysis the Friedman test revealed that the knowledge of faculty members in the field of content knowledge was the most and in the field of technological knowledge was the least ($p \leq 0.001$). Besides, in the subjective interpretation of qualitative data, leadership and educational management were the most frequent themes. Moreover, regarding the pedagogical solutions, the focus principally was on the teaching-learning domain followed by revising curriculum planning. In addition, considering the content solution, the concentration predominantly was on the domain of the development of educational resources. From the viewpoint of faculty members, the challenge of the shift to e-learning and pedagogical, technological, and content solutions for e-readiness of faculty members can be resolved through planning and performing professional development programs and this cannot be achieved without effective leadership.

KEYWORDS: Medical Education, E-Learning, E-readiness, Mixed-method Study, Leadership.

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1. Introduction

E-learning is an effective and appropriate educational approach for undergraduate clinical medical education (Delungahawatta et al., 2022). Using e-learning as an electronic medium for communication and interaction between faculty members and collegians is a natural and logical result of the needs of new generations especially in this situation (Awad & Siddik, 2019; Davidson & Rasmussen, 2006). With the onset of the coronavirus disease 2019 (COVID-19) pandemic, universities have inevitably taken steps to integrate e-learning into traditional education to continuity of learning for health professions students (Jin et al., 2021; Naciri et al., 2021; Sindiani et al., 2020). During this integration, medical schools rapidly digitized their instructional equipment and provided faculty members with their computer-based competence by continuing education opportunities and time resources (Hertling et al., 2023). However, e-learning potential requires a certain level of institutional readiness in human resources and infrastructure, which is not always provided in low- and middle-income countries. Therefore, performing

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efficacious e-learning in educational institutes is associated with the readiness levels of faculty members (T. Eslaminejad et al., 2010; Mariani et al., 2012). The institutional readiness for e-learning adaptation ensures the alignment of new tools with the educational and financial resources of setting (Frehywot et al., 2013). According to the results of a study conducted in 2019 on the readiness of countries to implement e-learning, Iran is ranked 59th out of 60 countries, sufficiently determining the importance of finding the strategies to improve this situation (Awad & siddik, 2019).

Several factors should be considered to assess e-learning readiness as a valuable option for providing education and training. Because, a medical university, as a knowledge-based organization, uses a wealth of resources to develop e-learning solutions, these factors must be taken seriously to reduce the risk of failure. One of the necessary factors to implement effective e-learning is analyzing the faculty members' pedagogical knowledge. In this study, readiness in terms of pedagogical solutions is referred to knowledge, attitudes, skills, and habits of faculty members in using appropriate approaches created through face-to-face interaction of the classroom to adapt to e-learning classroom and learners. In other words, pedagogical knowledge refers to the practices, processes, strategies, procedures, and methods of teaching and learning (T. Eslaminejad et al., 2010). Another major factor is an organization's readiness in applying technology and media in the instruction which are computers, the internet, digital video, etc. Faculty members will not be satisfied without sufficient skills and knowledge in applying technology.

Faculty members should have enough knowledge in subjects, such as providing technical support to students, employing multiple versions of a software package, using several operating systems, and the developed and integrated content-producing tools (WD, 2000). Results of a previous study demonstrated that not only the institutions must deliver a sufficient and reliable technical infrastructure to support e-learning activities, but faculty members and students should have technical skills to use e-learning tools. In this regard, faculty members must be both trained to use technology and also be able to organize and provide material with appropriate technology (Paloff RM, 2011). Studies have shown that acceptance of the use of technology in teaching and learning and successful implementation depends on a wide range of factors (Mumtaz, 2000) including training, leadership support, motivation to users, and policies for e-learning technologies (Landa et al., 2020). Valentine (2002) reported that the problems of using technology may be due to lack of knowledge and training, the attitude of the faculty member, or hardware difficulties.

Another major factor influencing faculty members' e-learning readiness is content which is the subject matter that is to be taught. An e-learning program requires content or topics focusing on faculty member's activities. In addition, successful online learning education is influenced by learning experiences properly planned and made possible by knowledgeable educators (Eslaminejad et al., 2010). The final factor is the technological pedagogical content knowledge (TPACK) which is the connections and interactions between these three types of knowledge. TPACK is involved in the understanding of the complexity of relationships among students, teachers, content, technologies, and practices (Archambault & Crippen, 2009). Moreover, TPACK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (S, 2019). TPACK should look into the online teaching readiness of online teachers so that they are well equipped with the online pedagogical knowledge for effective teaching and learning. The findings showed a weak positive correlation between the domains of TPACK and technological readiness of online teachers. Moreover, among other domains in TPACK, the weakest correlation has been shown between technological knowledge and readiness (Rafiqah M. Rafiq K, 2022). This is reflected by the fact indicated in other studies (Gyaase PO, 2019), which mentions that even though the technological knowledge is high, the readiness of teachers to use technology effectively is still low. Considering this fact, technological knowledge does not correlate with the teacher readiness. However, teachers can understand and master TPACK with sufficient technological knowledge to engage students in learning. From this, it can be concluded that the domain of technological knowledge in TPACK is the domain that provides teachers with appropriate technological skills to use in the classroom (Rafiqah M. Rafiq K, 2022).

Although, this method has put a lot of pressure on faculty members and many efforts have been made in this regard, there are still concerns about how much this method has been effective in teaching students, and concerns have been raised about what strategies can be used to improve e-learning. Providing necessary facilities, such as e-learning software and forcing faculty members to provide time-consuming content cannot guarantee the effectiveness of an e-learning system. As, in this way, necessary programs are needed that should be arranged according to the e-readiness of the system (Lindquist & Long, 2011; Najimi et al., 2017).

Accordingly, this study was conducted to investigate the e-learning readiness of faculty members during the COVID-19 pandemic and the recognized constituents of pedagogical, technological, and content solutions influencing efficacious implementation of e-learning in the arena of medical education from viewpoint of faculty

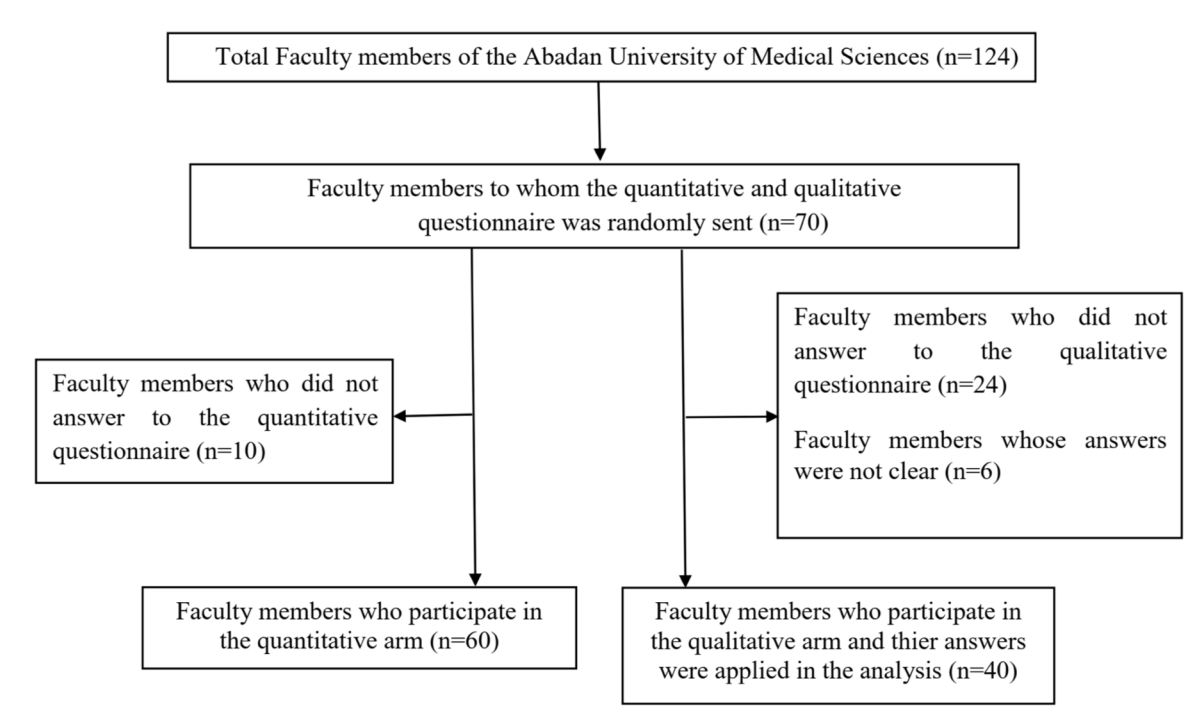

Figure 1 - Flow chart regarding enrollment of faculty members in the present study.

members to use the method that is more desired by the faculty members to improve e-readiness in each domain.

2. Materials and Methods

2.1 Research Approach and Context

This research used a mixed-method approach collecting and analyzing both quantitative and qualitative data from respondents. The mixed-method approach has been satisfactorily practiced in education-based research. Therefore, the collected and analyzed data can be more qualified and reliable (Junus et al., 2021). Considering the aim of the study, this research applied faculty members from a university located in the southwest of Iran who was representative of the population and selected participants with varied experiences and backgrounds. Quantitative data were gathered to measure the e-readiness of faculty members. Also, qualitative data were obtained aimed to investigate the pedagogical, technological, and content solutions of faculty members to improve e-learning readiness. This study was supervised by a faculty member who was responsible for the professor's empowerment unit, who had also participated in various medical education workshops and had a fellowship degree in the field of medical education, and had presented lectures at the medical education conference. The main collaborator of this project who was the director of the education development center, had the degree in three senior medical education courses and had presented a paper in the field of medical education, owned the top rank in medical education conference, and also was a supervisor of thesis in the field of medical education.

2.2 Participants and sampling

This research was conducted on 70 academic teachers working at Abadan University of Medical Sciences, Abadan, Iran as faculty members. It was a sequential (Quantitative-Qualitative) mixed-method study, which was conducted from February-March 2020. Faculty members were selected by a voluntary and convenient online sampling technique. The quantitative component of the study consisted of a Likert-based questionnaire while a web-based semi-structured interview by completion of an online questionnaire were done in the qualitative component of the study to explore faculty members' experiences. In this technique, quantitative and qualitative questionnaires were designed in an online survey system called "DigiSurvey", to easily conduct at uncomplicatedness, low cost, time savings, and the enormous available population. Then, questionnaires were sent randomly to the participants relying on social media during the study, when the pandemic began in Iran and all universities had decided to host e-learning. All the answers were collected in "DigiSurvey" web-based written form. This research focused on faculty members from a university in south-western Iran, who held e-learning classes during the COVID-19 pandemic. Those who did not answer to the qualitative (n=24) or the quantitative questionnaire (n=10) and whose answers to the qualitative questionnaire were not clear (n=6) were excluded from the study. Finally, 60 faculty members

participated in the quantitative arm and 40 participated in the qualitative arm of the study (Figure 1). It should be noted that simultaneously with receiving the answers; they were analyzed and the purposive sampling method continued until reaching data saturation. In other words, the interviews continued until the researchers realized that continuing the interview would not add a new solution to the list.

2.3 Data Collection and Analysis

Quantitative arm

Quantitative data were taken from a Likert-based Archambault & Crippen questionnaire developed to evaluate online teachers' technological pedagogical content knowledge including 24 questions that was provided online for the first time to measure the respondent's perceptions of academic teachers' s e-readiness by using deductive and logical thinking. This questionnaire was based on the TPACK model, in four domains including pedagogical knowledge, technological knowledge, content knowledge, and ability to integrate the pedagogical, technological, and content knowledge (10). Responses were on a Likert-type scale, ranging from 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, and 5 = Excellent. The construct validity of the questionnaire has been established in a previous study on online teachers undertaking the expert review and two rounds of think-aloud piloting (Archambault LM, 2010).

Quantitative data were analyzed using Friedman's test procedure for analysis of variance by ranking the knowledge of faculty in different fields i.e., observed rank scores obtained by numerical outcomes in the lack of strong normal distribution assumptions. The test was supported by IBM SPSS statistics software version 26 which is routinely discussed in textbooks on nonparametric statistics (Eisinga et al., 2017).

Moreover, nonparametric correlations were applied to determine the association between domains.

Qualitative arm

Through the web-based questionnaire, each faculty member underwent a semi-structured interview about his/her suggestion to improve his/her e-learning readiness. At the beginning of the questionnaire, a text was written to explain the purpose of the research. The qualitative questionnaire consisted of 4 open-ended questions investigating the faculty member's viewpoint about pedagogical, technological, and content solutions to improve e-learning readiness and the way to integrate e-learning in conventional teaching (Houshmandi et al., 2019). Participants were free to respond to questions. The qualitative data obtained from the interviews were coded to discover their patterns. They were then interpreted using the method of subjective interpretation of qualitative data along with a systematic classification and coding process to analyze the answers which were inspired by Khanipoor et al (2017). Conventional content analysis was done to extract the themes. In the other words, the preconceived categories were not used. The texts were read repeatedly to understand them and determine meaning units. Then, the meaning units were integrated to specify the codes and neglect meaningless units. The results of subjective interpretation of qualitative data were used to determine pedagogical, technological, and content solutions to improve e-learning readiness of faculty members.

3. Results

Table 1 summarizes the demographic characteristics of participants. The faculty members were mostly aged between 30-39 years old. Fifty-six percent of faculty members had a teaching experience between 1 - 5 years, while 16% of them had more than 10 years of teaching experience. Also, 60% of the participants were instructor, 35 of them were assistant professors, and 5% of them were associate professors.

Table 1 - Demographic characteristics of the participants.

Attribute	Category	n (%)
Location	Faculty of medicine	24 (34%)
	Faculty of nursing	21 (31%)
	Faculty of paramedical	13 (18%)
	Faculty of health	12 (17%)
Discipline	Medicine	10(14%)
	Nursing	21(30%)
	General health	4(6%)
	Environmental health	5(7%)
	Laboratory sciences	4(6%)
	Health Information Technology	3(4%)
	Basis science	14(20%)
	Professional Health	3(4%)
	Other	6(9%)

Quantitative interpretation of faculty members' e-readiness

As shown in Table 2, the Friedman test revealed that the knowledge of faculty members in the field of content knowledge was the most and in the field of technological knowledge was the least ($p \leq 0.001$).

Also, Spearman's correlation analysis showed that technology content knowledge (r=0.8, $p \leq 0.001$) and technological pedagogical knowledge (r=0.9, $p \leq 0.001$) have a positive strong relationship with technological pedagogical content knowledge. Moreover, technological knowledge has a positive weak relationship with pedagogical knowledge (r=0.3,

p<0.05) and pedagogical content knowledge. (r=0.4, p<0.05) (Table 3).

Table 2 - Mean rank of e-readiness domains (the Friedman test was applied to determine the mean rank of e-readiness, $p \leq 0.001$).

E-readiness domains	Mean rank	SD
Pedagogical knowledge	4.11	0.537
Technological knowledge	2.59	0.831
Content knowledge	5.19	0.536
Technology content knowledge	4.39	0.686
Pedagogical content knowledge	4.94	0.558
Technological pedagogical knowledge	3.44	0.735
Technological pedagogical content knowledge	3.34	0.696

Qualitative interpretation of solutions for e-learning improvement from the viewpoint of faculty members

In the method of subjective interpretation of qualitative data, 151 initial meaning units and 72 codes were obtained from the answers given to 4 questions. These codes were categorized into 8 core themes according to their similarities. Themes extracted from the codes were repeated in all questions, but their repeatability was different and fewer themes were extracted from some questions. The ranking of themes based on repetition in all 4 questions is shown in Table 4.

In question No.1 (pedagogical solutions), the focus primarily was on the teaching-learning domain followed by revising curriculum planning. Examples of the extracted codes related to the teaching-learning domain were "using images in content presentation and designing of analytical homework, quizzes, and forums". Also, "deduction of semester units", "transparency of educational context", and "expression of educational goals" were examples of codes extracted related to the domain of revising curriculum planning. Extra examples are given in Table 5.

In question No.2, the focus primarily was on the domain of leadership and educational management. Examples of the extracted codes related to this domain were "using experiences of other universities" and "creating financial incentives and privileges in various regulations for faculty members". Extra examples are given in Table 6.

In question No.3 (content solution), the concentration primarily was on the domain of the development of educational resources. Examples of the extracted codes related to this domain were providing e-learning training booklets and introducing e-books to students, and providing them with access to electronic library systems. Extra examples are presented in Table 7.

In question No. 4 (suggestions to integrate e-learning in teaching), concentration was equally on the domains of leadership and educational management, revising curriculum planning, and development of educational resources. Examples of the extracted codes related to this domain were "creating a virtual education unit", "hiring virtual education specialists", "adapting lesson plans based on principles of e-learning", and "using the integrated system". Extra examples are given in Table 8.

Domains	PK	TK	CK	TCK	PCK	TPK	TPCK
PK	1.000	.299*	.673**	.545**	.670**	.599**	.559**
TK	.299*	1.000	.411**	.568**	.386**	.550**	.621**
CK	.673**	.411**	1.000	.754**	.768**	.639**	.681**
TCK	.545**	.568**	.754**	1.000	.717**	.761**	.801**
PCK	.670**	.386**	.768**	.717**	1.000	.732**	.727**
TPK	.599**	.550**	.639**	.761**	.732**	1.000	.873**
TPCK	.559**	.621**	.681**	.801**	.727**	.873**	1.000

Table 3 - The correlation between e-readiness domains.

PK: pedagogical knowledge; TK: technological knowledge; CK: content knowledge; TCK: technology content knowledge; PCK: pedagogical content knowledge; TPK: technological pedagogical knowledge; TPCK: technological pedagogical content knowledge; * Correlation is significant at p<0.05; **Correlation is significant at p<0.001.

Table 4 - Ranking of themes based on repeatability in 4 questions.

Rank	Extracted themes according to their importance
1	Leadership and educational management
2	Development of educational resources
3	Empowerment of faculty members, teaching-learning, and development of educational platform
4	Revising curriculum planning
5	Evaluation of faculty members
6	Evaluation of students

Table 5 - Examples of the codes and themes for question No.1 (pedagogical solutions).

Codes	Themes
Composing facilitative regulations	Leadership and educational management
Interactive e-learning	Teaching-learning
Providing a suitable physical platform and hardware facilities	Development of educational platform
Defining the system of encouragement and punishment for faculty members	Evaluation of faculty members

Table 6 - Examples of the codes and themes for question No.2 (technological solutions).

Codes	Themes
Increasing bandwidth and facilitating students' access to educational systems	Development of educational platform
Using virtual reality technologies for laboratory lessons	Development of educational resources
Using simple and up-to-date content-producing software	Development of educational platform
Setting up a content-producing studio and providing the necessary hardware	Development of educational platform

Table 7 - Examples of the codes and themes for question No.3 (content solutions).

Codes	Themes
Holding training workshops in the field of e-learning	Empowerment of faculty members
Applying diverse, up-to-date, engaging, and high-quality educational content	Teaching-learning
Presenting key and practical points of the educational content	Revising curriculum planning
Sharing experiences in various fields of teaching, students' assessment etc.	Empowerment of faculty members

Table 8 - Examples of the compressed meaning units and codes for question No.4 (suggestions to integrate e-learning in teaching).

Codes	Themes
Providing incentive support for faculty members using e-learning methods	Leadership and educational management
Creating a virtual education unit and hiring virtual education specialists	Development of educational platform
Construction of classrooms equipped with electronic devices	Development of educational platform
Developing skills in academic members by holding empowerment workshops	Empowerment of faculty members

4. Discussion and conclusion

This study was performed to determine the e-readiness and identify the most important factors influencing the e-readiness regarding pedagogical, technological, and content solutions to implement e-learning from the viewpoint of faculty members in a university of medical sciences in Iran. The results of quantitative data showed that the content knowledge of faculty members was the most and their technological knowledge was the least. Moreover, technology content knowledge and technological pedagogical knowledge indicated a positive strong relationship with technological pedagogical content knowledge. Besides, technological knowledge displayed a positive weak relationship with pedagogical knowledge and pedagogical content knowledge. Accordingly, a similar study on the universities of Medicine in Iran reported that the readiness of faculty members in the technical domain was less than the readiness in the pedagogical domain and continuous training suggesting the need to improve the IT knowledge of faculty members (Tahereh Eslaminejad et al., 2010). Also, in a similar study, the e-readiness of faculty members working in Ardabil University of Medical Sciences, Ardabil in northwestern Iran was identified and reported that technological pedagogical knowledge was the first and pedagogical knowledge was the last priority of the knowledge needs among faculty members (Houshmandi et al., 2019). These results revealed the need for a basic understanding of the compound issues regarding the official and principled uses of technology among faculties. Because consciousness from the educational strategy allows the online faculty members to adopt a grounded design approach, the use of active learning method and compound strategy in course design and assessment of e-learner was one of the critical components that were emphasized by faculty members. This was because in an online learning system the faculty members are not always present to conduct teaching; thus, it is essential to have good e-material courses and clear instructions (Vesely et al., 2007).

It is important for the educator to adapt multiple teaching strategies to meet the needs of diverse learning styles in an online class. Therefore, faculty member readiness is one of the significant requirements for improving the e-learning system, because other critical factors on successful e-learning, such as learning resources design and improve students' capacity to prepare for online learning are correlated to this aspect (Piskurich, 2003).

It is reported that faculty members must pay consideration to the educational strategy principles in their online course design because basic knowledge and understanding of the legal and ethical use of technology are necessary to deliver online courses. Nevertheless, they require more time and greater incentives for designing and developing an e-learning course. However, there are some differences compared to the traditional method, for example, how the online curriculum is delivered is new and very much different from the traditional approach. This is a critical factor influencing the success of e-learning. It is not only related to e-learning content and providing a volume of texts, Word, or PowerPoint documents but is also an essential element of e-learning in the teaching development that underscores communication and interaction with students(Driscoll, 2010; Lee & Owens, 2004).

Also, the results of qualitative data revealed that the development of the teaching-learning process and revising of curriculum planning are the most important pedagogical solutions to improve the e-learning readiness of faculty members. Results of a meta-analysis investigating the efficiency of discussion plans in online learning showed that "rich pedagogical strategies" have the most effect on students' performance compared to when they involve in a conventional online discussion. Rich pedagogical strategies included faculty member participation, communication with students, and facilitation of students' collaboration as well as constant observing and adaptable discussions, which all involve teaching-learning topics (Darabi A, 2013). Furthermore, using e-learning is recommended to develop the teaching-learning process (Benta et al., 2015).

Research has shown that curriculum planning is one of the factors hindering integration of e-learning into course delivery (Dagada R, 2013). Mirzaei et al. pointed out that the development of information and communication technology (ICT) in Iran is dependent on the improvement of social and information-technology-based curriculum planning (Mirzaei, 2015). Also, not only presentation of the online curriculum is novel and very dissimilar from the traditional method, but also curriculum revision is one of the basic elements of e-learning and an important factor in its success. Moreover, curriculum revision is associated with e-learning content and presentation of Word or PowerPoint documents. Besides, it focuses on communication and interaction with students (Eslaminejad et al., 2010).

Also, the results of the present study showed that leadership and educational management was the most frequent domain of technological solutions identified for assessing the e-learning readiness of faculty members and was suggested as a solution to integrate e-learning in teaching. Thus, it can be considered a crucial aspect of the e-learning readiness of faculty members. In line with our study, Altunisik identified that leadership is an important factor to guarantee the implementation of e-learning in an institute (Altunisik, 2012). Also, Dembowski stated that universities must do leadership process properly to implement educational programs effectively and achieve training goals. A leader must set goals and inspire employees to move in that direction and motivate them to work towards goals and overcome challenges (Dembowski, 2006). Moreover, several studies have reported that success in this evolution and moving towards e-learning depends on how it is managed (De Coster et al., 2008; Salmi, 2011; Zhu & Zayim-Kurtay, 2018), and management deficiencies in educational technologies lead to program failure (Kentnor, 2015).

Besides, our results demonstrated that content solutions for improving e-learning readiness may be focused on the development of educational resources. Thus, educational content and materials are recommended to be in the open-access form to education and knowledge [open educational resources], which is referred to as a learning management system and special services offering videos and live streaming, such as apps and e-book systems (Ebner M, 2020). The used content should be interactive, up-to-date, relevant, and user-friendly (Mariani et al., 2012).

In the present study, the factors influencing the integration of e-learning in the educational process were also identified, focusing on the development of educational resources, leadership and educational management, and revising curriculum planning. Resource development is one of the most important necessities lack of which will disrupt the proper execution of the program (Jafari et al., 2020; Meggs et al., 2012). Designing an e-learning framework needs careful analysis and investigation of resources available to the institution (Kituyi G, 2013). According to the existing literature, O'Doherty et al., (O'Doherty et al., 2018) found that the development and implementation of e-learning resources along with educational strategies and skills are among obstacles and solutions in this context. Educational resources are developed by having trained human resources, allocating financial resources, and supporting all stakeholders concerning their needs, all of which are needed to create appropriate mechanisms by e-learning managers. Faculty members as a valuable human resource to continue participation in the development of e-learning should receive support from institutions (Perlman et al., 2014). This support is essential for the future success of the organization. Therefore, an organizational strategy is needed to facilitate key skills and scientific methods when implementing online learning (Bediang et al., 2013).

The findings of this study showed that educational programs should be conducted to improve the e-readiness of faculty members, especially in the field of technological knowledge. Also, improving technological knowledge may be related to increasing the pedagogical knowledge, content knowledge, and pedagogical content knowledge of faculty members. These findings guide the faculty empowerment programs and help the university to know in which areas it should spend more time and cost to strengthen the faculty members.

Because, e-learning readiness in the field of medical education is a novel meaning and is influenced by pedagogical, technological, and content factors, it is important that medical universities and their faculty members be aware of solutions for the improvement of e-learning readiness.

In the meantime, there is a need for a culture that works to improve e-learning readiness among employees. In this way, faculty members will be better organized to challenge in this digital age. Thus, the challenge of the shift towards e-learning and pedagogical, technological, and content solutions for e-learning readiness of faculty members can be handled through planning and performing professional development programs and this cannot be achieved without effective leadership and educational management.

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References

Altunisik, R. (2012). The role of leadership in the success of e-learning programs: The case of Sakarya University e-MBA program. Procedia-Social and Behavioral Sciences, 55, 539-546.

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. Contemporary issues in technology and teacher education, 9(1), 71-88.

Archambault LM, B. J. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. Computers & Education, 55(4), 1656-1662.

Awad, F. R., & siddik, M. S. M. (2019). The Readiness of Countries for E-Learning with Special Focusing on the Sudanese Experience. (Ed.),^(Eds.).

Bediang, G., Stoll, B., Geissbuhler, A., Klohn, A. M., Stuckelberger, A., Nko'o, S., & Chastonay, P. (2013). Computer literacy and E-learning perception in Cameroon: the case of Yaounde Faculty of Medicine and Biomedical Sciences. BMC Med Educ, 13, 57. https://doi.org/10.1186/1472-6920-13-57

Benta, D., Bologa, G., Dzitac, S., & Dzitac, I. (2015). University level learning and teaching via e-learning platforms. Procedia Computer Science, 55, 1366-1373.

Dagada R, C. A. (2013). Integration of E-Learning into Curriculum Delivery at University Level in South Africa. International Journal of Online Pedagogy and Course Design, 3(1), 53-65.

Darabi A, L. X., Suryavanshi R , Yurekli H. (2013). Effectiveness of Online Discussion Strategies: A Meta-Analysis. American Journal of Distance Education 27(4). https://doi.org/10.1080/08923647.2013.837651

Davidson, G. S. V., & Rasmussen, K. L. (2006). Web-based learning: Design, implementation, and evaluation. New Jersey: Pearson.

De Coster, I., Forsthuber, B., Oberheidt, S., Parveva, T., & Glass, A. (2008). Higher Education Governance in Europe: Policies, Structures, Funding and Academic Staff. ERIC.

Delungahawatta, T., Dunne, S. S., Hyde, S., Halpenny, L., McGrath, D., O'Regan, A., & Dunne, C. P. (2022). Advances in e-learning in undergraduate clinical medicine: a systematic review. BMC Med Educ, 22(1), 711. https://doi.org/10.1186/s12909-022-03773-1

Dembowski, F. (2006). The Changing Roles of Leadership and Management in Educational Administration. International Journal of Educational Leadership Preparation, 1(1), n1.

Driscoll, M. (2010). Web-based training: Creating e-learning experiences. John Wiley & Sons.

Ebner M, S. S., Braun C, Ebner M, Grigoriadis Y,Haas M , Leitner P , Taraghi B. (2020). COVID-19 Epidemic as E-Learning Boost? Chronological Development and Effects at an Austrian University against the Background of the Concept of "E-Learning Readiness". Future Internet 12(6), 94. https://doi.org/https://doi.org/10.3390/fi12060094

Eisinga, R., Heskes, T., Pelzer, B., & Te Grotenhuis, M. (2017). Exact p-values for pairwise comparison of Friedman rank sums, with application to comparing classifiers. BMC Bioinformatics, 18(1), 68. https://doi.org/10.1186/s12859-017-1486-2

Eslaminejad, T., Masood, M., & Ngah, N. A. (2010). Assessment of instructors' readiness for implementing e-learning in continuing medical

education in Iran. Med Teach, 32(10), e407-412. https://doi.org/10.3109/0142159X.2010.496006

Eslaminejad, T., Masood, M., & Ngah, N. A. (2010). Assessment of instructors' readiness for implementing e-learning in continuing medical education in Iran. Medical teacher, 32(10), e407-e412.

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., Bedada, S., Korhumel, K., Koumare, A. K., & Scott, J. (2013). E-learning in medical education in resource constrained low- and middle-income countries. Hum Resour Health, 11, 4. https://doi.org/10.1186/1478-4491-11-4

Gyaase PO, G. S., Kuranchie A. (2019). Gauging the E-readiness for the integration of information and communication technology into pre-tertiary education in Ghana: an assessment of teachers' technological pedagogical content knowledge (TPACK). Int J Inf Commun Technol Educ, 15. https://doi.org/10.4018/IJICTE.2019040101

Hertling, S. F., Back, D. A., Kaiser, M., Loos, F. M., Schleussner, E., & Graul, I. (2023). Students' and lecturers' perspectives on the implementation of online learning in medical education due to COVID-19 in Germany: a cross-sectional pilot study. Front Med (Lausanne), 10, 1145651. https://doi.org/10.3389/fmed.2023.1145651

Houshmandi, S., Rezaei, E., Hatami, J., & Molaei, B. (2019). E-learning readiness among faculty members of medical sciences universities and provide strategies to improve it. Research and Development in Medical Education, 8(2), 105-112.

Jafari, M., Laei, S., Kavyani, E., & Jalali, R. (2020). Exploring the Components of the Research Empowerment Program of the Faculty Members of Kermanshah University of Medical Sciences, Iran Based on the CIPP Model: A Qualitative Study. Educational Research in Medical Sciences, 9(2).

Jin, Y. Q., Lin, C. L., Zhao, Q., Yu, S. W., & Su, Y. S. (2021). A Study on Traditional Teaching Method Transferring to E-Learning Under the Covid-19 Pandemic: From Chinese Students' Perspectives. Front Psychol, 12, 632787. https://doi.org/10.3389/fpsyg.2021.632787

Junus, K., Santoso, H. B., Putra, P. O. H., Gandhi, A., & Siswantining, T. (2021). Lecturer readiness for online classes during the pandemic: A survey research. Education Sciences, 11(3), 139.

Kentnor, H. E. (2015). Distance education and the evolution of online learning in the United States. Curriculum and teaching dialogue, 17(1), 21-34.

Khanipoor, F., Amini, M., & Bazrafcan, L. (2017). Evaluation of educational program in the Master of Medical Education by Eisner's educational connoisseurship and criticism model. Journal of education and health promotion, 6.

Kituyi G, T. I. (2013). A framework for the integration of e-learning in higher education institutions in developing countries International Journal of Education and Development using Information and Communication Technology (IJEDICT), 9 (2), 19-36.

Landa, E., Zhu, C., & Sesabo, J. (2020). Managerial Aspects for Deployment of E-Learning Technologies: A Literature Review of Selected Themes. European Journal of Teaching and Education, 2(2), 107-121.

Lee, W. W., & Owens, D. L. (2004). Multimedia-based instructional design: computer-based training, web-based training, distance broadcast training, performance-based solutions. John Wiley & Sons.

Lindquist, T., & Long, H. (2011). How can educational technology facilitate student engagement with online primary sources? A user needs assessment. Library Hi Tech.

Mariani, A. W., Terra, R. M., & Pêgo-Fernandes, P. M. (2012). E-Learning: from useful to indispensable tool. Sao Paulo Medical Journal, 130(6), 357-359.

Meggs, S. M., Greer, A., & Collins, S. (2012). Virtual reality in interior design education: Enhanced outcomes through constructivist engagement in Second Life. International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), 7(1), 19-35.

Mirzaei, K. (2015). Exploring the effective elements of e-learning development in Iran's higher education system. JOURNAL OF TEACHING ENGLISH LANGUAGE STUDIES, 3(4).

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. Journal of information technology for teacher education, 9(3), 319-342.

Naciri, A., Radid, M., Kharbach, A., & Chemsi, G. (2021). E-learning in health professions education during the COVID-19 pandemic: a systematic review. J Educ Eval Health Prof, 18, 27. https://doi.org/10.3352/jeehp.2021.18.27

Najimi, A., Yamani, N., & Soleimani, B. (2017). Needs assessment of virtual training development: Assessment of the level of readiness at faculties of Isfahan University of Medical Sciences. Iranian Journal of Medical Education, 17, 70-76.

O'Doherty, D., Dromey, M., Lougheed, J., Hannigan, A., Last, J., & McGrath, D. (2018). Barriers and solutions to online learning in medical education - an integrative review. BMC Med Educ, 18(1), 130. https://doi.org/10.1186/s12909-018-1240-0

Paloff RM, P. K. (2011). The excellent online instructor: Strategies for professional development. Jossey Bass.

Perlman, R. L., Christner, J., Ross, P. T., & Lypson, M. L. (2014). A successful faculty development program for implementing a sociocultural ePortfolio assessment tool. Acad Med, 89(2), 257-262. https://doi.org/10.1097/ACM.0000000000000120

Piskurich, G. M. (2003). The AMA handbook of e-learning. Amacom.

Rafiqah M. Rafiq K, M. Y. S. M. (2022). Re-envisioning Technological Pedagogical Content Knowledge and Online Teaching Readiness of English for Foreign Language Pre-service Teachers in Language Teacher Education. Frontier in Phisiology, 13.

S, D. (2019). Transfer of Training Aircraft Maintenance: Perceptions of Blended Learning Impact, Arizona State university].

Salmi, J. (2011). The road to academic excellence: Lessons of experience. The road to academic excellence: The making of world-class research universities, 323-347.

Sindiani, A. M., Obeidat, N., Alshdaifat, E., Elsalem, L., Alwani, M. M., Rawashdeh, H., Fares, A. S., Alalawne, T., & Tawalbeh, L. I. (2020). Distance education during the COVID-19 outbreak: A cross-sectional study among medical students in North of Jordan. Ann Med Surg (Lond), 59, 186-194. https://doi.org/10.1016/j.amsu.2020.09.036

Valentine, D. (2002). Distance learning: Promises, problems, and possibilities. Online J Dist Learn Admin, 5(3).

Vesely, P., Bloom, L., & Sherlock, J. (2007). Key elements of building online community: Comparing faculty and student perceptions. MERLOT Journal of Online Learning and Teaching, 3(3), 234-246.

WD, M. (2000). Online education in school [Electronic version]. Int J Educ Manag 14, 315–324.

Zhu, C., & Zayim-Kurtay, M. (2018). University governance and academic leadership: perceptions of European and Chinese university staff and perceived need for capacity building. European Journal of Higher Education, 8(4), 435-452.

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Teaching and Learning Centers and Coordinated Technologies for an Effective Transition at COVID-19 Pandemic Time to Massive Distance Learning and Online Exams

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Abstract

In higher education two key factors for achieving resilience during an emergency are the presence of a teaching and learning center, in charge of supervising all the switchover activities and providing daily assistance to lecturers and students, and the adoption of a variety of technological tools, each with a specific purpose but used in a coordinated way. In this paper we illustrate the rapid transition in the second half of the academic year 2019/2020 to massive distance learning and online exams guided by the teaching and learning center of the University of Urbino. The toolset featured the learning management system Moodle and the webconference tool Blackboard Collaborate, both employed for online lectures and oral exams, together with the e-proctoring tool Smowl for computer monitoring and the webconference tool Google Meet used on students smartphones for environmental monitoring, additionally employed for online written exams. We finally present the outcome of a survey of students opinions on massive distance learning.

KEYWORDS: Online Teaching, Online Exams, Learning Management Systems, Webconference Tools, e-Proctoring Tools.

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1. Introduction

During the second half of the academic year 2019/2020, i.e., from March to September 2020, the COVID-19 pandemic imposed an unexpected reorganization of lectures and exams within universities in order not to stop students careers. The second semester had commenced a few weeks before when on March 8 the lockdown period was decreed in Italy, thus forcing a massive conversion of face-to-face lectures into online ones. According to data collected by MUR, the Italian Ministry for University and Research, and Fondazione CRUI, the Conference of the Rectors of the Italian Universities, the reaction of the Italian university system was extremely rapid, at least technologically. Within one month from the beginning of the lockdown, more than 90% of the teaching activities of undergraduate courses ("corsi di laurea") had been moved online.

In mid May several restrictions about traveling as well as interpersonal distance were still active, so that also exams and thesis defenses had to be supported by digital technologies. This opened a passionate debate on how exams, especially written ones, had to take place online. Actually, the discussion about massive distance learning had already started in March, with an increasing number of webinars organized by both Fondazione CRUI and CODAU, the Conference of the Directors of the Italian University Administrations, in which a few universities presented their experiences and several vendors illustrated their products. Those webinars were

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important occasions for all the Italian universities, which participated through their delegates to digital transformation and innovative teaching as well as their technical staff, to share information about digital technologies and teaching methodologies so as to improve resilience to the pandemic.

The objective of this paper is to report on our experience at the University of Urbino in facing the transition to massive distance learning and online exams due to the COVID-19 outbreak. The main lesson learnt is that two key factors for achieving a quick and successful change from face-to-face to online didactics are the presence of a teaching and learning center, in charge of supervising all the switchover activities and providing daily assistance to lecturers and students during the pandemic, and the choice of a variety of tools, each serving a specific purpose but used in a coordinated way.

The paper is organized as follows. In Section 2 we discuss the role of teaching and learning centers, especially in an emergency period, and the use of coordinated technologies. In Section 3 we recall the activities of the teaching and learning center at the University of Urbino along with the organization of its Moodle platforms. In Section 4 we illustrate the rapid transition to massive distance learning, online thesis defenses, and online oral exams via Moodle and the webconference tool Blackboard Collaborate under the guidance of our teaching and learning center. In Section 5 we address online written exams conducted through a combination of the e-proctoring tool Smowl on students computers and videosurveillance via Google Meet on students smartphones. In Section 6 we present a survey of students opinions on massive distance learning and online exams. Finally, in Section 7 we provide some concluding remarks.

2. Teaching & Learning Centers and Coordinated Technologies

Teaching and learning centers (T&LCs) serve as crucial support systems for lecturers and students by fostering effective teaching and learning practices. They have become integral to modern higher education institutions, aiming to improve teaching quality and students learning outcomes. They provide lecturers and students with a range of resources, training, and support to enhance their educational experience. Simultaneously, the rapid advances in technology have led to the integration of online solutions, such as learning management systems (LMSs) and massive open online courses (MOOCs), to address the growing demand for flexible and accessible education.

In general, T&LCs in higher education institutions have the following functions:

- Lecturers development by offering workshops, seminars, and one-to-one counseling to cover pedagogical strategies, technology integration, and innovative teaching methodologies. T&LCs encourage a reflective teaching approach and foster continuous improvement in instructional practice (Baker et al., 2017).
- Students support for improving their learning skills, such as time management, note taking, and study techniques. T&LCs also provide tutoring services, writing centers, and peer-assisted learning programs to enhance students success and retention rates.
- Instructional design by collaborating with lecturers to (re)design courses to align with learning objectives and engage students effectively. T&LCs promote the use of active learning strategies, technology tools, and multimedia resources to create engaging learning experiences (Nilson and Goodson, 2021).
- Assessment and evaluation by assisting lecturers in developing appropriate methods and rubrics to measure students learning outcomes. T&LCs also offer support in analyzing assessment data to improve course effectiveness and identify areas for enhancement (Walvoord and Anderson, 2011).

Information and communication technology is at the core of T&LCs for enabling distance learning and online exams. It provides digital tools like LMSs, webconference platforms, virtual classrooms, and content sharing utilities, which facilitate the creation and delivery of interactive, multimedia-rich online courses. It also supports online examination systems, ensuring secure test administration, plagiarism detection, and efficient grading. Features like automated evaluation, instant feedback, and data analytics assist lecturers in assessing students performance and identifying areas for improvement. T&LCs should instruct and guide lecturers and students in the use of all these technologies, by clarifying which tool should be employed for which purpose as well as providing a coordinated view of all the tools made available by the institution.

How does the role of T&LCs and coordinated technologies change in the case of emergencies such as pandemics, floodings, and earthquakes? Their role becomes even more important, as was realized worldwide with the advent of the COVID-19 outbreak, which caused a rapid replacement of all in-person activities related to course delivery and examinations by transitioning to online mode.

In these situations, a T&LC should assist the education institution in maintaining a high level of quality during the shift from face-to-face or blended teaching to massive distance learning. The initial step in this direction involves using virtual classrooms and webconference tools to reproduce face-to-face lectures. However, when the emergency persists, it becomes necessary to harness multiple available technologies to propose alternative synchronous and asynchronous activities, with the aim of compensating for the inevitable decrease of human interaction that the situation of distancing entails. Regarding examinations,

they should be conducted in a manner that ensures formal integrity of exam tests and verifies students identity (Rodchua, 2017; Bawarith et al., 2017; Butakov et al., 2019; Sanchez-Cabrero et al., 2021; Muzaffar et al., 2021). At the same time, measures must be adopted to safeguard the privacy and data of those connecting from their homes within various virtual environments (GDPR, 2023).

3. Teaching & Learning Center and Blended/Distance Learning at Urbino

Since the academic year 2004/2005, at the University of Urbino a very limited number of undergraduate programs offer online activities. From the academic year 2004/2005 to the academic year 2013/2014, they used different LMSs: Land of Learning (Pigliapoco & Bogliolo, 2008; Pigliapoco & Lattanzi, 2009), ItsLearning (2023), and Moodle (2023).

At the beginning of 2015, a big investment was made to create a T&LC called CISDEL – *Centro Integrato Servizi Didattici ed E-Learning* (Sisti, 2019). The center coordinates and provides support for face-to-face and online activities dedicated to undergraduate and graduate students as well as all lecturers and their collaborators. The aforementioned activities focus on methological issues and consist of courses and seminars about teaching and learning strategies, paper writing, bibliographic search, content-and-language integrated learning, and intercultural laboratories.

Furthermore, after one year of experimentation in 2014/2015, with the advent of CISDEL all the distance learning activities were integrated into three Moodle platforms, each one having a different purpose and accessible in single sign-on by all lecturers and students, which are hosted by the local server farm since the academic year 2015/2016. At the beginning of every academic semester, CISDEL organizes seminars to instruct lecturers about how to set up and use Moodle resources and activities. Moreover, it maintains a web page where plenty of short textual notes and videotutorials are available to help using Moodle.

The first platform, *Moodle blended*, is structured by automatically importing the whole undergraduate offer from the software system U-Gov Didattica (Cineca, 2023) via the Moodle plug-in Course Fisher (Course Fisher, 2023). It provides a virtual room for each course of every undergraduate program, which in the academic year 2019/2020 were 34 divided into 15 “laurea triennale”, 5 “laurea magistrale a ciclo unico”, and 14 “laurea magistrale biennale”. These programs were overall composed of almost 1,000 courses, taught by more than 300 professors and researchers and 400 external lecturers – assisted by 40 foreign language experts – and attended by slightly more than 14,000 students.

Every room is accessible only by the lecturer teaching that course, who has to register via Course Fisher, and all students enrolled on that course, who have to register via the Moodle plug-in AutoEnrol (AutoEnrol, 2023) based on data extracted from the students career management system Esse3 (Cineca, 2023). Moreover, the room is automatically equipped with a link to the web page of the course and a forum. In each of the academic years from 2015/2016 to 2018/2019, more than 80% of the aforementioned virtual rooms were used for discussing on the forum, sharing teaching material in the form of lecture notes, slides, or multimedia resources, and organizing activities such as quizzes and assignments by means of which students can assess their preparation before taking exams.

The second platform, *Moodle elearning*, is structured in the same way, but is devoted to the undergraduate programs that offer part of their lectures online, which were 5 in the academic year 2019/2020. These programs, mainly related to computer science, social science, and communication science, started using in the academic year 2004/2005 the very rich textual chat of Land of Learning, which we subsequently implemented in Moodle to overcome the limitations of its native textual chat (Bontà et al., 2016). Between 2014 and 2016 the open-source webconference tool BigBlueButton (BigBlueButton, 2023) was experimented to move from a message-based interaction to a more friendly, audiovisual interaction. At the beginning of the academic year 2016/2017, CISDEL decided to adopt the proprietary webconference tool Blackboard Collaborate (henceforth BBCollab) (Blackboard Collaborate, 2023) for all distance learning synchronous activities within all Moodle platforms. BBCollab allows lecturers to plan and give their audiovisual lectures directly inside Moodle and students to find the recordings again inside Moodle. In addition to features available in most webconference tools like a textual chat, document presentation, and screen sharing, BBCollab already provided a button for raising a hand, an integrated whiteboard, a polling mechanism, support for breakout groups, and dynamic management of roles and permissions, which are quite effective in a teaching context. Till February 2020, it was used only inside the Moodle elearning platform for the audiovisual lectures of the 5 aforementioned programs.

The third platform, *Moodle education*, contains virtual rooms for all the other teaching activities like CISDEL services, foreign language courses, contamination labs, summer/winter schools, postgraduate masters, PhD programs, and lifelong learning for university personnel, school teachers, professionals, companies, and institutions, including courses on safety in work places as well as personal data protection regulations.

4. Switching to Massive Distance Learning and Online Oral Exams

The University of Urbino had to stop its on-site teaching activities already on March 2, one week in advance with

respect to the national lockdown. A couple of days before, lecturers and students were informed via e-mail, social networks, and the official website. Till the end of May, all face-to-face lectures were substituted for by online ones, taking place according to the same timetable, on the Moodle blended platform via BBCollab. To cope with connectivity problems or lack of adequate devices, CISDEL invited lecturers to record their online lectures – some of them uploaded pre-recorded activities – and students to keep their microphones and webcams disabled except when asking questions.

The University of Urbino was ready for this quick and broad switchover, so as not to stop students careers, for two reasons. The former was the presence of a T&LC – CISDEL – that had periodically trained users and to which users were accustomed to ask for assistance. The latter was the availability of an LMS for all the undergraduate programs – the Moodle blended platform – with which the vast majority of lecturers and students were familiar since the end of 2015.

The aforementioned switchover had to be accompanied by a number of additional measures, though. Firstly, CISDEL assistance, mostly taking place via e-mail, was enhanced by introducing a phone help desk responding Monday to Friday from 9 am to 6 pm. Secondly, the web page maintained by CISDEL was enriched with additional notes and videotutorials about distance learning because only the lecturers and students of 5 undergraduate programs out of 34 were used to meet via BBCollab. Thirdly, a higher number of computational resources had to be reserved in our server farm to the Moodle blended platform to satisfy the increased workload. The platform architecture was also optimized in terms of caching and parallelism and entirely revisited by decoupling the application from its database for achieving better performance.

From the beginning of March to the beginning of May, we were able to manage every workday around 10,000 users accessing our Moodle blended platform and using BBCollab in it, with peaks of 3,000 users in the same hour, especially in the morning. By the end of March, more than 90% of our almost 1,000 courses within the 34 undergraduate programs were delivered online. A positive side effect was that also the 4 PhD programs started using Moodle and BBCollab systematically. The undergraduate and PhD theses defenses scheduled on March and April were moved to BBCollab as well and broadcast via the official web channel to allow relatives and friends of graduating students to attend.

Starting from mid April, oral exams took place – like distance lectures – within course rooms in the Moodle blended platform via BBCollab. According to a precise protocol, before starting each exam the lecturer had to make sure of the student identity. Moreover, the lecturer had to verify – via the student webcam – that no other person was in the student room and that no teaching material was near the student computer – except for the case of a student with special needs – with the verification being repeatable at any time during the exam. The protocol allowed all students enrolled on a course to follow online exams of that course, with their microphones and webcams off.

It is interesting to revisit the decision made by CISDEL in 2016 of adopting BBCollab in the light of the extraordinary development of webconference tools that was observed during the first half of 2020, witnessed by the success of Zoom (Zoom, 2023), the enhancement of Cisco Webex (Cisco Webex, 2023) and Adobe Connect (Adobe Connect, 2023), and the transition from Skype to Microsoft Teams (Microsoft Teams, 2023) and from Google Hangouts to Google Meet (Google Meet, 2023). All those tools have been empowered in general terms, for instance by supporting higher numbers of simultaneous participants, most of whom visible in a grid layout, but not in specific terms for distance learning. Being adequate in a teaching context means satisfying requirements ranging from integrability with the major LMSs – for a distance learning experience as complete as possible – to ease of use in the most widespread operating systems and browsers – as the audience is wide and variegated – and presence of functionalities typical of a teaching environment – distinction of roles and permissions, integrated whiteboard, button for raising a hand, polling mechanism, etc.

Despite the mentioned advances, which made the considered webconference tools well suited for smart working, we believe that the choice of BBCollab was still fully adequate in the second half of the academic year 2019/2020 for the didactic needs of lecturers and students. To the best of our knowledge, at that time BBCollab was the only webconference tool possessing all the following features together:

SETTINGS, ROLES, PERMISSIONS:

- usable on the operating systems Linux, MacOS, Windows, Android, IOS via the browsers Firefox, Chrome, Safari without having to install any additional software component;
- supporting up to 250 participants in normal mode and 500 participants in webinar mode;
- establishing audiovisual connection subject to prior consent to share microphone and webcam;
- multiple roles: moderator, speaker, caption creator, participant;
- multiple permissions: audio, video, messages, drawings;
- dynamic management of roles and permissions, including expulsion.

FUNCTIONALITIES:

- visibility of the full list of participants and their status in textual format;
- possibility to record audiovisual chats;
- buttons immediately accessible for activating/deactivating microphone and webcam;
- button immediately accessible for raising a hand with audio and popup notification;

- integrated textual chat with emoji and audio and popup notifications;
- integrated whiteboard usable in a shared way;
- sharing the entire screen, an application in a single window, or a document;
- sharing a further webcam (to frame a text, an object, or a physical board);
- live manual caption creation;
- live polling mechanism;
- breakout groups.

INTEGRATION IN MOODLE:

- planning and joining audiovisual chats within Moodle;
- guest link for the participation of those who have no Moodle access;
- availability of audiovisual chat recordings within Moodle;
- keeping user identity when moving from Moodle to an audiovisual chat;
- coordination between Moodle roles (lecturer, collaborator, student) and audiovisual chat roles.

5. Online Written Exams: Proctoring + Videosurveillance

The organization of an online written exam is more complex because of multiple students taking the exam simultaneously, instead of one at a time like in an oral exam. Many lecturers thus decided to convert their written exams into oral ones during the second half of the academic year 2019/2020. However, there are disciplines like sciences, economics, and foreign languages for which this is not always appropriate or feasible.

Similar to traditional written exams, online ones can be computer based or take place by pen and paper. In the former case, the Moodle activities quiz and assignment naturally lend themselves to be used for setting up a written exam, provided that the lecturer can monitor the correct behavior on each student computer. In the latter case, Moodle can still be useful for delivering the text of the exam to all students, with the lecturer checking what is going on via each student webcam. In both cases, a webconference tool is necessary to establish a communication channel between the lecturer and the students throughout the exam, so that students can pose questions and the lecturer can answer them or warn students in case of misbehavior.

In March a big debate started within the Italian universities about how to guarantee the correctness of online written exams, also known as academic integrity. One option is to adopt an e-proctoring system, which is a mechanism for controlling what is happening on students computers. These systems range from lockdown browsers, which prevent students from launching programs different from the allowed ones, to applications performing facial recognition and monitoring all computer activities, which let students use any program. A different option is to set up a videosurveillance system for environmental monitoring by taking advantage on the lecturer side of the grid or carousel view available in many webconference tools like Zoom, Google Meet, and Microsoft Teams. Every position in the grid corresponds to a student smartphone, located in the student room in such a way that the lecturer can see both the student and the student computer or the paper on which the student is writing.

The debate was motivated by the fact that e-proctoring systems seem to be more effective – even in the case of pen-and-paper exams as students may cheat by looking for answers on computers – but they are more expensive, usually require students to install additional software components on their computers, and should guarantee a full compliance with regulations about students privacy. On the other hand, the videosurveillance option does not incur the aforementioned problems, but is less effective as it does not really permit to observe what is happening on students computers, especially when there are many students taking the exam.

While most universities considered the two options as alternative to each other, we viewed them as complementary, so that the strategy adopted by CISDEL was to combine an e-proctoring system with videosurveillance. As for e-proctoring, we avoided resorting to lockdown browsers like, e.g., Safe Exam Browser (Safe Exam Browser, 2023). Although they constitute the most adequate option for computer-based exams taking place on-site, in which computers are used by students only during the exams, in the case of online written exams these tools may not be able to detect (and close) programs opened by a student before the exam commences, thus the student may keep sharing the computer screen with a third party who may suggest the right answers. Among the remaining systems, we focused on European solutions, for a higher confidence in privacy regulation adherence, that could be used within LMSs, in particular Moodle.

We adopted the GDPR-compliant, Moodle-integrated, e-proctoring tool Smowl (Smowl, 2023), also because it allows several Moodle activities to be monitored – not only quizzes – and from May to September it was offered at a discounted price depending only on the number of students using the tool – instead of the number of exams taken by those students. Smowl performs facial recognition without resorting to videos. In contrast, it takes one picture per minute on average via the student webcam and highlights with a red frame those in which the student is not in front of the screen or some other person replaces or gets close to the student during the exam. In addition to that, through the Smowl CM component it monitors all the applications that are open on the student computer – including those launched before the exam, possibly automatically by the operating system – by periodically taking screenshots. Videosurveillance was instead realized via Google Meet on student smartphones with the grid view active on the lecturer computer, thanks to the free educational license available at the University of Urbino.

The precise protocol to be followed in the case of written exams was established in mid May. More than 100 courses jointly used Smowl and Google Meet till the end of September, with almost 4,000 students involved in online written exams. In that period, the University of Urbino was among the very few ones that handled online written exams by a combination of tools each serving a specific purpose:

- Moodle for delivering exam tests and receiving students answers via quiz or assignment activities, as well as for hosting the BBCollab activity, the Smowl proctoring, and the Google Meet url.
- BBCollab for the initial phase of the exam and audio monitoring afterwards, with the latter allowing students to pose questions and the lecturer to provide clarifications and warn misbehaving students.
- Smowl for e-proctoring consisting of students facial recognition via students computer webcams and application monitoring on students computers.
- Google Meet for environmental monitoring via students smartphones – with the grid view active on the lecturer computer – which can also be considered as a secondary channel to communicate with students.

The Smowl plug-in for Moodle originates a Smowl block inside Moodle that has different functionalities for lecturers and students. Prior to the first online written exam, a lecturer has to activate the Smowl block inside the Moodle room of the course; in this way, the Smowl block becomes available also to all students enrolled on that course. On the other hand, regardless of the specific course, at least 72 hours before the first online written exam a student has to register once and for all with Smowl, by following a link available in the Smowl block of the course. Smowl registration is accomplished by taking three facial pictures – for facial recognition at exam time – and installing the Smowl CM component on the computer – for monitoring applications at exam time. In 2020 the Smowl CM component was available for Windows and MacOS, but not for Linux, and the recommended browsers when using Smowl at exam time were Firefox and Chrome.

From the Smowl block of the course, the lecturer sees which students successfully registered to Smowl and decides which quiz or assignment activities should undergo to Smowl monitoring. At the beginning of the exam, the lecturer and the students virtually meet on the Moodle blended platform via BBCollab. For each student, the lecturer performs the same verifications mentioned in the case of online oral exams and additionally checks that no HDMI cable is attached to the student computer, so as to avoid hardware connections with nearby people which could not be detected by Smowl. The student is then invited to join Google Meet via the smartphone, to be located in a proper position as already described.

After this initial phase, the online written exam can start. When entering the Moodle quiz or assignment, every student is informed that the Smowl monitoring is about to start and is asked consent to proceed. Then the image captured by the student webcam is displayed within Moodle to the student and a small window reminding the student that Smowl CM is active stays open until the end of the online written exam. Computer monitoring through Smowl CM is in use only during the online written exam and the student is free to install it just before the exam and remove it as soon as the exam is over.

On the lecturer side, the Smowl CM monitoring outcome can be immediately looked up from the Smowl block as screenshots are made available in real time. In this way, the lecturer can promptly warn students who are using, intentionally or because launched in background by the operating system, applications that are not permitted, especially those allowing for screen sharing as well as search engines. In contrast, the facial recognition outcome is available within 24 hours, i.e., pictures are not immediately ready. This delay can be mitigated thanks to the use of the environmental monitoring via Google Meet, as the lecturer can see in real time all students taking the exam and may notice inappropriate situations, even if not systematically as Smowl would do.

6. Student Opinions on Massive Distance Learning and Online Exams

All the 14,372 undergraduate students of the University of Urbino were invited via e-mail to participate in a survey on massive distance learning and online exams that took place from July 25 to September 7. The survey was administered as a computer-assisted telephone interview by an external company and supervised by an internal committee not involving CISDEL. The overall number of returned questionnaires was 1,901. The question set was divided into three parts: attendance, connectivity, devices, BBCollab (13 questions); distance learning assessment (18 questions); future of distance learning (5 questions).

The first part pointed out that, between March and May, 86% of students participated in at least two online courses, 84% attended at least half of the lectures, 80% of lecturers recorded their online lectures, and recordings of at least half of the lectures were downloaded by 70% of students. As far as connectivity is concerned, 45% of students used an ADSL connection, 38% a fiber connection, and 14% a mobile connection, in 87% of cases from a room not shared with other people. The most frequently used devices for online lectures were laptop computers (70%), followed by desktop computers (16%), smartphones (10%), and tablets (4%) – with smartphones being the most used as secondary devices (52%) – where those devices where shared with other people in 20% of cases – with sharing yielding attendance problems in 28% of cases. Apart from 30% of students who did not experience any problem during online lectures, 50% encountered connectivity problems, 13% problems with BBCollab,

and 4% problems related to obsolete devices or scarce familiarity with technology. With respect to the use of BBCollab, 11% of students never had connectivity problems, 34% rarely, 50% sometimes, and 4% always, with 92% of students rating BBCollab at least 6/10.

The second part revealed that 72% of students preferred that the lecturer kept the webcam on - while in 16% of cases it was on and in 66% of cases it was sometimes on and sometimes off – and 83% of students always kept their webcams off. The use of webcams was viewed as rather intrusive by 57% of students and a high source of distraction by 57%, whereas it was considered to foster a good interaction level with the lecturer by 54% and a high sense of community by 35%. According to 87% of students, most lecturers left enough time for students questions and interventions, with the latter taking place in all online lectures in 50% of cases and in some online lectures in 37% of cases, with a frequency higher than, comparable to, or lower than the one of face-to-face lectures in 28%, 41%, or 24% of cases, respectively, and a higher ease of intervention ascribed to the textual chat in 46% of cases and the microphone in 29%. The impact of distance learning was rated at least 6/10 by 75% of students with respect to what they learnt, 70% with respect to oral exams, 63% with respect to the interaction with the lecturer at teaching time, 58% with respect to keeping attention during lectures, 55% with respect to the interaction with the lecturer before or after teaching, 46% with respect to written exams, 45% with respect to the interaction with the lecturer at reception time, and 32% with respect to the interaction with coursemates.

The third part showed that in the future distance learning should be integrated with face-to-face lectures according to 61% of students, be used only in emergency or specific situations according to 28%, and replace traditional lectures according to 10%. The major strengths of distance learning emerging from the survey were higher flexibility and accessibility due to lectures recording, reduction of traveling time and costs, and elimination of teaching room overcrowding, whilst the major weaknesses were connectivity problems, distraction, difficulties with online exams, poor interaction with coursemates, and the need of improving online teaching material and methodologies. For the first semester of the academic year 2020/2021, the possibility of following lectures both on-site and online was selected by 49% of students, while attending only on-site or only online was chosen by 18% and 32%, respectively.

7. Conclusions

The pandemic accelerated the exploration of distance learning, which is thus expected to be adopted more frequently in the future as a natural complement to traditional teaching. A large body of literature (see, e.g., Seechaliao, 2017) shows how the relationships among pedagogical methodologies, disciplinary contents, and technological applications impact on the transformative nature of learning and teaching processes. In particular, the effective use of technologies in educational contexts depends on its acceptance, which represents a prerequisite and at the same time a critical factor for the improvement of the aforementioned processes (El-Gayar et al., 2011; Birch and Irvine, 2009; Radovan and Kristl, 2017). As indicated by the survey, the current generation of students is definitely ready for a higher education that integrates face-to-face activities with online ones and audiovisual material (Ghilay, 2016).

Our experience in tackling the COVID-19 pandemic emphasizes the importance of an LMS already in place for all the major teaching activities, along with a T&LC in charge of supervising the transition and assisting lecturers and students every day. In case of health, weather, hydrogeological, and seismic emergencies, both factors contribute to reduce enormously the switchover time and increase consequently the institution resilience. Furthermore, having good educational tools is as important as receiving suitable guidelines, so as to avoid a chaotic use of technology arising from a multitude of similar digital platforms made available to lecturers and students without explaining when to use them and how to exploit their strengths and cope with their weaknesses.

As for massive distance learning, our experience shows that it is fundamental to have not only a mature LMS like Moodle, but also an integrated webconference tool like BBCollab that is teaching oriented, i.e., possesses features that are strictly necessary in a teaching context. If we consider instead online written exams, it turns out that using an e-proctoring tool alone is not fully satisfactory from a timing viewpoint, while resorting to videosurveillance alone is even risky as it provides no systematic feedback about what is happening on students computers. To set up an effective anti-cheating system, we firmly believe that the right solution is a GDPR-compliant combination of e-proctoring and videosurveillance. On the other hand, we noticed that, on average, lecturers are not ready yet for the adoption of advanced e-proctoring tools like Smowl that offer a wide gamut of functionalities. Rather, they seem to prefer simpler tools like lockdown browsers, even if these tools cannot guarantee the same level of academic integrity.

References

Adobe Connect (2023). Adobe Connect website. https://www.adobe.com/products/adobeconnect.html.

AutoEnrol (2023). AutoEnrol website. https://moodle.org/plugins/enrol_autoenrol.

Baker, V. L., Lunsford, L. G., and Pifer, M. J. (2017). *Developing Faculty in Liberal Arts Colleges:*

Aligning Individual Needs and Organizational Goals. Rutgers University Press.

Bawarith, R., Basuhail, A., Fattouh, A., and Gamalel-Din, S. (2017). E-exam cheating detection system. *International Journal of Advanced Computer Science and Applications*, 8:176-181.

BigBlueButton (2023). BigBlueButton website. https://bigbluebutton.org/.

Birch, A. and Irvine, V. (2009). Preservice teachers' acceptance of ICT integration in the classroom: Applying the UTAUT model. *Educational Media International*, 46:295-315.

Blackboard Collaborate (2023). Blackboard Collaborate website. https://www.blackboard.com/.

Bontà, E., Torrisi, G., and Bernardo, M. (2016). ChaRLeS: An open-source chat room learning system. In *Proc. of the 2nd Italian Conf. on Education, Multimedia and Moodle (EMEM ITALIA 2016)*, pages 1084-1093. Genova University Press.

Butakov, S., Shcherbinin, V., Diagilev, V., and Tskhay, A. (2019). Embedding plagiarism detection mechanisms into learning management systems. In *Scholarly Ethics and Publishing: Breakthroughs in Research and Practice*, pages 216-231. IGI Global.

Cineca (2023). Cineca website. https://www.cineca.it/.

Cisco Webex (2023). Cisco Webex website. https://www.webex.com/.

Course Fisher (2023). Course Fisher website. https://github.com/bobopinna/moodle-blocks_course_fisher.

El-Gayar, O., Moran, M., and Hawkes, M. (2011). Students' acceptance of tablet PCs and implications for educational institutions. *Educational Technology & Society*, 14:58-70.

GDPR (2023). Complete guide to GDPR compliance. https://gdpr.eu/.

Ghilay, Y. (2016). *Online Learning in Higher Education*. Nova Science Publishers.

Google Meet (2023). Google Meet website. https://workspace.google.com/products/meet/.

ItsLearning (2023). Itslearning website. https://www.itslearning.com/.

Microsoft Teams (2023). Microsoft Teams website. https://www.microsoft.com/en-us/microsoft-teams/group-chat-software/.

Moodle (2023). Moodle website. https://moodle.org/.

Muzaffar, A. W., Tahir, M., Anwar, M. W., Chaudry, Q., Mir, S. R., and Rasheed, Y. (2021). A systematic review of online exams solutions in e-learning: Techniques, tools, and global adoption. *IEEE Access*, 9:32689-32712.

Nilson, L. B. and Goodson, L. A. (2021). Online Teaching at its Best: Merging Instructional Design with Teaching and Learning Research. John Wiley & Sons.

Pigliapoco, E. and Bogliolo, A. (2008). The effects of psychological sense of community in online and face-to-face academic courses. *International Journal of Emerging Technologies in Learning*, 3:60-69.

Pigliapoco, E. and Lattanzi, E. (2009). A computer-aided methodology for direct and indirect monitoring of the learning process. In *Proc. of the 1st Int. Conf. on Computer Supported Education (CSEDU 2009)*, volume 2, pages 33-40. INSTICC Press.

Radovan, M. and Kristl, N. (2017). Acceptance of technology and its impact on teachers' activities in virtual classroom: Integrating UTAUT and CoI into a combined model. *Turkish Online Journal of Educational Technology*, 16:11-22.

Rodchua, S. (2017). Effective tools and strategies to promote academic integrity in e-learning. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 7:168-179.

Safe Exam Browser (2023). Safe Exam Browser website. https://safeexambrowser.org/.

Sanchez-Cabrero, R., Casado-Perez, J., Arigita-Garcia, A., Zubiaurre-Ibanez, E., Gil-Pareja, D., and Sanchez-Rico, A. (2021). E-assessment in e-learning degrees: Comparison vs. face-to-face assessment through perceived stress and academic performance in a longitudinal study. *Applied Sciences*, 11:7664.

Seechaliao, T. (2017). Instructional strategies to support creativity and innovation in education. *Journal of Education and Learning*, 6:201-208.

Sisti, F. (2019). Il centro integrato di servizi didattici ed e-learning (CISDEL). In *Innovazione Didattica Universitaria e Strategie degli Atenei Italiani*, pages 183-188.

Smowl (2023). Smowl website. https://smowl.net/.

Walvoord, B. E. and Anderson, V. J. (2011). *Effective Grading: A Tool for Learning and Assessment in College*. John Wiley & Sons.

Zoom (2023). Zoom website. https://zoom.us/.

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Problematic Smartphone Use and University Students' Academic Performance

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Abstract

One of the most pressing emergent educational issues addressed by the international research literature concerns the effects that excessive or problematic smartphone use can have on students' academic performance. An exploratory study was thus carried out with 46 students enrolled in a five-year degree program at the University of Padova (Italy) who were asked to provide their perceptions of their level of smartphone dependence and academic performance. Findings seem to indicate a significant correlation between high levels of smartphone addiction, difficulty concentrating while studying, and a frequent tendency to procrastinate on completing assigned tasks. Responses regarding smartphone distraction during in-person classes were particularly interesting: over 75% of respondents reported using their smartphones frequently in class. In order of importance, their reasons for doing so were to view and answer social media messages (61%), "boredom" due to the teaching strategies employed by some teachers in presenting lessons (41%), and the need to take a break from concentrating in class (35%). Lastly, smartphone use and its effects on academic performance involve three principal components: usage time, distraction in class, and frequency of smartphone checks. Smartphone usage time seems to have a direct negative effect on exam grades. Distraction in class is most significant for respondents who use their smartphones for messaging, while the frequency with which respondents check their smartphones is inversely proportional to their age. To limit these problems, we suggest that proven educational and teaching strategies be used to raise students' awareness of smartphone addiction, encourage students to participate actively, and use the smartphone as a teaching tool. As the study's findings are based on a self-report questionnaire, they reflect students' perceptions. To more accurately assess and confirm these findings, planned future fieldwork will monitor smartphone dependence during class and determine the actual amount of time students spend on their smartphones and how it correlates with academic performance.

KEYWORDS: Smartphone Addiction, Higher Education, Innovative Teaching, Educational Technology, Mobile Phones.

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1. Introduction: Smartphone Addiction

1.1 A particular kind of addiction

The concept of technology addiction or dependence is by no means new and refers to the excessive and disordered use of a specific device, such as a video gaming console or a personal computer, for surfing the Web. Smartphone addiction or Problematic Smartphone Use (PSU) (Kuss et al., 2018) is usually classified under the broader heading of behavioural addiction, or in other words, a behaviour that results in dependence and at the same time can also cause a series of physical symptoms (APA, 2013). Though very similar to other forms of dependence, smartphone addiction is riskier because the smartphone has become an indispensable tool we carry wherever we go.

There can be many signs of dependence, including:

- Loss of a sense of time.

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- Difficulty in completing tasks involving work, family or school commitments.
- Euphoria when online, and anxiety and depression when offline,
- Using and/or keeping the smartphone on during the night, and lastly
- "Phantom vibration syndrome", or the continual tension about missing a call or text.

1.2 Nomophobia and interpersonal relationships

If deprived of their phone for some reason, people with smartphone addiction can show signs of restlessness and anxiety, developing into a syndrome that has been dubbed nomophobia or no mobile phone phobia (Yildirim & Correia, 2015). Nomophobia chiefly entails (Bragazzi, Re & Zerbetto, 2019):

- The fear of being unable to communicate;
- The feeling of being disconnected from virtual communication platforms and thus not being kept up to date in real-time;
- The fear of not being able to access potentially important information;
- The fear of giving up the convenience of having a smartphone.

The smartphone is a highly personal device that can inspire strong emotional attachment, which can relieve everyday stress (Cho, Kim & Park, 2017). As such, it is very similar to what psychology calls a "comfort object" or "transitional object" that provides emotional security but can create anxiety if unavailable. This form of addiction appears to be particularly prevalent among young people (De-Sola Gutiérrez, 2016): several studies suggest that dependence in younger age groups is heavily influenced by factors associated with family and/or social environments. Poor family functioning, for example, with conflict and lack of communication, can be highly predictive of smartphone addiction in adolescents (Li et al., 2018). Accordingly, the risk of addiction is especially high in schools and universities precisely because of the problems that can arise in peer relationships (Jeong & Gweon, 2020). The more critical these relationships become, the more strongly they correlate with smartphone addiction: indeed, the lack of quality relationships can exacerbate excessive phone use. It is thus not surprising that with the social distancing measures introduced during the pandemic and the decision to adopt distance teaching, many students spent excessive amounts of time online with their smartphones, increasing their dependence and developing symptoms of anxiety and depression (Servidio et al., 2021).

2. Diagnosing smartphone addiction

2.1 Smartphone Addiction Scale

"Diagnosing" smartphone addiction is not easy, as it involves considering a wide range of *qualitative* factors (psychosomatic manifestations, felt emotions, etc.) and *quantitative* factors (usage time, number of online interactions, etc.). The most widely used instrument for gauging the level of dependence is the SAS, Smartphone Addiction Scale (Kwon et al., 2013). Though the SAS is useful, it relies on self-perceptions and thus does not provide objectively measured data. Several studies, in fact, have found that self-report estimates of smartphone usage are not entirely reliable (Wilcockson, Ellis, & Shaw, 2018). There is also a short version of the SAS, the SAS-SV, which has been adapted in several languages and cultural contexts (including Italy) and targets adolescents. It consists of 10 items tapping various aspects of smartphone addiction (Table 1).

Table 1 - Smartphone Addiction Scale Short Version for Adolescents (Kwon et al., 2013).

n.	SAS-SV Scale items
1	Missing planned work due to smartphone use.
2	Having hard time concentrating in class, while doing assignments, or while working due to smartphone use.
3	Feeling pain in the wrists or at the back of the neck while using a smartphone.
4	Won't be able to stand not having a smartphone.
5	Feeling impatient and fretful when I am not holding my smartphone.
6	Having my smartphone in my mind even when I am not using it.
7	I will never give up using my smartphone even when my daily life is already greatly affected by it.
8	Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook.
9	Using my smartphone longer than I had intended.
10	The people around me tell me that I use my smartphone too much.

3. Smartphone addiction and distraction effects

3.1 Distraction effects caused by smartphones

Threats to students' attention in class by no means began with the smartphone: "mind wandering" has long been recognised as a problem (Wammes, 2019). However, mind wandering is innate to everyone's mental life and does not require cognitive activity of any kind in interacting. By contrast, using smartphones calls for significant cognitive effort to deal with the continual feedback required by social media, for example, and thus aggravates the problem of inattention (Marty-Dugas et al., 2018). Several studies have found that, on average, 50% to 70% of students check their smartphones at least once during a lecture and that few are able to resist the temptation (Atas & Çelik, 2019). A smartphone ringtone or notification heard during a lesson or while doing an assignment that requires concentration reduces academic performance just as much as actively using the phone (Stothart et al., 2015). Even the smartphone's mere presence is a critical factor significantly reducing the brain's available cognitive capacity (Ward et al., 2017). Models have recently been developed that seek to formalise the most essential variables operating in distractive smartphone use (Throuvala et al., 2021), finding that such use is driven primarily by the need for validation and control of self-presentation on social media and can be amplified by syndromes such as FOMO, or Fear Of Missing Out and the need to seek reassurance from continual feedback and new posts (Elhai et al., 2020).

3.2 The challenges of integrating smartphones into teaching

The use of smartphones in formal educational settings can thus be a powerful distraction, but whether it is or not also depends on teachers' ability to hold their students' attention: it appears that students engage more with their smartphones primarily when they are bored by the lesson (Green, 2019) or when topics they consider less critical are being covered (Bolkan & Griffin, 2017). However, the problem also arises when teachers attempt to use smartphones in specific learning activities with the BYOD (Bring You Our Own Device) model. In such cases, the student is required to perform two simultaneous and cognitively challenging tasks: listen to what the teacher is saying and at the same time, work with the mobile device. This multitasking is frequent and inevitable, and according to recent studies, can have a negative impact not only on attention but also on recall, comprehension and efficiency in completing academic tasks (May & Elder, 2018). The risks for learning processes are high. Extensive research literature demonstrates that students who do not use smartphones in class take notes more effectively, have better recall of lecture content, and show higher overall performance than those who do (Flanigan & Titsworth, 2020). Even students who are interested in the lecture and attentive may attempt to multitask with their smartphones, with the same negative impacts we have just described. The time spent on the smartphone outside the school setting is also an important indicator, as it often interferes with students' rest, relaxation and studying. (Gui & Gerosa, 2021; Lee et al., 2014).

4. Methodology

This exploratory study collected data and evidence for future work with larger samples. The research questions were as follows:

1. How much does excessive smartphone use influence university students' academic performance? What are the possible causes of excessive use?
2. Are there strategies that teachers can implement to curb the potential harm caused by smartphone addiction?

4.1 Instruments and sample

To answer the research questions, we created a questionnaire with 19 items (Table 2). Only a few of these items were taken from the SAS-SV because the goal was not only to measure the level of smartphone dependence but also to determine which habits involved in students' relationship with the smartphone can have a negative impact on academic performance and the number and nature of the smartphone's distraction effects. The ultimate aim is thus to gather information that can be useful in making students aware of the problem and proposing solutions to it.

The questionnaire, which mainly consisted of items on a 5-point Likert scale, was administered online to 46 students (F=43, M=3) with an average age of 24 years, all enrolled in the first year of the five-year degree program in Education Sciences and Primary Education Sciences for the academic year 2021/2022.

4.2 Analyses

The analysis of the responses from the questionnaire involved multiple stages and was conducted using Jamovi software, an open-source platform that utilises R as its engine. The initial stage of the analysis involved generating descriptive and frequential statistics to provide a preliminary overview of the

Table 2 - Adapted Questionnaire Items.

n.	Questionnaire items
	Demographics
1	Age
2	Gender
3	Current grade point average
	Smartphone usage
4	Average daily hours of smartphone use
5	Right number of hours of smartphone use for people your age
6	What do you normally use your smartphone for?
7	I use my smartphone even when I should be finishing more important things. (5-point Likert scale)
8	I spend more time on my smartphone than I should. (5-point Likert scale)
9	I use my smartphone in bed until late and fall asleep with it on. (5-point Likert scale)
10	Constantly checking my smartphone so as not to miss conversations between other people on Twitter, Instagram, Facebook or other social media. (5-point Likert scale)
11	I prefer studying with my smartphone than with my computer. (5-point Likert scale)
12	What are the greatest difficulties you have studying with your smartphone rather than your computer?
	Distractions in class and while studying
13	What is the greatest source of distraction during in-person classes? (5-point Likert scale)
14	If you use your smartphone during class, what are the reasons?
15	Do you think teachers ought to prohibit smartphone use during class? (5-point Likert scale)
16	When I'm studying, I manage to concentrate only for short periods. (5-point Likert scale)
	Openness to proposals
17	Do you think it would be useful to attend a seminar on how to deal with excessive smartphone dependence and its consequences on academic performance? (5-point Likert scale)
18	Do you think it would be useful to attend a seminar on how to deal with excessive smartphone dependence and its social consequences? (5-point Likert scale)
	Optional item
19	If you were told you could choose a big gift, would you pick a new smartphone, or something else?

collected data. Subsequently, a correlation matrix was constructed to identify potential interactions between variables. The third stage involved conducting a Principal Component Analysis (PCA) to synthesise the data and identify latent variables. Another correlation matrix was then created to examine any correlations between the components identified in the PCA and other variables. Finally, a logistic regression analysis was conducted to determine the influence of the identified components and other relevant variables on the students' grade point average (GPA).

5. Results

The situation emerging from descriptive analysis was as follows:

- There is no consensus among students about how much time should be spent on the smartphone daily: responses range from "less than an hour" to "5 hours", though the majority think the right time is between 1 and 2 hours.
- Most respondents use their smartphones more than they think they should (median 4 hours). However, the number of hours considered right and the actual number of use are directly proportional.
- The smartphone is the second-greatest source of distraction during class (76%), immediately after talking to classmates (80%).
- 60% of the respondents say that the smartphone is a source of distraction because of notifications from social media or chatgroups.
- 41% of the respondents say that the smartphone is a source of distraction because lessons are boring.
- Only a minority (median Likert score 2 out of 5) thinks that instructors should prohibit smartphone use in the classroom.
- Smartphones are used chiefly with chat apps (89%) and social networks (74%). 72% of the respondents carry out personal web searches, and only 63% use the smartphone to make calls.
- Few respondents use smartphones instead of computers for academic tasks (median 2).
- Respondents are open to being educated in correct smartphone use (median 4 for both proposed seminars).

A correlation matrix was then constructed, which provided some interesting insights.

Distraction and grades

There is a fairly sizable negative correlation ($r=-0.453$, $p=0.002$) between having a smartphone as the most significant source of distraction in class and grade point

average (GPA); respondents who are distracted by talking with classmates do not seem to have the same problem. Lastly, as can be expected, respondents who are not distracted in class are more likely to do well on exams (r=0.389, p=0.008).

Grades and night-time smartphone use

A small negative correlation (r=-0.322, p=0.031) exists between GPA and falling asleep while using the smartphone in bed until late at night.

Smartphone distraction and procrastination

Respondents who are distracted by their own smartphone in class are also likely to be distracted by other people's phones (r=0.482, p=<.001) and generally use their smartphones even when they ought to be finishing more important things (r=0.524, p=< .001).

Types of smartphone distraction

The findings confirm that the smartphone activities that cause the most distraction during class are messaging and using chat apps (r=0.392, p=0.008). All other activities do not influence classroom distraction. Using messaging and chat apps also interferes with concentration while studying (r=0.494, p=< .001), as does using the smartphone despite having more urgent commitments (r=0.510, p=< .001). Interestingly, respondents who use their smartphone to make calls tend not to be distracted by their phone during class (r=-0.305, p=0.042), indicating that this is a radically different way of using the phone than messaging.

As the second step, we sought to summarise the data and find latent variables with Principal Component Analysis.

Three particularly significant components were identified (Table 3) and labelled as follows:

1. Smartphone usage time;
2. Generic distraction in class;
3. Frequency of smartphone checks.

Table 3 - Principal Component Analysis: statistics.

Component	SS Loadings	% of Variance	Cumulative %
1 Time	4.01	13.8	13.8
2 Distraction	3.52	12.1	25.9
3 Frequency of use	3.02	10.4	36.4

Analysing these components with a correlation matrix confirmed some earlier findings and brought several new points to light: the "smartphone usage time" component is negatively correlated with GPA (r=-0.327, p=0.029) and positively correlated with both proposed seminars (r=0.358 and r=0.337).

The "frequency of smartphone checks" component has a strong negative correlation with student age (r=-0.535, p<.001); in other words, younger students check their phones more frequently than older students.

The "generic distraction in class" component, which includes all types of distraction, does not seem to affect the other variables. However, it is influenced by variables such as using the smartphone with chat apps (p=0.043). It is interesting to note that searching the Web for study purposes—which is part of this component—has a negative factor loading (-0.429). This is borne out by the correlation matrix as regards distraction caused by "studying other things" during class (r=-0.298, p=0.047).

Lastly, a logistic regression analysis was run. The students' GPA was the dependent variable, while the independent variables included in the model were the three principal components identified in the PCA: 'smartphone usage time', 'generic distraction in class', and 'frequency of smartphone checks'. These components were selected as independent variables because they represented key dimensions of smartphone use and its effects on academic performance, as identified in the PCA. The results confirm that the component that can have the most negative influence on GPA is "smartphone usage time" (p=0.030).

6. Discussion

After organising and interpreting the findings of the various analyses, we can say that our sample shows that excessive smartphone use undoubtedly negatively influences academic performance. This confirms the findings of several studies and meta-analyses (Amez & Baert, 2020; Kates, 2018).

In particular, smartphone distraction in class directly influences academic performance, unlike other types of distraction. The data show that the activity with the most deleterious effect on attention and the ability to study is the use of messaging and chat apps, as found earlier by Carrier et al. (2015).

This can be explained by the push notifications and previews displayed on the smartphone home screen: messaging apps keep the user's attention by making it possible to read messages (and, in some case, to respond) directly on the phone's notification panel.

Other literature maintains that social media use causes the most distraction and disturbance in class and while studying (Dontre, 2021). However, this is not entirely at odds with our findings, given that social media often provide messaging functions.

In analysing the distraction mechanisms, respondents who are distracted by their smartphones in class are also likely to be distracted by other people's smartphone activity, making them even more vulnerable to adverse effects during class.

In addition to causing distraction in class and while studying, excessive smartphone use leads to habits that can undermine students' productivity in informal, non-university settings. For example, it can encourage procrastination, or in other words, using the smartphone when there are more pressing things to be done, thus putting off essential commitments or activities (Li, Gao & Xu; 2020; Rozgonjuk, Kattago & Täht, 2018; Yang, Asbury & Griffiths, 2019). Similarly, habitual smartphone use at bedtime (Geng et al., 2021) can result in poor sleep quality, leading in turn to consequences such as anxiety and depression (Huang et al., 2020; Mac Cárthaigh, Griffin & Perry, 2020; Yang et al., 2020; Lanaj, Johnson & Barnes, 2014; Demirci, Akgönül & Akpinar, 2015). All these habits and their consequences can potentially be detrimental to academic performance: nine per cent of the respondents report using their smartphones for more than five hours a day, the threshold after which there is an increased risk of sleep problems (Huang et al., 2020).

Some respondents state that they are not distracted during class and, in fact show better academic performance. However, what sets these students apart? In general, they spend less time on their smartphones and are older than the others. Above all, they use their phones less frequently and do not feel the urge to check continually for notifications and news.

One positive sign is that the respondents realise that they use their smartphones too much, and those who use them most are also the most open to the proposed seminars on responsible smartphone use.

7. Conclusions

On the basis of the foregoing considerations, we can formulate several proposals for dealing with problematic smartphone use:

- *Students should be made more mindful of smartphone addiction* through targeted seminars and courses, given that respondents— and especially those who use their smartphones most — are open to such a proposal. Schools or universities can be the settings where addictive behaviours in smartphone usage emerge most prominently, precisely because they come into direct conflict with institutional, behavioral rules. However, within these settings, educators can intervene with targeted activities to make students aware of the problem and implement specific programs, sometimes akin to actual "detox programs", yielding intriguing experimental results (Schmuck, 2020). Typically, these initiatives involve not only enforcing punitive actions, such as phone confiscation or shutdown, but also working on mindfulness processes and cognitive-behavioural therapies (Lan et al., 2018).
- *Using teaching strategies where the student is not merely a passive listener*, as in the classic professorial lecture, could help solve most of the problems caused by distraction.
- *The smartphone should be used as an active teaching tool*: lectures are seen as a frequent cause of student boredom, and students who take an active and interactive attitude towards their smartphone will be less likely to use it for activities that are not consistent with classwork. This approach appears to have positive effects on student's academic performance (Han & Yi, 2019; Ng et al., 2017) and, at the same time, seems not to lead to the negative effects of using the smartphone for other purposes (Lin et al., 2021).
- *Students should be encouraged to use apps that help deal with smartphone addiction* and limit usage time, such as Digital Wellbeing, Hold and Forest.

Recent research reports seem to confirm that students who have been involved in one or more such initiatives show significantly lower levels of observed distraction, as well as increased mindful awareness and sense of self-efficacy in dealing with excessive smartphone use (Gámez-Guadix & Calvete, 2016; Throuvala, 2020). The smartphone itself can help if it is used as a tool for active learning and/or together with digital wellbeing apps to limit its use and reduce problematic behavior such as procrastination (Lukas & Berking, 2018): as we have seen, it is not the device itself that is problematic, but its excessive use in inappropriate settings. We thus believe that potential solutions should show a common denominator: all should approach the problem from an educational perspective.

Limitations

The study is based on students' self-reported perceptions and should be extended numerically with a larger group, qualitatively with a more heterogeneous group and methodologically to include objective "field" observations of students' behaviour during class to determine whether their problematic smartphone use is confirmed, underestimated or overestimated. Due to the aforementioned reasons, the results can not be generalised at the moment.

Attribution

Although this paper is the result of joint research between the two authors, and each of them supervised and reviewed the paper as a whole, single paragraphs can be attributed as follows: 1, 2, 3: C. Petrucco; 4, 5: D. Agostini; 6: C. Petrucco & D. Agostini.

References

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (DSM-5®). American Psychiatric Pub.

Amez, S., & Baert, S. (2020). Smartphone use and academic performance: A literature review. International Journal of Educational Research, 103, 101618.

Atas, A. H., & Çelik, B. (2019). Smartphone use of university students: Patterns, purposes, and situations. Malaysian Online Journal of Educational Technology, 7(2), 59-70.

Bolkan, S., & Griffin, D. J. (2017). Students' use of cell phones in class for off-task behaviors: The indirect impact of instructors' teaching behaviors through boredom and students' attitudes. Communication Education, 66(3), 313-329.

Bragazzi, N. L., Re, T. S., & Zerbetto, R. (2019). The relationship between nomophobia and maladaptive coping styles in a sample of Italian young adults: Insights and implications from a cross-sectional study. JMIR mental health, 6(4), e13154.

Carrier, L. M., Rosen, L. D., Cheever, N. A., & Lim, A. F. (2015). Causes, effects, and practicalities of everyday multitasking. Developmental Review, 35, 64-78.

Cho, H. Y., Kim, D. J., & Park, J. W. (2017). Stress and adult smartphone addiction: Mediation by self□ control, neuroticism, and extraversion. Stress and Health, 33(5), 624-630.

De Pasquale, C., Sciacca, F., & Hichy, Z. (2017). Italian validation of smartphone addiction scale short version for adolescents and young adults (SAS-SV). Psychology, 8(10), 1513-1518.

De-Sola Gutiérrez, J., Rodríguez de Fonseca, F., & Rubio, G. (2016). Cell-phone addiction: A review. Frontiers in Psychiatry, 7, 175.

Demirci, K., Akgönül, M., & Akpinar, A. (2015). Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. Journal of Behavioral Addictions, 4(2), 85-92.

Dontre, A.J. (2021). The influence of technology on academic distraction: a review. Human Behavior and Emerging Technologies, 3, 379–90. hbe2.229. doi: 10.1002/hbe2.229

Elhai, J.D., McKay, D., Yang, H., Minaya, C., Montag. C., Asmundson. G.J.G. (2020). Health anxiety related to problematic smartphone use and gaming disorder severity during COVID−19: fear of missing out as a mediator. Human Behavior and Emerging Technologies *3*(1), 137-146. doi: 10.1002/hbe2.227

Flanigan, A. E., & Titsworth, S. (2020). The impact of digital distraction on lecture note taking and student learning. Instructional Science, 48(5), 495-524.

Geng, Y., Gu, J., Wang, J., & Zhang, R. (2021). Smartphone addiction and depression, anxiety: The role of bedtime procrastination and self-control. Journal of Affective Disorders, 293, 415-421.

Green, M. (2019). Smartphones, distraction narratives, and flexible pedagogies: Students' mobile technology practices in networked writing classrooms. Computers and Composition, 52, 91-106.

Gámez-Guadix, M., & Calvete, E. (2016). Assessing the relationship between mindful awareness and problematic Internet use among adolescents. Mindfulness, 7, 1281–1288. doi: 10.1007/s12671-016-0566-0

Gui, M., & Gerosa, T. (2021). Smartphone pervasiveness in youth daily life as a new form of digital inequality. In Handbook of Digital Inequality. Edward Elgar Publishing.

Han, S., & Yi, Y. J. (2019). How does the smartphone usage of college students affect academic performance? Journal of Computer Assisted Learning, 35(1), 13-22

Huang, Q., Li, Y., Huang, S., Qi, J., Shao, T., Chen, X., ... & Chen, H. (2020). Smartphone use and sleep quality in Chinese college students: a preliminary study. Frontiers in Psychiatry, 11, 352.

Jin Jeong, Y., Suh, B., & Gweon, G. (2020). Is Smartphone addiction different from Internet addiction? Comparison of addiction-risk factors among adolescents. Behaviour & Information Technology, 39(5), 578-593.

Jones-Jang, S. M., Heo, Y. J., McKeever, R., Kim, J. H., Moscowitz, L., & Moscowitz, D. (2020). Good news! Communication findings may be underestimated: Comparing effect sizes with self-reported and logged smartphone use data. Journal of

Computer-Mediated Communication, 25(5), 346-363.

Kates, A. W., Wu, H., & Coryn, C. L. (2018). The effects of mobile phone use on academic performance: A meta-analysis. Computers & Education, 127, 107-112.

Kuss, D. J., Kanjo, E., Crook-Rumsey, M., Kibowski, F., Wang, G. Y., & Sumich, A. (2018). Problematic mobile phone use and addiction across generations: The roles of psychopathological symptoms and smartphone use. Journal of Technology in Behavioral Science.

Kwon, M., Kim, D. J., Cho, H., & Yang, S. (2013). The Smartphone addiction scale: Development and validation of a short version for adolescents. PloS One, 8(12), e56936. https://doi.org/10.1371/journal.pone.0056936.

Lan, Yukun, Jiao-Er Ding, Wei Li, Jiang Li, Yifei Zhang, Mingbo Liu, and Hua Fu. (2018). A pilot study of a group mindfulness-based cognitive-behavioral intervention for smartphone addiction among university students. Journal of Behavioral Addictions 7, no. 4 (2018): 1171-1176.

Lanaj, K., Johnson, R. E., & Barnes, C. M. (2014). Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. Organizational Behavior and Human Decision Processes, 124(1), 11-23.

Lee, Y. K., Chang, C. T., Lin, Y., & Cheng, Z. H. (2014). The dark side of smartphone usage: Psychological traits, compulsive behavior and technostress. Computers in Human Behavior, 31, 373-383.

Li, J., Li, D., Jia, J., Li, X., Wang, Y., & Li, Y. (2018). Family functioning and internet addiction among adolescent males and females: A moderated mediation analysis. Children and Youth Services Review, 91, 289-297.

Li, L., Gao, H., & Xu, Y. (2020). The mediating and buffering effect of academic self-efficacy on the relationship between smartphone addiction and academic procrastination. Computers & Education, 159, 104001.

Lin, Y., Liu, Y., Fan, W., Tuunainen, V. K., & Deng, S. (2021). Revisiting the relationship between smartphone use and academic performance: A large-scale study. Computers in Human Behavior, 122, 106835.

Lukas, C. A., & Berking, M. (2018). Reducing procrastination using a smartphone-based treatment program: A randomized controlled pilot study. Internet Interventions, 12, 83-90.

Mac Cárthaigh, S., Griffin, C., & Perry, J. (2020). The relationship between sleep and problematic smartphone use among adolescents: A systematic review. Developmental Review, 55, 100897.

May, K. E., & Elder, A. D. (2018). Efficient, helpful, or distracting? A literature review of media multitasking in relation to academic performance. International Journal of Educational Technology in Higher Education, 15, 1–14.

Marty-Dugas, J., Ralph, B. C., Oakman, J. M., & Smilek, D. (2018). The relation between smartphone use and everyday inattention. Psychology of Consciousness: Theory, Research, and Practice, 5(1), 46.

Moreno-Guerrero, A. J., Aznar-Díaz, I., Cáceres-Reche, P., & Rodríguez-García, A. M. (2020). Do age, gender and poor diet influence the higher prevalence of nomophobia among young people?. International Journal of Environmental Research and Public Health, 17(10), 3697.

Ng, S. F., Hassan, N. S. I. C., Nor, N. H. M., & Malek, N. A. A. (2017). The Relationship between Smartphone Use and Academic Performance: A Case of Students in a Malaysian Tertiary Institution. Malaysian Online Journal of Educational Technology, 5(4), 58-70.

Rozgonjuk, D., Kattago, M., & Täht, K. (2018). Social media use in lectures mediates the relationship between procrastination and problematic smartphone use. Computers in Human Behavior, 89, 191-198.

Servidio, R., Bartolo, M. G., Palermiti, A. L., & Costabile, A. (2021). Fear of COVID-19, depression, anxiety, and their association with Internet addiction disorder in a sample of Italian students. Journal of Affective Disorders Reports, 4, 100097.

Schmuck, D. (2020). Does digital detox work? Exploring the role of digital detox applications for problematic smartphone use and well-being of young adults using multigroup analysis. Cyberpsychology, Behavior, and Social Networking, 23(8), 526-532.

Stothart, C., Mitchum, A., & Yehnert, C. (2015). The attentional cost of receiving a cell phone notification. Journal of Experimental Psychology: Human Perception and Performance, 41(4),893–897.

Throuvala, M. A., Pontes, H. M., Tsaousis, I., Griffiths, M. D., Rennoldson, M., & Kuss, D. J. (2021). Exploring the dimensions of smartphone distraction: development, validation, measurement

invariance, and latent mean differences of the Smartphone Distraction Scale (SDS). Frontiers in Psychiatry, 12, 199.

Wammes, J. D., Seli, P., & Smilek, D. (2018). Mind-wandering in educational settings. In The Oxford Handbook of Spontaneous Thought: Mind Wandering, Creativity, and Dreaming (pp. 259-271). New York: Oxford University Press.

Ward, A. F., Duke, K., Gneezy, A., & Bos, M. W. (2017). Brain drain: The mere presence of one's own smartphone reduces available cognitive capacity. Journal of the Association for Consumer Research, 2(2), 140–154.

Wilcockson, T. D., Ellis, D. A., & Shaw, H. (2018). Determining typical smartphone usage: What data do we need? Cyberpsychology, Behavior, and Social Networking, 21(6), 395-398.

Yang, J., Fu, X., Liao, X., & Li, Y. (2020). Association of problematic smartphone use with poor sleep quality, depression, and anxiety: A systematic review and meta-analysis. Psychiatry Research, 284, 112686.

Yang, Z., Asbury, K., & Griffiths, M. D. (2019). An exploration of problematic smartphone use among Chinese university students: Associations with academic anxiety, academic procrastination, self-regulation and subjective wellbeing. International Journal of Mental Health and Addiction, 17(3), 596-614.

Yildirim, C., & Correia, A. P. (2015). Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. Computers in Human Behavior, 49, 130-137.

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Distance Learning according to Special Education Teachers: pedagogical considerations and educational instructions

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Abstract

The consequences of the pandemic on the school system are currently being debated in the main international organizations, in the scientific and educational communities. Over the last year, several researches in the educational field have had the purpose, on the one hand, of analyzing the educational implications connected to the introduction of Distance Learning (DaD) then Integrated Distance Learning (DiD), on the other hand, to reflect on aspects related to initial and in service teacher training. The aim is to provide some suggestions for facing the educational challenges of the current situation. In this broad debate, a further focus of analysis concerns the impacts of DAD on the most fragile subjects of the school system such as students with disabilities. For this reason, the research aims to explore some aspects inherent to the teaching experiences carried out by a sample of support teachers of different school grades in the last two years. The research analyzed the strategies used in the perspective of inclusive teaching as well as the results achieved and the personal and contextual resources activated by teachers to face this educational challenge. In line with the results of the main international and national researches, the results here presented give back some pedagogical reflections and some indications for teaching. These considerations can be a further element to hoard the lessons learned from the current educational challenge also in relation to the initial and in-service training of teachers.

KEYWORDS: Distance Learning, Educational Research, Inclusive Teaching, Initial and In-service Training.

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1. Introduction

The data provided by *The World Bank,* UNESCO & UNICEF (Azevedo et. al., 2021a) show how the partial or total closure of schools involved about 1,6 billion students, with prominent effects in terms of social exclusion and the rise of educational and social inequalities (UNESCO, 2021).

In this sense, the reduction of learning opportunities can be read in light of the construct of educational poverty (Save the Children, 2014, p. 4). The rise of educational poverty is understandable not only due to the structural factors linked to the closure of schools or the lack of infrastructural ICT equipment for students and teachers, but also in relation to the approaches to teaching- learning relationships and educational strategies that have not been able to counter phenomena connected to the losses and educational gaps for the new generations of students (Pokhrel, Chetri, 2021; Fiorenzato et al., 2021; Doucet et al. 2021; Hamilton et al., 2020; Petrie, 2020). These critical issues have been worsened by the pandemics, but are already highlighted both on international scale (Azevedo et. al., 2021a; 2021b) and national scale (INVALSI, 2021) in terms of consolidated trends of implicit dispersion and, consequently, of *Early living from education and*

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training (ELET) and *Not engaged in education, employment or training* (NEET) (European Council, 2021; IPSOS; 2021; UIS-UNESCO, 2020).

Basically, if the effects of the pandemics have turned into the reduction or worsening of the opportunities of growth, development and learning, on the other hand

> *"This crisis has in many ways exacerbated existing inequalities in education, which is why a focus on equity and learning recovery is paramount as children return to school". (Azevedo et al., 2021a, p. 5).*

Starting from this consideration, the crisis has worsened the inequalities and educational gaps, reducing the opportunities for subjects already in contexts of socioeconomic, cultural and educational disadvantage (Trinchero, 2021; Wagner & Warren, 2020).

In fact, the main educational organizations at international level and the scientific literature focused on infrastructural barriers (closure of schools, connection, Wi-fi at home and within the family; space overcrowding etc.) (Save the Children, 2021; Pokhrel, Chetri, 2021) and the required redefinition of *"suitable pedagogies"* with the introduction of distance learning (Doucet et al. 2021), that can generate a deep rethinking of the teaching-learning relationship, in order to enhance significant learning and compensate the impact of the pandemics (Van de Velde et al., 2021; Vicari, Di Vara, 2021; Schleicher, Reimers, 2020; Hamilton et al., 2020; Petrie, 2020; Basilaia, Kvavadze, 2020).

At the same time, some considerations on this topic, supported by empirical researches on national scale (Mascheroni et al., 2021; Batini, et. al., 2021), although underlining the effects of distance learning on Italian students, stress the need of improving the teacher trainings on developing educational and didactical strategies that increase the student's involvement, interest, motivation (Sannicandro et al., 2021; Stringher, 2021). Also, it has been pointed out the student's burnout with effect on the social connections and on the learning motivation (Gonzalez-Ramirez et al. 2020).

Moreover, phenomena connected to the increased educational poverty, due to the above-mentioned issues, cannot be reduced to structural aspects such as technological equipment of schools and families; on the contrary, there is a need to problematize the pedagogies that lead the educational practices. As Fernández-Cruz and Fernández-Diaz (2016, p. 97):

> *"La mera presencia de recursos tecnológicos […] no son suficientes para desarrollar en los alumnos la competencia digital. La clave fundamental viene determinada por las competencias tecnológicas y pedagógicas de los docentes". (The mere existence of technological resources […] is not enough to promote in the students the digital knowledge. The fundamental key is determined by the teachers technological and pedagogical skills).*

The authors' specification reminds to the importance that teachers think and act in the nowadays educational challenges taking into account the limits of technological infrastructure but, above all, problematizing the educational choices that lead the educational acting, also linked to the enhancing of digital pedagogical skills among the professional competences (Sannicandro, et al. 2021).

This research aims to present a further photograph of the representations and didactical practices put in place by a sample of teachers being trained in a "Specialization course for the special education activities for students with disabilities", in order to highlight how they have experienced distance learning. The study is consistent with the educational research instance to promote a reflective process in the involved subjects, with regards to their representations and practices that lead the educational and didactical act (Fabbri, 1994).

2. Materials and Methods

How can the didactical practices of special education teachers involved in the research contribute to the pedagogical debate regarding distance learning?

In compliance with the research request, the research objective explored the didactical practices of the selected sample of special education teachers in order to provide theorical considerations as well as methodological-educational guidance.

The explorative hypothesis that we are to address assumes that the difficulties due to the pandemics and the consequent use of distance learning have not been lived by the subsample of teachers as educational challenges to improve the teaching -learning relationship.

The analysis strategy is explorative with an inductive approach, not lead by theory and oriented to the context of discovering (Guba & Lincoln, 1989; Silverman, 2016). The research schedule can be synthetized as follows: Construction of the instrument, piloting in a group of special education teachers from the previous cycle (CSS5), chosen on a voluntary basis (November 2021); delivering of questionnaires (December 2021); data analysis (January 2022); restitution of the results (ongoing). The survey has been implemented through the delivering of a semi-structured questionnaire (Mantovani, 1998; Zammuner, 1998) to a group of 600 people enrolled into the specialization course for special education teachers (CSS6) at the Università Internazionale degli Studi di Roma – UNINT.

The semi-structured questionnaire has been created *ad hoc* with reference to some heuristic dimensions:

- Teaching experience in the two previous school years;
- Main educational methodologies put in place;
- Opinions and experiences with reference to the teaching experience in the two previous school years.

The validation of the questionnaire required: a phase of discussion among the research equip, made up by pedagogists, sociologists, psychologists and psychiatrics; a testing phase with the deliver to a group of 15 special education teachers; taking into account the issues raised improvement actions have been undertaken.

The questionnaire has been filled anonymously online. The questionnaire provides only two mandatory questions articulated in questions with multiple answer (with one or more options to be selected) and questions with level of agreement and disagreement on the *likert* scale (1 not at all, 2 little, 3 fairly, 4 very much). The questions are all mandatory.

A Likert scale with an even number of choices has been set up in which the "median" or neutral option is not possible. The use of the "forced multiple choice" method had the aim of avoiding non-positioned answers that concealed the respondents' point of view. From a methodological point of view, this choice is justified by the fact that the alternatives represent different degrees of presence of the construct and lie on the same continuum. Furthermore, we preferred to choose this method to reduce the forms of "social desirability" and "misplacement" that could have emerged by designing a 5-point Likert scale.

An analysis on the frequency distribution has been implemented, also for those questions whose answers were agreement or disagreement. The answering frequencies have been grouped in a little/not at all and sufficient/ a lot, calculating the frequency percentage.

This study used a finalized (not probabilistic) sampling, selecting the participants since they were considered experts in that particular context (Patton, 2015).

Criteria of inclusion in the sample are: being enrolled in the course CSS6 at UNINT; willingness to take part in the research; having conducted teaching support activities in the school years interested by distance learning (DaD) and fully implemented in remote. The selection strategy complies with the method of convenience sample. 269 participants answered to the questionnaire and, as per the criteria depicted above, the sample has been reduced to a subsample of 100 units. The analysis of the main background variables of the sample and subsample features enables to explicitating some considerations (Table 1).

Category	**Variables**	**Experience as Support Teacher in distance learning (%)**	
		No	**Yes**
Sex	F	82.4%	83.8%
	M	17.6%	16.2%
Age range	20-35 years	37.6%	29.3%
	36-45 years	38.8%	35.4%
	46-60 years	23.5%	35.4%
Qualification	High school diploma	17.7%	13.1%
	Bachelor	75.3%	76.8%
	Post lauream	7.0%	10.1%
Region of residence	Other regions	10.6%	12.1%
	Campania	67.6%	53.5%
	Lazio	21.8%	34.3%
Years of experience teaching	0 - no experience	10.0%	0.0%
	From 1 to 2 years	50.6%	25.3%
	From 3 to 5 years	3.5%	7.1%
	From 6 to 10 years	27.6%	45.5%
	From 11 to 20 years	6.5%	20.2%
	More than 20 years	1.8%	2.0%
Teaching qualification	No curricular teaching qualification	42.5%	54.5%
	Yes curricular teaching qualification	57.5%	45.5%
	No special education teaching qualification	96.7%	96.0%
	Yes special education teaching qualification	3.3%	4.0%

Table 1 - Socio-demographic characteristics of the sample of respondents in relation to their experience as special education teachers in distance learning (DaD).

Looking at the Table 1, the subsample is made up almost by the total of the female participants (83.8%), equally distributed in the age ranges 20-35 (29.3%), 36-45 (35.4%) and 46-60 (35.4%), while the average age is 41. The prevalent degree is bachelor (in the 76.8% of all cases) and the post-secondary school diploma characterizes the 10.1% of the subsample.

In the 53.6% of the cases Campania is the region of residence, while in 34.3% Lazio; as for the rest of the participants, they were variously distributed in other regions.

In the selected subsample the 70.8% has teaching experience from 1 to 5 years, while only the 29.3% has teaching experience from 6 up to 20 years.

With regards to the teaching qualification, the 96% clearly does not hold any special education teaching qualification and only the 45.5% holds curricular teaching qualification. The 50% declares having had experience in special education teaching both during the school year 2019/20 and in 2020/21, while the 17% just during 2019/2020 and the 33% only in 2020/21.

The activity took place mostly in distance learning, in part individually and in part with the schoolmates (58% of cases) while they attend at distance with the class or part of the class (35%) and at distance exclusively with the student (7%).

The average weekly number of hours dedicated to distance learning is distributed as follows: 13% more than 20 weekly hours, between 1 and 5 hours 17%, between 16 and 20 hours 30%, between 6 and 15 hours 40%.

Reading the research results it is interesting to see also the disabilities, disadvantages and/or educational needs of the students the subsample has worked with during the two school years we focus on. The Table 2 shows among the certified disability options, selected by the subsample, intellectual disability (20,1%), followed by values that do not differ in percentage by the others.

Type of need/certified disability (more options)	**%**
Specific learning disabilities	13.6%
Autism	11.5%
Intellectual disability	20.1%
Communication disorders	15.0%
Movement disorders	9.1%
ADHD	13.3%
Intellectual disability associated to a genetic Syndrome	10.6%
Other disability	6.8%
Total	**100.0%**

Table 2 - Type of need/certified disability.

3. Results

With regards to the research objective and the research inquiry, we hereby report the results collected on the basis of statistically significant dimensions related to the life experience and the perception of the teaching experience at distance learning during the pandemics.

A first topic that has been explored and helps understanding the special education teachers' previous technological skills, not reported in a Table for space reasons, embraces a dimension that explores the normal use of technologies as educational resource as well as their selecting criteria. The 18.9% of the subsample declares that, before the introduction of distance learning, would regularly use the tablet, video and clips (18.9%), and the smartboard 17.3%. About 3% indicates other tools: specific software for disabilities, digital newsstand, educational apps and games. Digital tools that, on the contrary, they declare to regularly use for personal use. Moreover, we find that teachers, while choosing the educational tools, ground their decisions for more than the 80% on the previous experience with regards to the objectives achieved with the students and the verification of the criteria of their appropriateness and accessibility.

A particularly interesting figure concerns the teachers' training in the new technologies: 93.8% of the subsample declares to have made their choice following suggestions and instructions received during their trainings. With the introduction of distance learning, besides the above-mentioned tools, we register an increase in the use of specific digital tools that were not reported in presence. In fact, more than the 50% of the subsample declares to have increased the use of: PPT presentation 72.9%, specific software for disabilities 51%, educational apps and games 57.3%.

Their knowledge of the technological tools applied to didactics, for the special education teachers, is not due to trainings put in place by the school institutions (14.8%), but to online courses attended apart from the school context (74% of the subsample).

The data in Table 3 and Table 4 show the answers of the subsample regarding the methodological changes and the classes at distance learning.

Although almost half of the subsample (46%) declares to have "fairly" changed their educational methodologies (Table 3), from the data in Table 4 we find that for a 22% and a 21% the traditional class and individual exercises are preeminent.

Another point investigated by this analysis concerns the subsample's evaluation of the worsening or bettering of the relationship with the student during distance learning: 66% declares that the relationship did not change, 22% that it has been ameliorated and 12% that it got worse.

Also, the inclusive aspects with regards to the students are perceived as they worsened during distance learning

(Table 5), as well as the quality of the relationships, in particular with the classmates: worse in the 45% (Table 6).

At this stage of our investigation, we wanted to understand what perception the special education teachers had with regards to distance learning from an educational point of views (difficulty and/or helpfulness of distance learning) and from the point of view of the impact on students with disabilities. As for the first point, the main challenge is represented by connection problems during classes, more than by problems due to the lack of technological skills, the lack of support from colleagues and/or school institutions as well as the difficulties in stimulating the students' attention (Table 7).

During the distance learning, did you make any change in the methodologies you used in presence?	N.	%
1 - Not at all	11	11.0%
2 - Little	30	30.0%
3 - Fairly	46	46.0%
4 - Very much	13	13.0%

Table 3 - Change of the educational methodology during distance learning.

During distance learning. how was the class characterized?	**N.**	**%**
Individual Exercises	53	21%
Flipped classroom	17	7%
Interactive games	34	14%
Group works	43	17%
Traditional class	54	22%
Activities to be performed at home with the parents	31	12%
Simulation	14	6%
Other	3	1%
Total	**249**	**100%**

Table 4 - Class characterization during distance learning.

The inclusion and/or integration is	**N.**	**%**
Better	8	8%
Worse	59	59%
Same as before	33	33%
Total	**100**	**100%**

Table 5 - Changes of inclusion/integration during distance learning.

The relationship with the classmates is:	**N.**	**%**
Better	11	11%
Worse	45	45%
Same as before	44	44%
Total	**100**	**100%**

Table 6 - Changes in the relationships with schoolmates during the distance learning.

What difficulties did you have to face? (more options)	**N.**	**%**
Lack of technological skills	25	11.0%
Lack of support from the colleagues	13	5.7%
Lack of support in general from the school institutions	25	11.0%
Lack of tools	27	11.8%
Difficulty in establishing a relationship with the class	10	4.4%
Difficulty in obtaining the student's attention	22	9.6%
Frequent changes in the regulations	18	7.9%
Instructions not clear enough	21	9.2%
None	19	8.3%
Connection issues	48	21.1%
Total	**228**	**100.0%**

Table 7 - Difficulties that have been faced.

Moreover, the subsample declares that teaching conditions worsened for the 60%, at such extent that the 69% declares to reject distance learning as integrative part of teaching in presence (against the 31% that sustains the contrary). The positive aspects, instead, are: the improvement of teachers' methodological skills and the innovation of the school system (Table 8).

Concerning students with disabilities, the subsample declares that distance learning has had a generally negative impact on diverse aspects (Table 9).

Once again it has been highlighted that the quality of participation has worsened with regards to the progresses with the classmates.

In order to identify significative differences with respect to the special education teachers' life experience, some significative variables have been crossed:

Age groups, experience with respect to methodologies applied during distance learning.

Although the variations among the percentages are minimal, it has been pointed out that lecturing -style teaching increase with the diminution of the special education teachers' age, so do the group works and just a little the individual exercises (Table 10).

This figure is most probably explainable because the age has an impact on the years of experience as a teacher and because when the experience is less, they feel more comfortable using more sure and traditional methodologies instead of those more innovative. These data are confirmed by linking the methodologies adopted during distance learning, with the years of experience in the next Table (Table 11).

3.1 Age groups, experience and challenges faced during distance learning

While for older teachers the lack of technological skills and connection problems are identified as issues in distance learning, when it comes to younger teachers

In a scale from 1 (not at all) to 4 (very much) how much do you think the experience of distance learning was useful for:	Little/Not at all		Fairly/Very much	
	N.	%	N.	%
Enhancing teachers' competences	22	22.9%	74	77.1%
Changing the methodological approaches	13	13.7%	82	86.3%
Improving the learning of students with disabilities	59	62.8%	35	37.2%
Improving the students' learning in general	56	59.6%	38	40.4%
Improving disability handling at school	66	70.2%	28	29.8%
Innovate the school system	32	34.0%	62	66.0%
Improving teachers' working conditions	52	56.5%	40	43.5%

Table 8 - Helpfulness of distance learning.

Lastly. in a scale of -2 (very negative) to + 2 (very positive) thinking about students with disabilities. what impact do you think distance learning has had with regards to these dimensions	Negative impact (-2 and -1)		Positive impact (+1 and +2)	
	N.	%	N.	%
Existence and quality of learning environments	35	36.5%	58	24.0%
Participation quality	44	45.8%	46	30.2%
Progressing along with the classmates	49	51.0%	42	21.9%

Table 9 - Impact of distance learning on some dimensions.

Methodology	Age range (years)						Total	
	20-35		36-45		46-60			
	N.	%	N.	%	N.	%	N.	%
Traditional class	17	24.3%	20	21.7%	17	19.5%	54	21.7%
Group works	14	20.0%	16	17.4%	13	14.9%	43	17.3%
Individual exercises	15	21.4%	22	23.9%	16	18.4%	53	21.3%
Flipped classroom	4	5.7%	5	5.4%	8	9.2%	17	6.8%
Interactive games	8	11.4%	14	15.2%	12	13.8%	34	13.7%
Simulation	6	8.6%	2	2.2%	6	6.9%	14	5.6%
Home activities to be performed with the parents	5	7.1%	12	13.0%	14	16.1%	31	12.4%
Other	1	1.4%	1	1.1%	1	1.1%	3	1.2%
Total	**70**	**100%**	**92**	**100%**	**87**	**100%**	**249**	**100%**

Table 10 - Characterization of class performing modalities in distance learning for age group.

Methodology	Years of experience as special education teacher				Total	
	More than 2 years		Up to 2 years			
	N.	%	N.	%	N.	%
Traditional class	24	19.5%	30	23.8%	54	21.7%
Group works	21	17.1%	22	17.5%	43	17.3%
Individual exercises	22	17.9%	31	24.6%	53	21.3%
Flipped classroom	11	8.9%	6	4.8%	17	6.8%
Interactive games	17	13.8%	17	13.5%	34	13.7%
Simulation	8	6.5%	6	4.8%	14	5.6%
Home activities to be performed with the parents	17	13.8%	14	11.1%	31	12.4%
Other	3	2.4%		0.0%	3	1.2%
Total	**123**	**100%**	**126**	**100%**	**249**	**100%**

Table 11 - Characterization of class performing modalities in distance learning as per years of experience in special education.

the challenges that emerged more often are related with minimal variation to lack of tools, instructions not clear enough and the insufficient support from the school institution (Table 12). This figure might also be understandable to the younger teachers' short experience: hypothetically, they perceived a deeper need of support and clear instructions than their older colleagues. In fact, it is possible in Table 13 to appreciate this link with years of experience.

In addition to this, the research has shown that the majority of the special education teachers declared that the school performance in distance learning remained unvaried in comparison with the class in presence, and so did the difficulties related to the disability. The same is not true for the motivation, where an important worsening has been registered, 44%.

Difficulties in distance learning	Age range (years)						Total	
	20-35		36-45		46-60			
	N.	%	N.	%	N.	%	N.	%
Lack of technological skills	5	7.7%	3	4.2%	16	17.8%	24	10.6%
Lack of tools	9	13.8%	7	9.7%	11	12.2%	27	11.9%
Connection problems	12	18.5%	16	22.2%	20	22.2%	48	21.1%
Lack of support from the colleagues	1	1.5%	7	9.7%	5	5.6%	13	5.7%
Lack in general of support from the school institutions	8	12.3%	8	11.1%	9	10.0%	25	11.0%
Instructions not clear enough	8	12.3%	4	5.6%	9	10.0%	21	9.3%
Frequent changes in the regulations	5	7.7%	8	11.1%	5	5.6%	18	7.9%
Difficulty in stimulating the student's attention	6	9.2%	9	12.5%	7	7.8%	22	9.7%
Difficulty in establishing a relationship with the class	3	4.6%	4	5.6%	3	3.3%	10	4.4%
None	8	12.3%	6	8.3%	5	5.6%	19	8.4%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	**65**	**100%**	**72**	**100%**	**90**	**100%**	**227**	**100%**

Table 12 - Difficulties in distance learning per group age.

Difficulties in distance learning	Years of experience as special education teacher				Total	
	More than 2 years		Up to 2 years			
	N.	%	N.	%	N.	%
Lack of technological skills	13	11.6%	11	9.6%	24	10.6%
Lack of tools	13	11.6%	14	12.2%	27	11.9%
Connection problems	29	25.9%	19	16.5%	48	21.1%
Lack of support from the colleagues	7	6.3%	6	5.2%	13	5.7%
Lack in general of support from the school institutions	14	12.5%	11	9.6%	25	11.0%
Instructions not clear enough	9	8.0%	12	10.4%	21	9.3%
Frequent changes in the regulations	8	7.1%	10	8.7%	18	7.9%
Difficulty in stimulating the student's attention	10	8.9%	12	10.4%	22	9.7%
Difficulty in establishing a relationship with the class	1	0.9%	9	7.8%	10	4.4%
None	8	7.1%	11	9.6%	19	8.4%
Other		0.0%		0.0%	0	0.0%
Total	**112**	**100%**	**115**	**100%**	**227**	**100%**

Table 13 - Difficulties in distance learning as per years of experience in special education teaching.

	Teachers that note a worsening both of performance and of motivation		Teachers that note an improvement in performance and motivation	
	N. and % of those that declare to have increased the use of the following technologies		N. and % of those that declare to have increased the use of the following technologies	
	N.	%	N.	%
Tablet	19	73.1%	13	86.7%
Platforms or web-based resources	21	80.8%	13	86.7%
Clips and on-line video	20	76.9%	14	93.3%
Presentation/ppt	17	65.4%	10	66.7%
Disability Specific Softwares	10	38.5%	11	73.3%
Gaming Apps	13	50.0%	12	80.0%
Console	5	19.2%	3	20.0%
E-book	11	42.3%	7	46.7%
Digital newsstand	10	38.5%	6	40.0%
Galleries and museums on-line	10	38.5%	4	26.7%
On-line events (concerts, shows, seminars, etc.)	10	38.5%	7	46.7%
Average frequency		51.0%		60.6%

Table 14 - Comparison of the increase of the use of multimedia tools among the teachers that declare a worsening of the performance and motivation and the teachers that indicate an improvement of the performance and motivation.

The Table 14 shows how, correlating the consideration of the worsening or bettering of the two variables with the use of technologies by the teacher, two interesting figures emerged. In fact, the teachers that consider the two variables as "worse", declare (in inferior percentages) that they had increased the use of digital tools that were at disposal during distance learning (51%). On the contrary, who registered an improvement in the student performance and motivation declares to have increased the use of the same tools in higher percentages (an average of 60.6% of the cases).

In the same way (Table 15), the choices are the same, regardless of the years of experience as special education teacher.

The most frequent resources used to cooperate among teachers, for all age groups, are "Messanger/Whatsapp /Telegram or similar", followed by teamworking platforms (Teams, Zoom etc.).

Finally, Table 16 and Table 17 show the sectors in which the respondents have declared cooperation was at its highest.

In the Table 16 we can see differences per age group: for the age group 20-35 years the first choice is "sharing educational materials" (19.5%), while for the age group 36-45 years the first choice is "creating educational materials" (15.8%) and, lastly, for the age group 46-60 the first choice is "sharing educational materials" (20.7%).

In the Table 17, with respect to the years of experience in special education, we note that, regardless of the modalities of this variable the main respondents' choice is again "sharing educational materials". In fact, respondents that pertain to the "more than 2 years" group choose this modality for the 19.9%, while those in the "up to 2 years" group make this choice for the 18.2%.

4. Discussion

The results showed in the previous paragraph offer some sparks for the theorical reflection and the educational practice. In the subsample a central figure is that 90% of the teachers involved in the research had experience in special education in a timespan from 1 to 6 years. As the literature reports (Caena & Redecker, 2019; Fernández-Cruz & Fernández-Diaz, 2016) regarding the need to invest in professional skills and in particular in teachers' digital skills, about 75% of the subsample affirms that their knowledge of technological tools was gained thanks to online courses outside the school context. Technological tools are not considered as connected to didactical intentionality that guides the use of these technologies in school contexts.

More than a half of the teachers think that their technological knowledge is appropriate (Table 7) and 69% does not want distance learning as integrative part of the class in presence, saying that teaching conditions were substantially deteriorated.

In fact, as we have noted (Table 8) distance learning has been seen as a chance to increase teachers' knowledge (77.1%), changing the methodological approaches (86.3%) and innovating the school system (66%) are not considered appropriate to enhance the learning of students with disabilities (62.6%), improving in general the student learning (59.6%), and bettering the handling of disability in the schools (70.2%). In the teacher subsample these latter 3 aspects do not seem to have helped or having been helped by distance learning. Form the teachers' perspective (Table 9), the negative impact of distance learning is identified in quality of participation (45.8%) – against the 30.2% of positive impact on the same dimension – and improvement along with the classmates (51%) – against the 21.9 % of positive impact on the same dimension.

This research also explored the cooperation among teachers, that has not been showed in a Table for reasons of space. In particular, for the total of 70% of the subsample, cooperation among colleagues in general remained the same, except for the fact that cooperation was enhanced especially among younger teachers while remained the same for the older ones. We also see that, as per the years of service as special education teacher, the overall cooperation remained the same for 70% of the respondents, although when service years increase, also polarizations increase about modalities different from "remains the same". The resources to cooperate among teachers, for all age groups and regardless of years of experience as special education teacher, are most of the times "Messanger/Whatsapp/Telegram or similar", followed by "teamworking platforms (Teams, Zoom etc.).

To wrap up the results, for the fields in which the respondents declare cooperation was stronger (Table 16 and Table 17) we find differences in the age groups: the age group 20-35 years and 46-60 years the first choice is "sharing educational materials", while for the age group 36-45 years the first choice is "creating educational materials". considering the years of service in special education, regardless of the modalities of this variable the respondents' principal choice is again "sharing educational materials".

Another aspect that the research has explored is the eventual adaptation of the didactical methodologies by the teachers in the shifting from the class in presence to that in distance learning (Table 3). 40% of the teachers declares that during distance learning methodologies that were used in presence did not get changed, compared to a 46% that declares to have "fairly" modified them. A key to understand the answer to this question is given by the following question (Table 4): teachers declare that didactical methodologies that were used more during distance learning have been the

Years of experience as Special Education Teacher	Teamworking platforms (Teams. Zoom. etc.)		Messanger/Whatsapp/Telegram or similar		Teamworking platforms provided by school institutions (for ex. Gsuite)		In presence meetings in the school context		Informal meetings		Shared cloud space		Other	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
More than 2 years	28	23.7%	36	30.5%	27	22.9%	9	7.6%	6	5.1%	12	10.2%	0	0.0%
Up to 2 years	37	33.0%	37	33.0%	25	22.3%	3	2.7%	5	4.5%	5	4.5%	0	0.0%
Total	**65**	**28.3%**	**73**	**31.7%**	**52**	**22.6%**	**12**	**5.2%**	**11**	**4.8%**	**17**	**7.4%**	**0**	**0.0%**

Table 15 - Distribution % of options of selecting the resources used to cooperate with other teachers as per years of experience in special education.

Age group	Design/updating PEI/PDP		Sharing methodologies		Creating educational materials		Sharing educational materials		Design of assessment and evaluation tools		Learning assessment and evaluation		Formative evaluation of learning processes		Discussion on events/facts related to the class and the student		Other	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
20-35 years	15	11.3%	14	10.5%	19	14.3%	26	19.5%	18	13.5%	17	12.8%	9	6.8%	15	11.3%	0	0.0%
36-45 years	14	10.5%	15	11.3%	21	15.8%	22	16.5%	18	13.5%	15	11.3%	10	7.5%	18	13.5%	0	0.0%
46-60 years	16	11.4%	19	13.6%	23	16.4%	29	20.7%	15	10.7%	13	9.3%	11	7.9%	14	10.0%	0	0.0%
Total	**45**	**11.1%**	**48**	**11.8%**	**63**	**15.5%**	**77**	**19.0%**	**51**	**12.6%**	**45**	**11.1%**	**30**	**7.4%**	**47**	**11.6%**	**0**	**0.0%**

Table 16 - Distribution % of the options of choice regarding the cooperation fields with other teachers per age group.

Years of experience as Special Education Teacher	Design/updating PEI/PDP		Sharing methodologies		Creating educational materials		Sharing educational materals		Design of assessment and evaluation tools		Learning assessment and evaluation		Formative evaluation of learning processes		Discussion on events/facts related to the class and the student		Other	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
More than 2 years	17	9.4%	20	11.0%	26	14.4%	36	19.9%	25	13.8%	21	11.6%	12	6.6%	24	13.3%	0	0.0%
Up to 2 years	28	12.4%	28	12.4%	37	16.4%	41	18.2%	26	11.6%	24	10.7%	18	8.0%	23	10.2%	0	0.0%
Total	**45**	**11.1%**	**48**	**11.8%**	**63**	**15.5%**	**77**	**19.0%**	**51**	**12.6%**	**45**	**11.1%**	**30**	**7.4%**	**47**	**11.6%**	**0**	**0.0%**

Table 17 - Distribution % of options of choosing the cooperation fields with the other teachers as per years of experience as special education teacher.

traditional class and individual exercises. In the research promoted by SIRD (Batini et al., 2021) about the Italian teachers' life experience and evaluations we note the prevalent use of transmission methods in distance learning; in challenging situations the trend is to adopt educational strategies already experimented and consolidated, rather than innovating educational methods. The same figure emerges in the inquiry made by Indire (2020) targeting a selected sample of 2.546 of teachers: the curricular teachers state that in distance learning videoconference and assigning exercises were their most adopted teaching method (75% of the sample interviewed with a questionnaire). To the same consideration lead the data about the students' opinions photographed by the research of Fondazione Agnelli (2021) on distance learning. The survey shows how 9 students out of ten state that video classed, homework and tests were the sole activities proposed by the teachers. The teachers involved in the same research state that they used the video-class as prevalent educational methodology. Another useful figure to understand how the subsample of teachers has lived the experience in distance learning during the previous two school years concerns the variation of challenges

related to disability. The 83% of the teachers, state that the issues addressed before distance learning have not been reduced by the digital tools (51% of the teachers): as shown in Table 3 and Table 4, this often implied just lecturing and individual exercises. Herberger (2020) underlines the importance for teachers of structuring in distance learning an online learning environment that helps in general the student's needs, not only students with disabilities.

As shown also in other studies (Van de Velde et al., 2021; Hamilton et al., 2020; Petrie, 2020; Basilaia, Kvavadze, 2020; Gonzalez-Ramirez et al., 2020), considering the point of view of the teachers involved, the experience in distance learning did not contribute positively to enhancing the relationship with the students, nor did it help, in several cases, to obtain a better achievement.

As per these researches, as well as those conducted in the Italian context (Batini et al., 2021), for the 82% of the teachers their class motivation to study has worsened or has not been modified while, for the 44%, it has worsened.

Ajello (2002, p. 41), notes:

> *"se ci accorgiamo che problemi di motivazione si pongono tutte le volte che sfugge il senso e il significato di quello che si fa, allora dovremo convenire che all'origine di molte disaffezioni c'è proprio il mancato riconoscimento di tale significato e conseguentemente la perdita di interesse per ciò che si propone". ("if we understand that motivational problems arise every time the sense and the meaning of what is done are not clear, then we should agree that at the origin of many disaffections there is exactly the lack of recognition of that meaning and, therefore, the drop in interest for what is proposed").*

This consideration reminds us to plan educational activities that foster motivation: they have not been activated in the subsample due to the pedagogies subtended to the didactical methodologies supported by the employed ICT (Maragliano, 2000; Murdaca et al. 2017).

Another interesting aspect, already highlighted in the SIRD survey, shows (Table 15 and Table 16) how the quality of the relationship, especially with the classmates, in the teachers' opinion has worsened in the 45% of cases (Table 6). In the Indire (2020) study we see how teachers state that most fragile students have been more affected by the segregation during distance learning. We also note that in this survey the younger are the teacher the more they rely on lecturing, group work and individual exercises (Table 10). The less experienced is the teacher, the more traditional methodologies will be trusted compared to the more innovative ones, because they are considered safer.

Lastly, if older teachers identify as problems the lack of technological skills and connection difficulties during distance learning, the younger teachers, on the other hand, find challenging the lack of tools, instructions not clear enough, and the insufficient support from the school institutions (Table 11). This aspect also emerged in an article about the teachers' initial education in the TFA (Patera, 2018), where it is underlined how, even if at the end of the TFA course there were methodological and educational placings related to the socio-constructivist didactics, many of them after one year have opted for a more traditional training ascribable to a transmission approach.

The experience of distance learning, as reported in the analyzed literature, highlights a need: "Teaching strategies need to change, along with the competence profiles teachers need to develop, so as to deploy innovative pedagogies and empower responsible learners" (Caena & Redecker, 2019, p. 356).

In the same way (Stringher, 2021), qualitative educational research carried out just a bit before the pandemics, underlines the teachers' point of view regarding the need of reflecting on their own way of teaching: in fact, it is considered a factor that can lead to explicit and implicit dropouts and that increases the cultural gap between the way students learn and the way teachers teach.

Starting from the results that emerged in this research, we find that the teachers' initial training and during their service is even more important and actual, when including educational topics in which technology represents a tool to enhance the student participation, interests and motivation towards a quality teaching – learning relationship.

5. Conclusions

In conclusion, as per the research inquiry and explorative hypothesis, the data related to the subsample confirm what already vastly registered in the thematic literature: the fact that the problems due to the pandemics and the subsequent adoption of distance learning did not become real educational challenges for the subsample teachers and their school contexts in order to improve the teaching – learning relationship, starting from reflection on the representations and on the practices of their educational action. The research highlights the need of improving the teacher designing skills, starting from a reflection on their own educational action (Marek et al. 2021), with the perspective of building the profile of an inclusive teacher (Sannicandro et al. 2021). Moreover, some limits emerged that, in meta-evaluative terms (Trinchero, 2002), can represent an opportunity for an in-deep exploration of this research data. In particular, we believe it is advisable to adopt a *mixed-methods* approach jointly to qualitative research strategies and

analyses (Denzin, Lincoln, 1994) to appreciate the teachers' representations and educational practices with reference to the modalities and strategical choices that lead their own educational action (Aiello& Pace, 2020).

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References

Ajello A. M., (2002), Apprendimento e competenza: un nodo attuale. Scuola e Città, 1, pp. 39-56. (Tr.: Learning and competence: an actual issue)

Aiello, P., Pace, E.M.,(2020) Inclusive Educational Principles, Policies and Practices in Italy,In Oxford Research Encyclopedia of Education. Ed. Umesh Sharma. New York: Oxford University Press, pp. 1-22.

Azevedo, J.P., Halsey, Rogers, F., Ahlgren, S. E., Cloutier, M. H., Chakroun, B., Chang, G., Mizunoya, S., Reuge, N. J., Brossard, M., Bergmann, J. L., (2021a), The State of the Global Education Crisis: A Path to Recovery. Washington, D.C.: World Bank Group, url: http://documents.worldbank.org/curated/en/416991638768297704/The-State-of-the-Global-Education-Crisis-A-Path-to-Recovery

Azevedo, J.P., Montoya, S., Akmal, M., Wong, Y. N., Gregory, L., Geven, K. M., Cloutier, M. H., (2021) Learning Poverty Updates and Revisions: What's New? Working Paper. Washington, DC: World Bank, url: https://openknowledge.worldbank.org/handle/10986/36082

Basilaia, G., Kvavadze, D., (2020), Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. Pedagogical Research, url: https://doi.org/10.29333/pr/7937

Batini, F., Sposetti, P. & Szpunar, G., (2021), La parola alle e agli insegnanti. Prima analisi di categorie e sottocategorie delle risposte qualitative al questionario SIRD, in AA.VV. La DaD in emergenza: vissuti e valutazioni degli insegnanti italiani. Scelte metodologiche e primi risultati nazionali, Pensa MultiMedia, Lecce, (Tr.: Leaving the floor to teachers. First analysis of categories and subcategories of qualitative answers to the SIRD questionnaire, in AA. VV., Distance learning in emergencies: Italian teachers' life experience and evaluation. Methodological choices and first national results)

Bocci, F., (2017) Valorizzare il corso di formazione per la specializzazione alle attività di sostegno: l'esperienza laboratoriale di RomaTre, in G. Domenici (ed.), La formazione iniziale e in servizio degli insegnanti, Armando, Roma, (Tr.: Valuing specialization training in Special Education: the workshop experience of RomaTre, in G. Domenici (ed.), The teacher's initial training and during their service)

Council of the European Union, (2021-2030) 2021/C 66/01. Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond Retrieved, url: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX3A32021G0226280129

D'Alonzo, L., & Cottini, L., Promuovere l'inclusione: l'insegnante specializzato per le attività di sostegno in primo piano, (numero monografico), II/2, 2014. (Tr.: Fostering inclusion: focus on the teacher qualified in Special Education)

Denzin, N. K., Lincoln, Y. S., (1994) Handbook of Qualitative Research. Thousand Oaks: Sage Publications.

Doucet, A., Netolicky, D., Timmers, K. & Tuscano, F. J, (2020) Thinking about pedagogy in an unfolding pandemic. Work of Education International and UNESCO. Retrieved, url: https://issuu.com/educationinternational/docs/2020_research_covid-19_eng

Fabbri, L., (1994) Ricerca pedagogica e pratiche educative. Per una pedagogia come scienza pratica. Tecnodid, Napoli, (Tr.: Pedagogical research and educational practices. For a pedagogy as practical science).

Fernández-Cruz, & F. J., Fernández-Diaz, J., (2016) Generation Z's Teachers and their Digital Skills, Comunicar, 46(24), 97-105.

Fiorenzato, E., Zabberoni, S., Costa, A. & Cona, G., (2021), Cognitive and mental health changes and their vulnerability factors related to COVID-19 lockdown in Italy, PLoS ONE, 16, 1: e0246204.

Fondazione Agnelli (2021), La DaD alle scuole superiori nell'anno scolastico 2020-21: una fotografia, url: (Tr. Distance learning at high school in the school year 2020-21)

https://www.fondazioneagnelli.it/2021/07/09/la-DaD-alle-scuole-superiori-nellanno-scolastico-2020-21-una-fotografia/

Gonzalez-Ramirez, J., Mulqueen, K., Zealand, R., Silverstein, S., Mulqueen, C., & Bushell, S., (2021) Emergency Online Learning: College Students' Perceptions During the COVID-19 Pandemic, College Student Journal, 55(1), 29-46.

Guba, E. G., & Lincoln, Y. S.,(1989) Fourth generation evaluation. Thousand Oaks, Sage.

Hamilton, L. S., Kaufman, J. H., & Diliberti, M.,(2020) Teaching and Leading through a Pandemic: Key Findings from the American Educator Panels Spring 2020 COVID-19 Surveys. Data Note: Insights from the American Educator Panels. Research Report. RR-A168-2. RAND Corporation.

Herberger, D.,(2020) Considerations for teachers providing distance learning to students with disabilities, WestEd.

INDIRE,(2020) Indagine Impatto della pandemia sulle pratiche didattiche e organizzative delle scuole italiane nell'anno scolastico 2020/21 report giugno 2020. (Tr.: Survey Impact of pandemics on the educational and operational practices in the Italian schools during the school year 2020/2021)

INVALSI, (2021) I risultati delle prove INVALSI, url: (Tr.: INVALSI tests: the results)

(https://www.invalsiopen.it/risultati/risultati-prove-invalsi-2021/

IPSOS, (2021)I giovani ai tempi del coronavirus, (Tr.: The youth at the time of Coronavirus) url: https://s3.savethechildren.it/public/files/uploads/pubblicazioni/i-giovani-ai-tempi-del-coronavirus.pdf

Mantovani, S., (a cura di), (1998) La ricerca sul campo in educazione. I metodi quantitativi, Mondadori, Milano, (Tr.: On field research in Education. Quantitative Methods)

Maragliano, R., (2000) Tre ipertesti su multimedialità e formazione. Laterza. (Tr. Three Hypertexts about multimedia and education)

Marek, M. W., Chew, C. S., & Wu, W. C. V. (2021). Teacher experiences in converting classes to distance learning in the COVID-19 pandemic. International Journal of Distance Education Technologies (IJDET), 19(1), 40-60.

Mascheroni, G., Saeed, M., Valenza, M., Cino, D., Dreesen, T., Zaffaroni, L. G., & Kardefelt-Winther, D., (2021) Learning at a Distance: Children's remote learning experiences in Italy during the COVID-19 pandemic, UNICEF Office of Research. Florence, url: https://www.unicef-irc.org/publications/pdf/learning-at-a-distance-childrens-remote-learning-experiences-in-italy-during-the-covid-19-pandemic.pdf (accessed 20 April 2021).

Murdaca A.M., Epasto A., Smeriglio D., Oliva P., (2017) Fattori individuali e atteggiamenti degli insegnanti per un uso efficace delle tecnologie digitali. Un progetto di ricerca. In P. LIMONE e D. PARMIGIANI (a cura di), Modelli pedagogici e pratiche didattiche per la formazione iniziale e in servizio degli insegnanti (240-257). Progedit, Bari, - ISBN 978- 886194-293-6 (Tr. Individual factors and the teachers' behaviors for using efficiently digital technologies. A research project. In P. LIMONE e D. PARMIGIANI (a cura di), Pedagogical models and educational practices for the teachers' initial training and during their service)

Patera, S.,(2018) Tra "il dire e il fare" nella relazione insegnamento-apprendimento. Un caso di studio sulle rappresentazioni degli insegnanti in formazione iniziale. Formazione & Insegnamento XVI (3), 2018. (Tr.: "Talk is cheap" in the teaching – learning relationship. A case study on the representations of the teachers in initial training)

Patton, M.Q., (2015)Qualitative Research and Evaluation methods. Thousand Oaks, Sage.

Petrie, C., (2020) Spotlight: Quality education for all during COVID-19 crisis. United Nation,url: https://hundred.org/en/collections/quality-education-for-all-during-coronavirus

Pokhrel, S. & Chetri, (2021) A literature review on impact of COVID-19 pandemic on teaching and learning, Higher Education for the Future, 8(1), pp. 133-141.

Sannicandro, K., De Santis, A., Bellini, C., Minerva, T. (2021). Competenze digitali e di (ri)progettazione didattica: proposte di formazione per gli insegnanti. QTimes, Anno XIII - n. 2, pp. 292-309 (Tr.: Digital Skills and for educational (re-) designing: training proposals for teachers)

Save the Children, (2016) Liberare i bambini dalla povertà educativa. A che punto siamo? Roma, Save the Children Italia. (Tr.: Rescuing children from educational poverty. Where are we?)

Save the Children, (2021) Our covid-19 response. Impact in 2020. Save the Children International, 2021, Retrieved, url: https://resourcecentre.savethechildren.net/document/covids-educational-time-bomb-out-of-school-children-global-snapshot/

Save the Children, (2014) La lampada di Aladino, url: (Tr. Alladin's Lamp) https://s3.savethechildren.it/public/files/uploads/pubblicazioni/la-lampada-di-aladino.pdf

Schleicher A., & Reimers F.,(2020) Schooling Disrupted, Schooling Rethought: How the

COVID-19 Pandemic is Changing Education, OECD Publications, Paris.

Silverman, D., (2016) Qualitative research. Thousand Oaks, CA: Sage Publication.

Stringher, C., (2021) Apprendere ad apprendere in prospettiva socio-culturale. Rappresentazioni dei docenti in sei paesi, Franco Angeli, Milano, (Tr. Learning how to learn in a socio-cultural perspective. Teachers' representations in six countries)

Trinchero, R., (2002) Manuale di ricerca educativa, Franco Angeli, Milano. (Tr.: Educational research Handbook)

Trinchero, R., (2021) Insegnare ai tempi del lockdown. Le differenze regionali, in AA.VV, La DaD in emergenza: vissuti e valutazioni degli insegnanti italiani. Scelte metodologiche e primi risultati nazionali (pp. 52-72). Lecce: Pensa multimedia. (Tr.: Teaching in times of lockdown. regional differences).

UIS-UNESCO, (2020)Out-of-School Children and Youth, url: http://uis.unesco.org/en/topic/out-school-children-and-youth

UNESCO, (2021) Understanding the impact of COVID-19 on the education of persons with disabilities: Challenges and opportunities of distance education, Paris, Policy Brief. url: https://unesdoc.unesco.org/ark:/48223/pf0000378404

Van de Velde, S., Buffel, V., Bracke, P., Van Hal, G., Somogyi, N. M., Willems, B., (2021) The COVID-19 International Student Well-being Study. Scandinavian Journal of Public Health, 49(1), pp. 114-122

Vicari, S., & Di Vara, S., eds., (2021) Bambini, adolescenti e Covid-19. L'impatto emotivo della pandemia dal punto di vista emotivo, psicologico e scolastico. Trento: Erickson. (Tr. Children, adolescents and Covid-19. The emotional impact of the pandemic from an emotional, psychological and academic point of view).

Wagner, E., & Warren, H., (2020) Save Our Education: Protect every child's right to learn in the COVID-19 response and recovery. Save The Children, 2020, url: https://resourcecentre.savethechildren.net/node/17871/pdf/save_our_education_0.pdf

Zammuner, V.L., (1998) Tecniche dell'intervista e del questionario. Il Mulino, Bologna. (Tr.: Interviewing techniques and of the questionnaire)

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Mapping Open Education: an analysis of the Open Educational Resources landscape in Brazil and South Africa

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Abstract

Initiatives such as the Open Educational Resources (OER) World Map provide a systematic means towards recording activities, documents and individuals related to open education (OE). In this article – which is part of a larger effort to evaluate and extend this World Map – the entries on Brazil and South Africa were critically evaluated in terms of the existing scholarship on open education from these two countries. Clear trends were evident from the World Map and the usefulness of both the methodology and platform to inform gaps and challenges within and across countries in terms of open education, providing inputs that can aid in the design of strategies and international cooperation.

KEYWORDS: Open educational resources, Brazil, South Africa, OER World Map.

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1. Introduction

This article explores the nature of the open educational resources (OER) landscape in Brazil and the Republic of South Africa in terms of the OER World Map (2021). Even though Brazil and South Africa may be different culturally and geographically, they share similar colonial histories and are considered developing economies and in both OER are used and reported on in unique ways. As an introduction these two contexts are briefly described.

Brazil is the largest country in South America, covering 8 516 000 km^2. With a population of approximately 211 million, it currently has 47 295 294 students in basic education, a number that has been steadily decreasing (from 48 796 512 in 2015). The overwhelming majority – more than 80% of students – are in the public system (INEP, 2021). An opposite trend can be seen in higher education, however, where 8 604 526 students are enrolled (up from 5 985 873 in 2019). Here, 75% of enrolment occurs in private universities pushed by a substantial increase in offerings in distance education. In 2019, 35% of enrolments was in distance education courses (INEP, 2020).

South Africa is located in the southern part of the African continent, and the country covers 1 219 602 km^2. In 2019, the country had an estimated population of 58.78 million people, and the country is very diverse, with 11 official languages (Tibane, Mokoena & Honwane, 2019) with South African Sign Language being in the process of being added as a twelfth official language. In terms of education, South Africa had 12 408 755 students in schools in 2019 (Department of Basic Education [DBE], 2020) and 1 283 466 students in post-school education and training in 2018 (Department of Higher Education and Training [DHET], 2020).

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The shift towards openness more generally, and OER more specifically, has been a subject of great interest in promoting access and quality education for all (UNESCO, 2019). Arinto et al. (2017) posit that OER are particularly relevant to the Global South, as they can be used to address the following challenges: "unequal access to education; variable quality of educational resources, teaching and student performance; and increasing cost and concern about the sustainability of education" (p. 6). Both South Africa and Brazil have had great visibility as regards developments in the field of OER, with notable projects such as Siyavula (Lambert, 2019) and MEC-RED (Amiel, Gonsales & Sebriam, 2018) as well as policy developments and practices at institutions such as the Open University of Brazil (Amiel & Soares, 2020) and the University of Cape Town (Hodgkinson-Williams et al., 2013).

There is a general hope that a "growing inventory of openly available educational tools and resources, and with an increasingly engaged and connected community, transformative opportunities for education abound" (Iyoshi & Kumar, 2008, p. 2). However, many have warned that we must not simply see OER as a "social good" (Glennie et al., 2012) and that we must be critical and base our expectations on evidence.

This article presents a methodology used to collect data on countrywide developments in OER while creating a network of student researchers in Brazil and South Africa. We present this data to give insight into the development of the OER movement in both countries. The main research question that drives the research in this article is as follows: What is the nature of the OER landscape in Brazil and the Republic of South Africa, based on the categories of data available in the OER World Map? Secondly, we also ask: What are some contextual and historical developments in the OER landscape that might help understand the similarities and differences in the current state of OER development in each country based on these categories of data?

2. The OER movement in South Africa

Discussions around open education (OE) are often contextualized with South Africa's historical legacy of unequal and differentiated access to education and resources (Mays, 2020). Specifically, after the Cape Town Open Education Declaration (2007), the idea of OE gained attention in the country. OER provide opportunities to translate resources into the country's 11 official languages, as there is a constitutional obligation to provide primary education in all the official languages (Goodier, 2017). Furthermore, there is also much potential in using OER for the decolonization of the curriculum (Olivier, 2020), which is a great need within the South African context. The decolonization of the curriculum can be negotiated through OER through a process of localization. OER are being incorporated into policies and governmental publications (Goodier, 2017).

National policies support OE regarding open learning principles for higher education (DHET, 2014). In the wider sense of information and communication technologies (ICT), the National Integrated ICT Policy White Paper (Department of Telecommunications and Postal Services [DTPS], 2016) supports a core philosophy of openness in terms of "open access, open Internet and open Government" (p. 12). Although the South African government, through its national Department of Basic Education and provincial education departments, allocates funds for learning and teaching support materials, Goodier (2017) found that no data are publicly available on how much is spent on OER.

However, there is a strong movement towards promoting and using OER through different initiatives from higher education institutions (HEIs) and even organizations such as the South African Institute for Distance Education and OER Africa. Increasingly, institutions are also adopting OER policies and open practices. However, the use of OER in education at all levels in South Africa is not yet common, and often, commercial textbooks not using open licenses are still the norm.

3. The OER movement in Brazil

Discussions around the topic of OER in Brazil began as early as 2008 with the OER Brazil initiative. Conversations revolved around important and essential efforts to purchase equipment and build infrastructure, with the apparent lack of developments in the production of content (Rossini, 2010). Indeed, despite repeated national policy efforts focused on educational technology and more recent initiatives to foment educational resource production, the results have lacked a cohesive strategy. Multiple repositories were created; diverse sets of projects in different HEI were fomented, but there is a lack of alignment in resource creation, availability, teacher professional development and internet availability (Almeida & Valente, 2016).

Initial efforts in OER development focus on large-scale policy change, with some encouraging results. Early on (2011), the city of São Paulo approved a decree that mandates that all resources produced or subsidized by the Secretariat of Education must be open. A law was approved in the Federal District (2015), mandating that publicly funded educational resources must be open. Finally, a federal law proposal was put in motion (2011) to mandate that educational resources funded with public monies must be open. Despite these efforts, there was little change in practice.

In 2016, the movement took a new direction, away from large-scale, top-down policy changes to a more bottom–up or mixed approach (Miao et al., 2019). Efforts were made to work with specific organizations, particularly in the public sector, to push for change in collective efforts.

Examples of the success of this process include the approval of ordinances in the Ministry of Education in both the Secretariat of Basic Education (SEB) and Higher Education (CAPES) with a focus on OER, and the adoption of open licenses in the Open University of Brazil (Amiel & Soares, 2020). The OER movement in Brazil remains an effort of a small but growing group of academics, researchers, teachers and activists (Amiel, Gonsales & Sebriam, 2018).

4. Methodology

This research followed a case study approach. For the purposes of this article, a case study is defined as "an in-depth description and analysis of a bounded system" (Merriam & Tisdell, 2015, p. 37). Then, a comparison between the two cases was conducted. The aim of this comparison was to better understand the development of OER in both countries, through the lense of the other. This is particularly useful as Brazil and South Africa are often seen as having similar economic challenges and are part of common group such as BRICS.

The project followed three phases throughout its development, using the OER World Map (originally available on oerworldmap.org) platform. However, the OER World Map was unfortunately discontinued in April 2022. The map was a georeferenced database of user-generated and collected data related to OE and OER worldwide. It allowed one to visualize services, organizations, policies, people, projects, and other areas related to OE/OER. The map allowed editing and insertion of data, which required a simple user registration on the site.

The work pertaining to this research began with extracting existing data from the map. The data extracted were from three categories: organizations, services, and policies. Following the successful scheme devised during a pilot initiative aimed at mapping the data just for Brazil, online spreadsheets were prepared with the data used by the project teams to monitor and revise their respective countries.

The team comprised of a professor and an undergraduate student in each country, and a project coordinator. To broaden the scope and depth of the mapping, the project coordinator conducted webinars with the students. The project coordinator introduced some of the more complex aspects of OER, and their technical and conceptual aspects were discussed. Beyond just a data entry and extracting effort, the project aimed to promote the professional development of the student participants and create a budding network of young researchers focused on OE/OER.

Phase one involved reviewing the projects already published on the OER World Map. Entries were supplemented with new metadata, where necessary, and in some cases (if a given project had inconsistent data or was duplicated), they were flagged for deletion. The project coordinators supervised each step of this first phase.

In phase two, new data were added to the map. The objective was twofold: on the one hand, the OER World Map would be updated and new projects would be discovered; on the other hand, by contacting experts in their countries, communities would be invited to get involved in the OER World Map project, establishing connections and strengthening OE networks both nationally and internationally.

Finally, the researchers in charge of the mapping were asked to review their experience and write a short report presenting their findings and a self-assessment. The data systematized through their reports can be found in the results presented below.

From this experience, new data on OER projects have been collected and added to the OER World Map, resulting in a better understanding of the mechanics of data collection and validation (including how to retrieve websites, analyze broken documentation [broken web links, databases with technical problems, inconsistent institutional information]).

The next sections begin with a presentation of the quantitative results based on the data that was present and included in the OER World Map. The analysis section contextualizes and attempts to interpret these results in light of the specificity of each country while also drawing comparisons. We finalize with implications of both the methods and the results of this research.

5. Results

The mapping initiative in Brazil (BR) resulted in the insertion of 31 organizations, 29 services and 5 policies, which were the focus of this study (Table 1). As a result, in Brazil, the OER World Map had 8 actions, 3 articles, 5 events, 78 organizations, 104 people, 8 policies, 5 products, 58 services, and 6 web pages. In turn, the mapping task in South Africa (SA)

	Organizations			**Services**			**Policies**		
	Before	Added	**Total**	Before	Added	**Total**	Before	Added	**Total**
SA	18	1	**19**	5	1	**6**	5	2	**7**
BR	47	31	**78**	29	29	**58**	3	5	**8**

Table 1 - Additions to the OER World Map by country.

led to the insertion of 1 organization, 1 service and 2 policies. An analysis of the OER World Map for the South African context reveals the presence of 19 organizations, 6 services, 7 policies, 15 persons, 14 projects, 3 events, 4 stories, and 22 publications.

Organizations that have activities or are responsible for specific actions around OE/OER can be included on the map. They are usually associated with specific services but can also be mapped for other reasons, such as an entity promoting OE/OER or association with policy initiatives. See Table 2 in this regard.

	Organizations	
	SA	**BR**
Community of practice	1	1
Government agency	2	28
Higher education institute	4	37
Other	1	2
Private agency	1	1
Research institute	1	1
Social enterprise/NGO	9	8
Total	**19**	**78**

Table 2 - Organizations by type and country.

In Brazil, there are many higher education (36) and government agencies (27) but also numerous social enterprises and NGOs (8). Following a somewhat similar pattern, in the context of South Africa, there are many higher education (4) and social enterprises, NGOs (9) and government agencies (2).

Various services can be offered, such as repositories (which store content) and referatories (which point to other repositories or websites). The map also allowed for categorization into content source, usually a web page, with no structure for metadata and standards used in repositories. Learning platforms also offer resources, but they are structured as training and not for the retrieval of specific content. Authoring tools categorize software and web services that allow for creating resources. In some cases, repositories allow people to create or remix existing resources on the platform itself. Finally, the community platform is a feature of some repositories that intentionally allows interaction between users. For example, they can follow a user and create communities of interest (Table 3).

For South Africa, the data generated for services showcase learning platforms (4) and repositories (2). For Brazil, there is a wider variety of offerings, predominantly a large number of repositories (41) and referatories (22) and a smaller number of learning platforms (8) and content sources (7). It is important to note that entries might be categorized in multiple categories (e.g., a repository might also be listed as a referatory).

Policies can be categorized into many different types, such as legislation, policy documents, and strategy documents (Table 4). The data gathered for policies revealed four strategy documents and three policy documents within the South African context. In Brazil, legislation is more prominent (5), followed by policy documents (3).

	Services	
	SA	**BR**
Authoring Tool	0	1
Community Platform	0	3
Content Source	0	7
Learning Management System	0	1
Learning Platform	4	8
Referatory	0	22
Repository	2	41
Total	**6**	**83**

Table 3 - Services by type and country.

	Policies	
	SA	**BR**
Legislation	0	5
Policy document	3	3
Strategy document	4	0
Total	**7**	**8**

Table 4 - Policies by type.

The map allowed for identifying the primary and secondary education sectors to which particular services are directed. The results of the analysis, when we were able to categorize them, can be seen in Table 5. Examples are mentioned in the analysis section.

6. Analysis

The data indicate that, in purely quantitative terms, the presence of OER-related initiatives in Brazil is substantially larger than in South Africa. Though both countries have a significant track record of activity in the field, there are significant differences in the size of the country, population and the overall number of institutions and organizations focused on education. In terms of the disparity of HEI, the sheer difference in numbers can explain. Data from 2019 (INEP, 2020) show that Brazil had a total of 2 309 HEI, of which 302 (13%) were public. Of these, 198 were universities, and 108 were public (55%). Furthermore, South Africa had

Primary educational sector	Organizations		Services		Policies	
	SA	BR	SA	BR	SA	BR
Higher education	5	43	2	19	4	4
School	5	24	3	32	0	3
Multisector	0	8	0	5	0	4
Cross-sector	2	0	0	0	3	0
Continued education	0	1	0	3	0	0
Professional education	0	0	0	1	0	0
Total						

Table 5 - Primary sectors for organizations, services, and policies.

487 HEI in 2022, which included 26 public universities, 123 private universities, 50 Technical and Vocational Education and Training (TVET) colleges, 9 community education and training colleges, and 279 private colleges (DHET, 2019). In other cases, such as many government agencies present on the map, it can likely be attributed to the strong emphasis of the Brazilian OER movement in the public sphere (Amiel, Gonsales & Sebriam, 2018). Different federal government sectors, such as CAPES (Ministry of Education), have been involved in discussions around OER for more than a decade. As CAPES funds the Open University of Brazil, a number of HEI that have begun some activity around OER were present on the map. A working group for OER was formed at the federal level (no longer active), which brought together many government sectors. Additionally, and partially related to the ministry's emphasis on OER, almost all states have an OER-related service, which lead to the inclusion of State Secretariats of Education on the map. Data from Latin America indicate that services such as repositories and referatories are most often public/state initiatives (Amiel & Soares, 2016).

In South Africa, the two main governmental departments related to education were listed on the map, specifically, the DBE, which focuses on school-based education, and the DHET, which relates to a different part of post-school education. A significant resource is the government-supported platform Thutong, which provides some openly licensed content. In addition, some universities had a footprint on the map. However, there was a distinct lack of representation by other government agencies on the map, reflecting a broader lack of acceptance of OER.

Repositories and referatories compose most services in Brazil, and repositories present a significant part of services for South Africa. Both are important for OER because they are services where educational resources can be found more easily. Unlike search engines (such as DuckDuckGo and Google) that return material based on recommendation algorithms, educational repositories usually curate resources. They allow for greater organization of materials through metadata (many times aligned to curricula) and community participation (uploading, curation, rating, selection, commenting). The three major repositories/referatories in Brazil, fomented at the federal level, are OER: eduCAPES (higher education), PROEDU (technical education), and MEC-RED (basic education). These were services created with OER in mind and have a significant reach. Additionally, through the Escola Digital initiative, all but seven states in Brazil (out of a total of 27, including the federal district) have an OER repository/referatory. The repositories and referatories from South Africa cover collections from other organizations. The presence of the repository from the University of Cape Town emphasizes the importance of higher education as the driver for OER initiatives in the country. However, the collection from OER Africa involves resources relevant to South Africa and the wider continent.

In terms of policy, Brazil has had a leading role worldwide. Many legislative documents have been approved (Federal District, City of São Paulo). Other decrees have been approved at sub-government levels (Ministry of Education at the basic education level). Some have been proposed and are moving forward (a Federal Law proposal, for example). Policy documents exist at the federal level (CAPES) and in institutions (e.g., Fiocruz, Federal University of Paraná; for a thorough review, see Duran, Amiel & Costa, 2018). There is no single national policy on OER or OE in South Africa. Many institution-specific policies were listed on the map, however. But there are significant gaps – such as the University of South Africa's ODL Policy (cf. Mays, 2020) – which were not listed on the map. These other policies that are listed are specifically related to HEI. The Policy for the Provision of Distance Education in South African Universities in the context of an integrated post-school system was also listed on the map and at least promotes the use of OER at the university level and significantly, OER Africa's OER Policy Review and Development Toolkit is also listed. This toolkit provides a means for other institutions to develop their own policies.

The adoption of OER is, in many respects, an easier prospect for higher education, which has a higher level of institutional autonomy compared to basic education. Still, there seems to be a reasonable balance of focus in organizations, services and policies between higher and basic education, with much less emphasis on other

sectors (e.g., technical education). In Brazil, though higher education has a pioneering role (through CAPES and the Open University of Brazil), there is still relatively little activity in OER at the institutional level (Soares & Amiel, 2017).

On the other hand, we have seen formal policy activity at the state and municipal levels (including the states of São Paulo, Paraná and the Federal District, and the city of São Paulo). As mentioned, a large number of states have OER repositories. At the technical level, the federal government has fomented the PROEDU platform. This OER repository unites the output of the Federal Professional and Technological Educational Network (Rede Federal de Educação Profissional, Científica e Tecnológica) which comprises over 40 federal degree-granting institutions (high school, undergraduate and graduate degrees). In South Africa, the prominence of HEI is clear. However, overall, in terms of national policies or governmental commitment to OER and openness, the map reflected reality.

Despite the strong narrative regarding the importance of fomenting remix and authorship in OER, there still seems to be a paucity of services related to authorship (see Ochoa, 2010). While this may be due to the nature of how people create and publish their content, there seems to be room for more services in both regions focused specifically on promoting the creation of content.

Despite some underrepresentation of some of the activities and bodies relevant to OER in the South African context, the map reflected the realities of the country's context. The prominence of some government-driven resources at school-level education and the emerging prominence of OER for universities in terms of the policy is clear. However, a large proportion of entries on the map specifically related to organizations focusing on OER. The map also showed evidence of what Mays (2020, p. 208) describes as follows: "OER is not yet a mainstream practice, and there remains some skepticism or even resistance to such engagement" in South Africa.

There is also a trend of repositories and resources listed as South African but have a continent-wide focus, such as OER Africa and the African Storybook. Apart from the latter resource, most resources from the listed entries are mainly in English, reflecting the de facto hegemonic position of English in South Africa. Although the country has 10 other recognized official languages, this is the reality.

Work on updating the map had been ongoing for Brazil since 2019, and the map portrayed an up-to-date picture of the major actors, organizations, services and policies focused on OER in the country. Government and public higher education seem to be the prominent actors and catalysts for OER in the country, as is the case in the region (Amiel & Soares, 2016). Notably, at the basic education level, a large network of state-level initiatives, which form part of a network (with support from private foundations), makes up for most initiatives. While there is substantial activity in terms of government policy at all levels, there is still limited activity in terms of institutional policy, particularly for HEI – a major gap. Moreover, as with South Africa, minority languages are not well represented, particularly indigenous languages. This shows us not only a limitation in terms of reach, in the sense that many in the country might not be able to access these resources, but also outreach, in the sense of contributing to the larger global exchange of educational resources, particularly to Portuguese-speaking regions of the world. Finally, it might also underscore the importance of identifying and promoting OER so that these communities can produce and share content widely and openly in their own language.

7. Conclusions

This article explored the nature of OER in Brazil and South Africa in terms of OER World Map entries. To this end, this article started by contextualizing Brazil and South Africa broadly, and then also in terms of the OER movements in the respective contexts. From this discussion, the differences between the countries and OER were evident. After describing the methodology – which also provides a good foundation for future similar endeavors – some statistics and general trends were described.

The project demonstrated the viability of engaging students in the world of OER by taking "ownership" of a particular country on the map. By undergoing a process of data collection, validation and input in a small network, students were able to learn more about OER generally and become knowledgeable on the state of OER in their particular country and other parts of the world. As such, from this experience, the researchers were able to collect new data on OER projects and add them to the OER World Map. They also gained a better understanding of the mechanics of data gathering and validation (for example, how to retrieve websites, analyze broken documentation [broken web links, database with technical problems, inconsistent institutional information]).

Platforms such as the OER World Map can provide a highly appropriate means to explore the nature of OER activities in individual countries and for comparison purposes. To a large extent, the listings on the map reflect the realities on the ground. However, the importance of adding and updating entries in the database is evident.

By identifying strengths and gaps in each country, one could identify opportunities for engagement and exchange. Both countries, which have many spoken and written languages, have challenges in engaging these minority languages within the OER movement. Brazil can provide guidance and models for legislative policy implemented in different states and government

agencies. On the other hand, specific institutions in South Africa could be role models for implementing strategic documents or internal policies on OER. Finally, specific services, particularly those that are small scale, can be connected with opportunities to exchange resources (through federation, or metadata exchange, for example). OER also enable more intense forms of collaboration, including subtitling, translation, and remix.

In countries with limited funding and support for OER activity, the field's growth depends greatly on engaging younger actors and researchers. The project now includes researchers from many different countries in Latin America (Colombia, Uruguay, and Argentina) and South Africa, who are engaged in researching and promoting OER through webinars, articles, and online discussions (Soares et al., 2021). One can also consider that substantial number (either in terms of percentages or in absolute terms) of new entries added to both countries. Considering the ever-changing landscape of OE/OER services – either by the addition of new initiatives or the discontinuation of others – mapping the OE/OER landscape remains a substantial effort. While automatic data extraction and treatment may likely enhance and provide new tools for mapping these initiatives, we believe that engaging young researchers in such activities can provide valuable skills and networking opportunities beyond the mere technical aspects of data input.

Finally, the lack of a coordinated and national project or strategy in each country focused specifically on OE/OER indicates that much of what happens in this space is the product of organizations and individuals acting independently or, at times, in orchestrated consortia (such as the Open University of Brazil system). The lack of a systemic approach that considers the many aspects needed for policy or strategy implementation might lead to projects, even large-scale and government initiatives, which are ephemeral and not sustainable (Amiel & Soares, 2017; Miao et al., 2019). As such, large-scale data can provide additional elements to identify actors and initiatives within a country to join and promote OE/OER in each country through a stronger network and coordinated effort.

References

Almeida M. E. B., Valente J. A. (2016), Políticas de tecnologia na educação brasileira: Histórico, lições aprendidas e recomendações (No. 4), CIEB, from https://cieb.net.br/cieb-estudos-4-politicas-de-tecnologia-na-educacao-brasileira-historico-licoes-aprendidas-e-recomendacoes/

Amiel, T., & Soares, T. C. (2016). Identifying Tensions in the Use of Open Licenses in OER Repositories. The International Review of Research in Open and Distributed Learning, 17(3). https://doi.org/10.19173/irrodl.v17i3.2426

Amiel, T., Gonsales, P., & Sebriam, D. (2018). Recursos Educacionais Abertos no Brasil: 10 anos de ativismo. EmRede, 5(2), 246–258. https://www.aunirede.org.br/revista/index.php/emrede/article/view/346/326

Amiel, T., & Soares, T. C. (2020). Advancing Open Education Policy in Brazilian Higher Education. In K. Zhang, C. J. Bonk, T. C. Reeves, & T. H. Reynolds (Eds.), MOOCs and Open Education in the Global South: Challenges, Successes, and Opportunities (pp. 229–235). Routledge. https://www.routledge.com/MOOCs-and-Open-Education-in-the-Global-South-Challenges-Successes-and/Zhang-Bonk-Reeves-Reynolds/p/book/9780367025779#eresources

Arinto P., Hodgkinson-Williams C., King T., Cartmill T., Willmers M. (2017), Research on open educational resources for development in the Global South, Project landscape.

Cape Town Open Education Declaration (2007), from https://www.capetowndeclaration.org/

Department of Basic Education (DBE) (2020), 2019 School Realities, from https://www.education.gov.za/Portals/0/Documents/Reports/School%20Realities%202019%20Final%20.pdf

Department of Higher Education and Training (DHET) (2014), White paper for post-school education and training: Building an expanded, effective and integrated post-school system, from https://www.gov.za/documents/white-paper-post-school-education-and-training-building-expanded-effective-and-integrated

Department of Higher Education and Training (DHET) (2019), Post-school Education and Training Monitor: Macro-indicator Trends, Pretoria, DHET, from https://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf

Department of Higher Education and Training (DHET) (2020), Statistics on Post-School Education and Training in South Africa: 2018, DHET, Pretoria, from https://www.dhet.gov.za/SiteAssets/Statistics%20on%20Post-School%20Education%20and%20Training%20in%20South%20Africa%2c%202018.pdf

Department of Telecommunications and Postal Services (DTPS) (2016), National Integrated ICT Policy White Paper, Government Gazette, 176(40325), from https://www.gov.za/af/documents/electronic-

communications-act-national-integrated-ict-policy-white-paper-3-oct-2016-0000

Duran, M. R. da C., Amiel, T., & Costa, C. J. da. (2018). Utopias e distopias da tecnologia na educação a distância e aberta. Unicamp/UFF. https://doi.org/10.5281/zenodo.1328232

Glennie J., Harley K., Butcher N. (2012), Introduction: Discourses in the development of OER practice and policy, In J. Glennie, K. Harley, N. Butcher, T. van Wyk (Eds.), Open educational resources and change in higher education: Reflections from practice (pp. 1-12). COL.

Goodier, S. (2017), Tracking the money for open educational resources in South African basic education: What we don't know, The International Review of Research in Open and Distributed Learning, 18(4), https://doi.org/10.19173/irrodl.v18i4.2990

Hodgkinson-Williams C., Paskevicius M., Cox G., Shaikh S., Czerniewicz L., Lee-Pan S. (2013), 365 Days of Openness: The Emergence of OER at the University of Cape Town, In R. McGreal, W. Kinuthia, S. Marshall (Eds.), Open Educational Resources: Innovation, Research and Practice (pp. 33-46), Commonwealth of Learning.

INEP (2020), Censo da educação superior 2019: Divulgação de resultados [Apresentação], INEP, from https://download.inep.gov.br/educacao_superior/censo_superior/documentos/2020/Apresentacao_Censo_da_Educacao_Superior_2019.pdf

INEP (2021), Censo escolar 2020: Divulgação de resultados [Apresentação], INEP, from https://download.inep.gov.br/censo_escolar/resultados/2020/apresentacao_coletiva.pdf

Iiyoshi T., Kumar M. S. V. (2008), Introduction, In T. Iiyoshi & M. S. V. Kumar (Eds.), Opening up education, The MIT Press.

Lambert S. (2019), The Siyavula case: Digital, collaborative text-book authoring to address educational disadvantage and resource shortage in South African schools. International Electronic Journal of Elementary Education, 11(3), 279-290, from https://files.eric.ed.gov/fulltext/EJ1206172.pdf.

Mays T. (2020), Open Educational Resources in South Africa, In R. Huang, D. Liu, A. Tlili, Y. Gao, R. Koper (Eds.), Current State of Open Educational Resources in the "Belt and Road" Countries (pp. 195–212), Springer Singapore, https://doi.org/10.1007/978-981-15-3040-1_11

Merriam, S.B., Tisdell, E.J. (2015), Qualitative research: A guide to design and implementation. John Wiley & Sons.

Miao F., Mishra S., Orr D., Janssen B. (2019). Guidelines on the development of open educational resources policies. UNESCO, Commonwealth of Learning (COL), from http://oasis.col.org/handle/11599/3455

OER World Map (2021), Retrieved January 27th 2021 from https://oerworldmap.org/

Olivier, J. (2020), Self-directed open educational practices for a decolonized South African curriculum: a process of localization for learning, Journal of e-Learning and Knowledge Society, 16(4), 20-28. https://doi.org/10.20368/1971-8829/1135330

Rossini, C. (2010). Green-Paper: The state and challenges of OER in Brazil: From readers to writers? (p. 75). Harvard University. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1549922

Soares, T., & Amiel, T. (2017). Recursos educacionais na Universidade Aberta do Brasil: Perspectivas e práticas. https://doi.org/10.5281/zenodo.1065516

Soares T. C., Pelerino L., Puerta Y., Mesquita R. D. C. D., Bartoli A. B., Núñez S. Z. (2021), Creando redes de educación abierta: Apuntes sobre una experiencia de mapeo de REA en América Latina. Publicaciones de la Asociación Argentina de Humanidades Digitales (PublicAAHD), from https://www.aacademica.org/noviembrehd/28

Tibane, E., Mokoena, M., Honwane, M. (Eds.). (2019). South Africa Yearbook 2018/19. Pretoria: GCIS. Retrieved September 8, 2020 from https://www.gcis.gov.za/south-africa-yearbook-201819

UNESCO (2019), Recommendation on Open Educational Resources, from https://unesdoc.unesco.org/ark:/48223/pf0000373755

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Using infographics to teach object-oriented programming to future computer science teachers

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Abstract

This study presents the results of a pedagogical experiment in teaching object-oriented programming to students of a pedagogical university. The pedagogical experiment was conducted at the Faculty of Physics and Mathematics of the Abai Kazakh National Pedagogical University and at the Kazakh National Women's Teacher Training University. The aim of this study was to test the proposed hypothesis on the use of infographics when teaching object-oriented programming. In the process of conducting the pedagogical experiment, the students involved in the study were divided into 2 subgroups: a control group and an experimental group. The control group used traditional teaching methods and tools, while the experimental group used visualisation tools, in particular infographics. In order to assess the learning outcomes, tests were conducted in both the control and experimental groups. The authors of the study used statistical methods to confirm or refute the proposed hypothesis of the study, i.e., at the end of the pedagogical experiment, a valid conclusion about the difference and coincidence between the data obtained was drawn. The main purpose of the experiment was to test the scientific hypothesis of the study in practice and to evaluate the methodology applied.

KEYWORDS: Object-oriented Programming, Infographics, Computer Science Teacher, Higher Education.

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1. Introduction

In the modern phase, one of the strategies for learning is the visualisation of learning information. Visualisation of learning information is of great importance in education, and the use of infographics enabling the presentation of information in a clear and understandable form is seen as an important instrument in the teaching of object-oriented programming. The use of infographics to teach basic concepts of object-oriented programming when training computer science teachers has therefore become an important research issue. The purpose of this study is to use infographics in teaching object-oriented programming to future computer science teachers.

Various types of visualisations have always been and are used in the learning process, and their role in this process is significant (Pakhomova et al., 2023; Msosa et al., 2022). This is particularly the case when the use of visual aids is not limited to mere illustration in order to make the training course more accessible and easier to learn, but becomes an organic part of the students' cognitive activity, a means of forming and developing not only visual imagery, but also abstract-logical thinking. The modern educational process uses such tools for visualising learning information as timelines, mind maps, scribing; infographics are particularly popular nowadays. Infographics are defined as visualisations of data or ideas that can be used to convey complex information to an audience in a way that can be quickly used and easily understood (Smiciklas, 2012). Brain research related to the physiology of vision and the ways in which the information is processed through the eyes provides a compelling rationale for considering the issue of using infographics in the learning process (Smiciklas, 2012).

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Analysis of works in the field of teaching object-oriented programming has demonstrated that learning the object-oriented approach should be started by mastering fundamental concepts such as object, class, succession, etc. (Windish, 2021)

The main purpose of the research is to define the features of educational infographics and their position in the training system for future teachers of computer science in the framework of object-oriented programming.

2. Literature review

Visual learning proves to be a great aid in helping students gain a clearer understanding of the principles of programming. According to the authors of the study, the use of infographics in teaching object-oriented programming allows to see the essence of the studied material, simplifies the perception of such concepts as encapsulation, polymorphism, succession, classes, etc., making them more visual and interesting for students. Infographics have a rich history and ancient origins. M. Friendly (2008) sets the starting point for the history of infographics almost in antiquity. He calls tables, anatomical and geographical maps, the simplest diagrams and charts of the movement of celestial bodies the forerunners of infodesign (Alrwele, 2017). As it has developed, infographics have become extremely popular in print and online mass media, advertising, marketing and public relations (PR), industrial design, as well as in education.

Infographics can be used effectively:

- improve students' performance in learning course content, to enhance intellectual, life skills and emotional development of students (Ozdamli & Ozdal, 2018);
- to use time effectively, to specify course content in order to make the class interesting and to activate students (Ibrahem & Alamro, 2021);
- to improve students' skills and motivation, to easily and efficiently process and present significant amounts of information (Heimbürger et al., 2020);
- to develop skills such as graphic design, filtering information, synthesizing, identifying basic concepts and the connections between them.

Similarly, infographics can serve as a useful tool for "authenticity"; in authentic assessment, teaching approaches usually reflect real life, i.e., the needs of students after graduation (Tarkhova et al., 2020). According to some scholars, the systematic use of infographics contributes to the development of personal media competence, which allows a specialist in any subject area to effectively address the challenges he or she faces. The use of complex structured infographics improves comprehension and learning of complex teaching material by an average of 20-25% (Kelidou & Siountri, 2020).

The use of infographics when studying a specific discipline can be used as an effective means of visual communication to enhance the quality of learning (Fadzil, 2018). Infographics improve the understanding of conceptual knowledge by providing an interesting way of explaining scientific concepts (Alqudah et al., 2020), helping to support students' perception of the information provided (Golubnycha, 2022). One of the characteristics of infographics is the presentation of complex and haphazard information by creating a story out of its components (Elaldı & Çifçi, 2021). Infographics can be used as training material when teaching complex topics. Instead of conventional presentations created with MS PowerPoint program, it is possible to use infographics, which are much more effective than presentations (Ozdamlı et al., 2016). Infographics can be used to present basic information about a subject, introduce new information or confirm information already known. Infographics are more instructive than textual material (Afify, 2018).

In the modern educational process, the following types of infographics are used: presentation infographics, mnemonic chart infographics, specialised infographics, directive infographics, cartographic infographics, static infographics, animated infographics, interactive infographics (Kelidou & Siountri, 2020). Static infographics enable students to focus on the subject matter being studied (Isamaeel & Al Mulhim, 2021), making it easy for students to grasp new concepts (Jaleniauskiene & Kasperiuniene, 2022). Meanwhile, a comparison of animated and static infographics revealed no significant differences (Alford, 2019).

While noting the great didactic potential of using infographics in the learning process, one also should not forget the possible difficulties accompanying this process, namely: poor elaboration of the key idea of the infographic object; the desire to focus attention in the infographic object on insignificant information not reflecting the main essence of the object or process being modelled; violation of the established requirements for designing an infographic object (Yildirim & Ozdener, 2021), lack of knowledge about this method of visualisation; the need for time to study and design infographics (Alford, 2019).

Using infographics in the learning process has revealed that students prefer to learn through visual material instead of books or other traditional materials (Alford, 2019). Teachers should be able to present information using infographics. In other words, teachers need to be able not only to decode infographics, but also to encode information by means of infographics. For instance, it is possible to provide students with individual concepts and then ask them to create an organised body of information depicted with the help of infographics. As a result of such work, students will have to synthesise

their prior knowledge with the content, make adjustments to their mental schemata and create new associations between given concepts (Yildirim & Ozdener, 2021). All this points to the necessity of training teachers to use visualization tools in the learning process, and in the given case – to create and use infographics in the teaching of object-oriented programming.

3. The observations on object-oriented programming teaching

Object-oriented programming (OOP) is a discipline included in the curriculum for students specialised in teacher education. The object-oriented programming course is one of the core subject courses for training a future computer science teacher. Therefore, its content, forms and teaching methods should be in line with the state-of-the-art in programming languages, methods and technologies.

OOP teaching is a challenging task, both for the teacher, who has to find the best way to illustrate the concepts, and for the students, who have to understand them. Over the years, teachers are still experimenting with different styles and approaches to identify the best and most effective ways of introducing object-oriented concepts and methods. Here are some important issues of interest and decision-making (Boudia et al., 2019):

- which object-oriented language should be used?
- what should be the order of teaching object-oriented concepts?
- what should the learning environment be like?
- when and how deeply should elements of modelling and object-oriented design be incorporated?

Choices relating to these and similar issues greatly influence the structure and success of mastering an object-oriented programming course (Boudia et al., 2019).

J. Bergin (2023) argues that the most important topics should be taught first, as delaying the learning of important concepts can lead to students developing a faulty understanding of them. Given this statement, when teaching the discipline of "Object-oriented programming" using infographics, this plan has been followed:

1. Based on the infographics, discuss the fundamental categories of OOP in accordance with everyday experience:
   • create infographics for explaining the nature of classes and objects and the relationships between them using real-world examples. Explain the concept of a class as a description of something that many similar objects have in common;
   • based on the infographics created, explain the idea of generating an object from an existing class. Create infographics for explaining the concepts of "Inheritance", "Encapsulation", "Polymorphism".
2. After explaining the basic concepts with the help of infographics, proceed to the study of a specific language.
3. To reinforce the skills of working with infographics, offer students the task of designing infographics independently.

Using the Piktochart service, an infographic was created to explain the basic concepts of object-oriented programming. The following are examples of infographics (Figures 1 and 2).

4. Materials and Methods

When conducting the pedagogical experiment, the students were divided into two subgroups: a control group and an experimental group. Both groups were trained based on the same curriculum, but using different methodologies. The control group (CG) used traditional learning tools and the experimental group (EG) used infographics. To determine the effectiveness of the methodology used, the pre-test and post-test were conducted one time. The tests were graded on a 100-point system. In order to determine the students' initial level of knowledge in the discipline of "Object-oriented programming", a Pre-Test was conducted, as well as a Post-Test was held at the end of the course. The tests consisted of 20 questions, each with four possible answers. The students were given 30 minutes to complete the test. The questions for the tests were taken from the training materials. Moreover, a questionnaire survey was carried out in order to identify students' interest in the use of infographics in the learning process.

Rationale for the choice of Pearson's chi-square test of homogeneity (χ^2) in this study is used to assess whether the distribution of categorical variables differs between two or more independent groups or populations. It is also used when categorical data are available and there is a need to determine whether there are statistically significant differences in the distribution of categories between groups.

In this study, in order to make a comparison between the two groups, the first group was considered as the baseline group and was the control one, and the second group was considered as affected by the infographic tool and was the experimental one. The study was carried out at two educational institutions: the Abai Kazakh National Pedagogical University and the Kazakh National Women's Teacher Training University. The authors of the study compared a control group in which training was conducted by using conventional means and methods (textbook, data demonstration and whiteboard) and an experimental

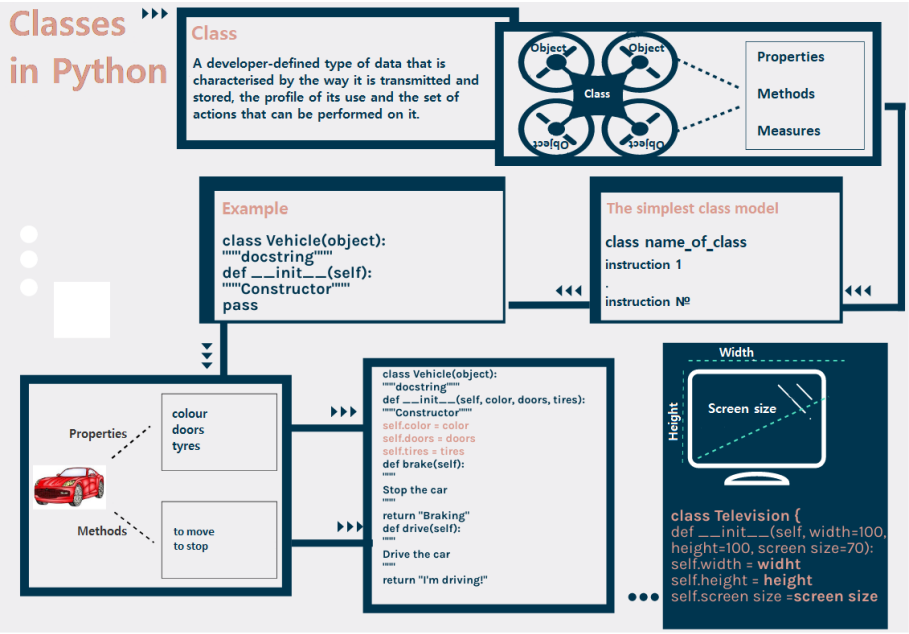

Figure 1 - Infographic on “Classes in Python”.

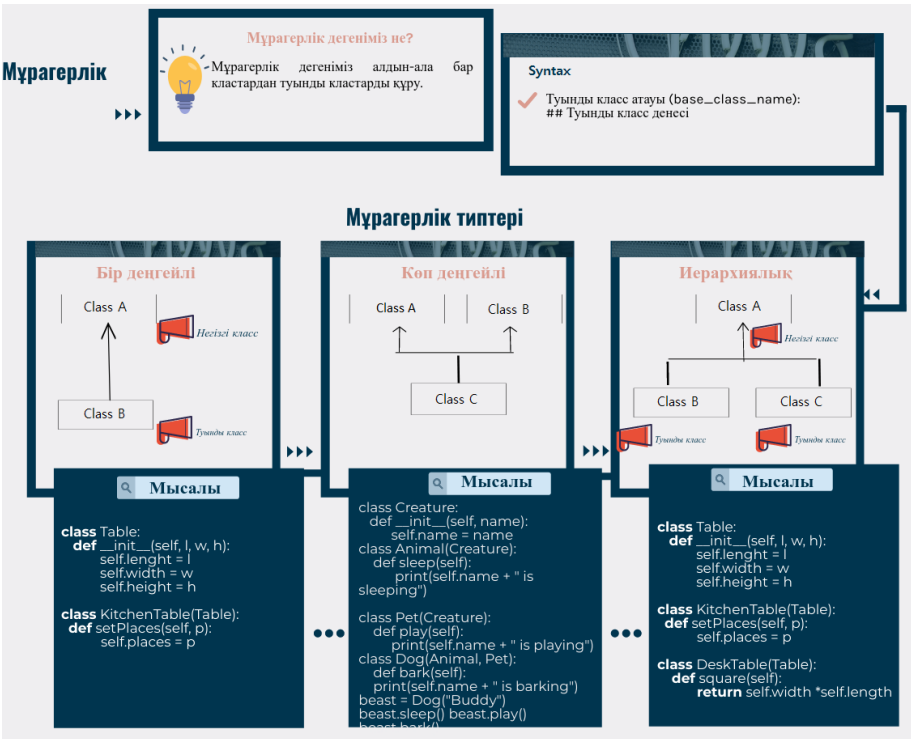

Figure 2 - Infographic on “Inheritance”.

group in which training was carried out using a developed training course with the use of infographics. The pedagogical experiment was conducted in the course of classes of students studying physics and mathematics at the Abai Kazakh National Pedagogical University and Kazakh National Women's Teacher Training University (2019-2020 academic years). Fourth year students in the 5B011100-Informatics specialisation took part in the experiment. A total of 70 students from the Faculty of Physics and Mathematics at the Abai Kazakh National Pedagogical University and the Kazakh Women's National Teacher Training University took part in the "Object-oriented programming" course. Overall, 78.5% were women and 21.4% were men.

5. Results

In this situation, the authors of the study chose Pearson's test for homogeneity x2, since the number of gradations in the ordinal scale (different points) was greater than three (L=4) and the sample size included 70 students. The results of the "pre-test" and "post-test" tasks were systematised on an ordinal scale (Table 1). The students' scores obtained were divided according to proficiency levels in percentages: L=4. Table 1 presents the results of the Pre-test.

Table 1 - Results of knowledge measurement in the control and experimental groups before the experiment.

Point (%)	CG pre-test (students)	EG pre-test (students)
100-90	2	1
89-70	11	10
69-50	12	14
49-0	10	10
Total	35	35

Table 2 presents the results of the descriptive statistics of the pedagogical experiment conducted. Based on the data in Table 2, one can see that the results of the experimental group are significantly higher than those of the control group, namely the arithmetic mean value of the experimental group is higher by 5.76 points and the median is higher by 10 points.

Table 2 - Descriptive statistics of the number of correctly solved tasks in the control group and the experimental group after the pedagogical experiment.

	Sample volume	Minimum	Maximum	Average	Median	Trend	Variance
Control group	35	30	95	68.78	70	75	324.9
Experimental group	35	40	98	74.54	80	75	260.72

The significant difference between the experimental and control groups was the amount of variance of the data around the arithmetic mean. The sample variance of the experimental group decreased compared to the control group, which was calculated from the post-test (Table 3).

Table 3 - Results of knowledge measurement in the control and experimental groups after the experiment.

Point (%)	CG post-test (students)	EG post-test (students)
100-90	4	7
89-70	10	17
69-50	10	6
49-0	11	5
Total	35	35

Since the value of χ^2=14.035 obtained empirically exceeds the critical value of the criterion χ^2=7.815 it can be concluded that the reliability of differences between the characteristics of the experimental and control groups after the experiment is 95%.

Based on statistical processing of the data from the pedagogical experiment, it has been proved that the use of infographics in teaching "Object-oriented programming" provides effective learning and increases students' motivation to learn. In order to determine the students' interest in using infographics in the learning process, the students in the experimental group (35 people) were asked to fill in a questionnaire after the lecture (Table 4).

Table 4 - Questionnaire to determine students' interest in using infographics in the learning process for students in the experimental group.

	Statement	Yes	No
1	The lecture material was clearly presented		
2	The lecture material was presented in an interesting way		
3	The lecture material was presented in a comprehensible way		
4	The lecture material stimulated creative thinking		
5	The lecture material was of great interest to you		
6	The lecture material did not take much time to understand and assimilate		

The questionnaire showed that 72% of the participants thought that the lecture material was clearly presented, 18% of the participants answered negatively to the statement, and 10% of the participants found it difficult to answer. 50% of the participants agreed with the statement that the lecture material was presented in an interesting way, 25% disagreed with this statement, 25% of the participants found it difficult to answer. The results of the questionnaire show that 72% of the survey participants think that infographics have enabled them to present lecture material in a comprehensible

way, 18% disagreed with this statement, and 10% found it difficult to choose an answer. 67% of students think that the use of infographics in lecture material stimulates creative thinking, 3% – answered "difficult to answer", 30% – said "no". The lecture material using infographics was of great interest to 84% of the participants, 10% of the respondents disagreed with this statement, while 6% of the students found it difficult to answer. 86% of those surveyed felt that the lecture material did not take long to understand and assimilate, while 4% of respondents disagreed with this statement and 10% found it difficult to answer. The questionnaire survey confirmed the benefits of using infographics in the learning process.

6. Conclusions

The main purpose of the experiment was to test the scientific hypothesis of the study in practice and to evaluate the methodology applied. The authors of the study used statistical methods to confirm or refute the proposed hypothesis of the study, i.e., at the end of the pedagogical experiment, a valid conclusion about the difference and coincidence between the data obtained was drawn. The work of confirming or disproving the proposed research hypothesis consisted of the following steps:

1. Calculation of the empirical value of the criterion based on the results of the "pre-test" and "post-test" of the experimental and control groups.
2. Comparison of the empirical value of the criterion with the critical value of the criterion (significance level 0.05). The reliability of the differences in the characteristics of the experimental and control group members will be 95% if the resulting empirical value of the criterion is greater than the critical value.

According to the results of using infographics in object-oriented programming classes at a teacher training university, although there were no significant differences between the experimental and control groups based on the pre-test, there was a significant difference between the scores of the groups after the test in favour of the experimental group. The results obtained demonstrate that infographics increase students' performance in object-oriented programming. Based on the results of statistical processing of the data from the pedagogical experiment, it has been proven that the use of infographics in teaching object-oriented programming provides good training for students. The proposed hypothesis was confirmed. Moreover, students were more motivated to use infographics in their teaching activities.

The results of the research analyzed in this article show that infographics are an effective means of enhancing students' learning of course content and that infographics have significant potential in education to enhance students' intellectual, life and emotional development. It can be argued that the use of infographics in teaching object-oriented programming helps in understanding the basic concepts and also improves student performance. This can also enhance visual and verbal levels of learning. The results of this study can form the basis of solutions for teachers who teach complex or abstract concepts to students.

Limitations of this study include the limited generalisability of the study due to its focus on a specific educational context, potential bias due to sample size and selection, lack of long-term impact assessment, lack of detailed control for external variables, reliance on self-reported motivation and the potential influence of the Hawthorne effect. In addition, the scope of the study is narrow as it predominantly explores the benefits of infographics without considering possible drawbacks and variations in their design.

References

Afify, M. K. (2018). The effect of the difference between infographic designing types (static vs animated) on developing visual learning designing skills and recognition of its elements and principle. International Journal of Emerging Technologies in Learning, 13(9), 223-204. https://doi.org/10.3991/ijet.v13i09.8541

Alford, K. (2019). The rise of infographics: Why teachers and teacher educators should take heed. Teaching/Writing: The Journal of Writing Teacher Education, 7(1), 158-175.

Alqudah, D., Bidin, A. B., & Hussin, M. A. H. B. M. (2020). The impact of educational infographic on students' interaction and perception in Jordanian Higher Education: Experimental Study. International Journal of Instruction, 12(4), 669-688. https://doi.org/10.29333/iji.2019.12443a

Alrwele, N. Sh. (2017). Effects of infographics on student achievement and students' perceptions of the impacts of infographics. Journal of Education and Human Development, 6(3), 104-117. https://doi.org/10.15640/jehd.v6n3a12

Bergin, J. (2023). Beyond Karel J robot: A gentle introduction to the art of object-oriented programming. New York: Slant Flying Press.

Booch, G. 2007. Object-oriented analysis and design with applications in C++. Boston: Addison-Wesley.

Boudia, C., Bengueddach, A., & Haffaf, H. (2019). Collaborative strategy for teaching and learning object-oriented programming course: A case study at Mostafa Stambouli Mascara University, Algeria. Informatica, 43(1), 129-144. https://doi.org/10.31449/inf.v43i1.2335

Burton, P. J., & Bruhn, R. E. (2003). Teaching programming in the OOP era. ACM SIGCSE Bulletin, 35(2), 111-114. https://doi.org/10.1145/782941.782993

Djelil, F., & Sanchez, E. (2022). Game design and didactic transposition of knowledge. The case of progo, a game dedicated to learning object-oriented programming. Education and Information Technologies. https://dx.doi.org/10.1007/s10639-022-11158-6

Elaldı, Ş., & Çifçi, T. (2021). The effectiveness of using infographics on academic achievement: A meta-analysis and a meta-thematic analysis. Journal of Pedagogical Research, 5(4), 92-118. https://doi.org/10.33902/JPR.2021473498

Fadzil, H. M. (2018). Designing infographics for the educational technology course: Perspectives of pre-service science teachers. Journal of Baltic Science Education, 17(1), 8-18. http://dx.doi.org/10.33225/jbse/18.17.08

Friendly, M. (2008). A Brief History of Data Visualization. In: C.-H. Chen, W. Härdle & A. Unwin (Eds.), Handbook of Data Visualization (pp. 15-56). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-540-33037-0_2

Golubnycha, G. (2022). The potential of interactive infographics: Gamification and edutainment. Scientific Collection InterConf+, 26(129), 381-392. https://doi.org/10.51582/interconf.19-20.10.2022.041

Graham, I. 2001. Object-oriented methods: Principles & practice. Boston: Addison-Wesley.

Heimbürger, A., Keto, H., & Isomöttönen, V. (2020). Learning via summarizing infographics assignment in software engineering management e-course? In: 2020 IEEE Frontiers in Education Conference (FIE). Uppsala: IEEE. https://doi.org/10.1109/FIE44824.2020.9274229

Ibrahem, U. M., & Alamro, A. R. (2021). Effects of infographics on developing computer knowledge, skills and achievement motivation among hail university students. International Journal of Instruction, 14(1), 907-926. https://doi.org/10.29333/iji.2021.14154a

Isamaeel, D. A., & Al Mulhim, E. N. (2021). The influence of interactive and static infographics on the academic achievement of reflective and impulsive students. Australasian Journal of Educational Technology, 37(1), 147-162. https://doi.org/10.14742/ajet.6138

Jaleniauskiene, E., & Kasperiuniene, J. (2022). Infographics in higher education: A scoping review. E-Learning and Digital Media, 20(2), 191-206. https://doi.org/10.1177/20427530221107774

Jusuf, H., Ibrahim, N., & Suparman, A.A. (2019). Development of hybrid learning material to support object-oritented programming course. In: Proceedings of the 1st International Conference on Science and Technology for an Internet of Things. Yogyakarta: EAI. http://dx.doi.org/10.4108/eai.19-10-2018.2281285

Kelidou, E., & Siountri, K. (2020). The use of Infographics as an educational tool for the upcoming digital transition. International Conference on Cultural Informatics, Communication & Media Studies, 1(1). https://doi.org/10.12681/cicms.2730

Kölling, M., & Rosenberg, J. (1996). Blue – A language for teaching object-oriented programming. In: Proceedings of the 27th SIGCSE Technical Symposium on Computer Science Education (pp. 190-194). Philadelphia: Association for Computing Machinery. https://doi.org/10.1145/236452.236537

Lian, V., Varoy, E., & Giacaman, N. (2022). Learning object-oriented programming concepts through visual analogies. IEEE Transactions on Learning Technologies, 15(1), 78-92. https://doi.org/10.1109/TLT.2022.3154805

Meyer, B. 1997. Object-oriented software construction. London: Prentice Hall.

Msosa, S.K., Ntshangase, B.A., & Mlambo, C. (2022). Gender parity among researchers in science, technology, engineering and mathematics. Entrepreneurship and Sustainability Issues, 9(4), 243-261. http://doi.org/10.9770/jesi.2022.9.4(13)

Ozdamli, F., & Ozdal, J. (2018). Developing an instructional design for the design of infographics and the evaluation of infographic usage in teaching based on teacher and student opinions. EURASIA Journal of Mathematics, Science and Technology Education, 14(4), 1197-1219. https://doi.org/10.29333/ejmste/81868

Ozdamlı, F., Kocakoyun, S., Sahin, T., & Akdag, S. (2016). Statistical reasoning of impact of infographics on education. Procedia Computer Science, 102, 370-377.

Pakhomova, T., Hryhorieva, V., Omelchenko, A., Kalenyk, M., & Semak, L. (2023). The formation of digital competence by means of information and communication technologies among students of higher education. Eduweb-Revista de Tecnologia de Informacion y Comunicacion en Educacion, 17(2), 78-88. DOI: 10.46502/issn.1856-7576/2023.17.02.7

Saidova, D. E. (2022). Analysis of the problems of the teaching object-oriented programming to students. International Journal of Social Science Research and Review, 5(6), 229-234. https://doi.org/10.47814/ijssrr.v5i6.418

Smiciklas, M. (2012). The power of infographics: Using pictures to communicate and connect with your audiences. Indianapolis: Pearson Education, Inc.

Tarkhova, L., Tarkhov, S., Nafikov, M., Akhmetyanov, I., Gusev, D., & Akhmarov, R. (2020). Infographics and their application in the educational process. International Journal of Emerging Technologies in Learning, 15(13), 63-80. https://doi.org/10.3991/ijet.v15i13.14647

Végh, L., & Stoffová, V. (2019). Learning object-oriented programming by creating games. eLearning & Software for Education, 1, 20-29. http://dx.doi.org/10.12753/2066-026X-19-002

Windish, D. W. (2021). A guide to basic statistics for educational research. MedEdPORTAL, 17, 11187. https://doi.org/10.15766%2Fmep_2374-8265.11187

Yildirim, O. G., & Ozdener, N. (2021). An action research study on the development of object-oriented programming course. International Journal of Technology in Education and Science, 5(4), 620-628. https://doi.org/10.46328/ijtes.277

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Mapping the field: a bibliometric analysis for Distance Education with a focus on Management Studies

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Abstract

The pandemic context has presented new challenges for education. In a short time, higher education institutions (HEIs) adapted their students, staff, technology, and infrastructures for a fast migration to distance learning. This change brought new challenges but also new opportunities that justify more contributions. The purpose of this paper is to study distance education (DE) methods and approaches, with a focus on management studies that are understudied. The research adopted a descriptive quantitative approach. Based on a sample of 400 documents using the Scopus database, a bibliometric analysis was carried out, aiming to identify the most prominent keywords, authors, sources, and countries for DE in general, with a focus on management courses in HEIs. The results suggest that innovation can be an asset for HEIs and can be seen as an ally for both teachers and students in learning new practices that involve digitalization. The bibliometric analysis highlights that motivation and collaboration are very important aspects and should be considered, especially when students are at the center of the teaching process. The main limitation regards the dominance of papers about DE, mostly based on the education sciences, and just a small number focusing on management courses. This limitation can influence the results achieved, but also allows this research to contribute for a better understanding of this field. This is one of few studies that has innovated by identifying the main subjects in DE literature, with a special emphasis on management courses, thus complementing previous scarce research in the field.

KEYWORDS: Bibliometrics, Distance Education, Management Courses, Higher Education, Covid-19.

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1. Introduction

Distance Education (DE) is not a recent concept, although the pandemic situation of the Corona virus (Covid-19) has proven and evidenced its importance, in training and knowledge contexts of Higher Education Institutions (HEIs) centered on face-to-face teaching. This has simultaneously brought a set of new challenges for the management of these HEIs, as well as for the adaptation of both teachers and students to this new teaching-learning model considering broad aspects such as technology, assessment systems, teaching strategies, among others. Moreover, in the context of HEIs offering management courses, DE is a particularly challenging teaching modality, especially in the initial period of the pandemic, in terms of contacts within applied research in co-creation, without an established protocol for action. However, mutual learning was also possible among the main actors involved in the process, in order to enable new practices that involve digitalization. According to Mukul and Büyüközkan (2023), technological development as part of Industry 4.0 has significantly changed the education system and there have been several implications for human life.

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This study aims to present a quantitative analysis of publications on DE in higher education in the sense of opening to the scientific community a new look at the DE modality, now more than ever a priority modality in a pandemic context, and its potential after the pandemic; in addition, the aim is to fill the gap in the insufficient existing literature on this subject within higher education courses in the management area.

To meet these objectives, it is necessary to consider that the changing context of the pandemic brought to teaching the need to reinvent the teaching–learning process, using remote technologies such as digital platforms to meet the need for continuity of classes in a non-face-to-face format. From this perception, it is possible to find some terms referring to the distance learning modality that can be analyzed and interpreted, such as, for example, e-learning, remote learning, virtual learning, collaborative environment, among others. Considering the weighting of the terms in the theme under study and the requirement of a particular incidence on courses in the management area, some keywords are defined. From this step information available in a database can be used, in this case Scopus, and other dimensions of reference on the theme under study can be explored.

The next section of this paper is methodological in nature, describing the main steps and criteria in defining terms that are appropriate to the theme to be addressed. The purpose of this section is to create a framework to then carry out a literature review, presented in section three, and subsequently, in the fourth section, a bibliometric analysis supported by this literature review. Section 5 presents the final conclusions.

2. Methodology

This paper aims to analyze scientific publications on distance education (DE) in higher education, with a special focus on management courses. Thus, Scopus was used, because it allows more extensive bibliometric analyses, as there has been a content reload from other Elsevier databases since 1966 to increase and enrich coverage (Costa et al., 2012). The present study was also supported by Bibliometrix software, focusing on four different dimensions of bibliometrics: keywords, authors, sources, and countries. Two well-known authors who have written on this software program, Aria and Cuccurullo (2017), mention that Bibliometrix, besides being flexible, can easily integrate other statistical programs, thus reaching a large and active community of scholars and researchers.

Initially, it was necessary to find terms associated with the topic, such as “distance”, “learning”, “online," and, at the same time, to select the areas of study most familiar to the topic, such as "social science," "computer science," and "business, management, and accounting." Given the nature of the study, an important condition to implement in this process was to restrict the topic to "higher education", disregarding other academic levels. Other restriction criteria adopted were the type of document, type of source and period (the latter being verified through reading), which led to a final sample of 52 documents (Table 1). Based on that sample, a literature review was carried out, aiming to identify the main subjects in DE literature with a focus on management fields, complementing previous research in the matter (section 3).

Stage	Description	Pros	Cons
1	Choose clear and precise keywords in the multi-database engine	-	-
2	Choose a database that gathers the most reputed authors for the topic under study	-	As the databases have different profiles, the researcher must find the one that gathers the most authors and relevant journals available for the topic under study
3	Restrict the sub-areas linked to the theme (management)	The sub-areas are very precise	-
4	Filter only scientific articles, reviews, and journals	-	-
Scopus database returns 332 publications			
5	Read the titles of the publications, detect repeated authors, and exclude or admit them, given some limitations	A careful reading helps to better define the issues addressed within the theme	There are articles published by more reputable authors that may be unavailable. It is also advisable to check that the article does not discretely "sidestep" the topic (false positives)
Scopus database returns 52 publications			

Table 1 - Description of the steps on the articles intended for the literature review.

Given the weak manifestation of "peaks", which means that the number of articles would only be understandable for recent or little studied themes (which goes against the study in question since it gathers data beyond the turn of the century), a new search in Scopus was conducted. The focus was to reduce the number of terms, to expand the subject and, consequently, increase the number of publications within the focus. By filtering again for the same requirements as previously, even though ensuring the exclusion of false positives, a final sample of 400 documents was reached to carry out the bibliometric analysis presented in section 4 (Table 2). It should be noted that of the total of 400 articles, some are related to broader themes, such as social sciences (239) and computer science (82), while others are associated with management themes, such as business, management and accounting (17), economics, econometrics and finance (5), among others (Figure 1).

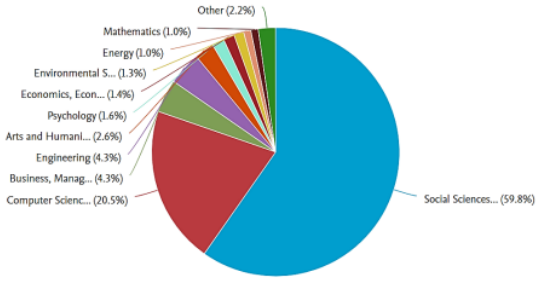

Figure 1 - Documents by subject area (source: Scopus 2021).

The authors' methodological choices are more precisely as follows. In order to make the scientific literature a line of confrontation of ideas and thoughts, it was necessary to identify some authors and, in this case, it was found that there are some highly regarded ones for the definition of distance education; however, they are not found in the Web of Science, only in Scopus, which proves that articles are reloaded into this database. The only types of articles included were scientific articles and, to a lesser extent, reviews, as these are the most rigorous and reliable materials. The choice of time period was based on the turn of the century and the year of the pandemic, more precisely, 20 years before and 20 years after the year 2000, which resulted in a period of 40 years. With regard to the choice of keywords, in the first phase, "direct" terms to the subject were used i.e., "distance", "education", "online", "learning", "higher" and "e-learning", linked with the additive particle "AND" ("distance" AND education" AND "online" AND "learning" AND "higher" AND "e-learning"), which generated 52 articles, after eliminating some "false positives" such as situations related to different levels of education and other areas of study. In a second phase, a new search was carried out, focusing on "distance education" AND "higher education".

The first 52 articles are written along the same lines and all the subjects are approached in a very similar way, differing only in each author's point of view. These 52 articles were read and analyzed "in depth" in order to obtain a coherent and objective literature review. The aim of increasing the number of articles - in this case, it was obtained 400 after the second search and after eliminating some "false positives" - was both to expand the subject and realize, with the support of Bibliometrix, whether the topics and authors of the first search were part of the second search and thus were still relevant. Some important authors can be named, namely: Moore (1990); Holmberg (1997); Garrison & Kanuka (2004); Bernard et al. (2004); Arbaugh et al. (2009); Abrami et al. (2011). These authors, as well as serving in the 52 publications mentioned, are also included in the final 400 publications, given their relevance. A further reason for generating a greater number of articles was to test the three fundamental

Stage	Description	Pros	Cons
More articles are needed to make the bibliometric analysis more robust			
6	Do a new search in the Scopus search engine, but this time reduce the number of terms, in order to broaden the subject and consequently increase the number of publications	In this step it is not necessary to read and analyze, the only aim is to increase the number of publications	Naturally, it will include false positives
7	Re-filter the same requirements considered in Table 1	-	Filter further to ensure the exclusion of false positives
The Scopus database returned 366 publications; the previous 52 were added and others were removed. The bibliometric review has 400 records in Bibliometrix			

Table 2 - Description of the steps on the articles for the bibliometric review.

laws of bibliometrics (i) Lotka's law; (ii) Bradford's law; (iii) Zipf's law.

3. Literature Review

3.1 Evolution of the concept of DE

There are several definitions of DE that attempt to explain this concept, presenting different views and perspectives on it. López-Pérez et al.'s (2011) definition of DE is possibly one of the most popular. The authors state that this is a teaching modality that allows individuals who are geographically separated to learn. Amidst definitions also come theories, namely the transactional distance theory formulated by Moore and Kearsley (2005), which stresses that distance is a pedagogical phenomenon and not just a matter of geographical distance.

DE differs from other modes of education. Thus, Anohina (2005), Bernard et al. (2004) and Keegan (1980) agree that in DE there is different lesson planning and preparation; the use of technical means connects teachers and students, and enhances content acquisition; and, finally, the provision of two-way means facilitates dialogue and interaction among all. From the perspective of Simonson et al. (2011), each form of technology linked to DE has advantages and disadvantages regarding the quality of the learning experience, and group collaboration and interaction may be more important than individual participation.

Theoretically, there is a natural conflict of interest between what is practical and what is efficient in the teaching-learning process. It is true that there are many appreciated conveniences in DE, such as the time factor, or comfort, but one must also take into consideration the implied drawbacks, such as the poor socialization and expectation of students who opt for a face-to-face course. According to Bonk (2020), sometimes there are not enough fully functioning technological resources and infrastructure, and in addition, some students may even have to share the Internet with family members or other people living in the same house, as well as the workspace.

For some, the lack of knowledge about the evolution of DE leads to it being easily equated with the term remote learning (Bonk, 2020). Moreover, Sun (2008) argues that students should be provided with instructional knowledge and technical assistance regarding e-learning in order to reduce uncertainty and frustration, thus leading to better learning experiences. In the same Vein, et al., (2010) points out that more time online means more work and less quality of life for everyone. Active approaches exist that allow the teacher to present options that appeal to most learning styles while still maintaining control over course coverage and content (Lage et al., 2000). In this sense, only the most motivated and proactive students perform better in relation to active methodologies (Chen et al., 2014). Blended learning as an example of active methodology becomes more learning-centered, with a focus on active learning through collaboration (Rovai & Jordan, 2004).

Higher education managers and leaders should adapt and change policies in emergency situations and consider all aspects of teaching and learning (Noori, 2021). According to Garrison and Kanuka (2004), a clear policy and strong leadership leads to a faster evolution regarding this methodology in HEIs. The authors argue that controlling this evolution influences learning outcomes, student satisfaction and achievement.

The inclusion of innovative technology accompanies the transition to a different learning context, as happened during the Covid-19 pandemic, and should be based primarily on facilitating and thus enhancing the learning process (Abudaqa et al., 2021; Biju et al, 2022). According to Evans and Haase (2001), the main reason behind the growth of distance education programs has been the chance to learn without being limited by geographical and/or time boundaries.

Is is known that the Internet and the World Wide Web emerged in the early 1990s. Palvia et al. (2018) state that over the years there has been a remarkable acceptance and integration in various countries around the world and on all continents. The author refers to the good timing of the USA in 1998 in introducing blended learning into the education system; highlights the interest of countries such as India, Saudi Arabia and South Africa in promoting e-learning; and recognizes the growing popularity of e-learning in countries such as Australia.

The advancement of digital technologies in higher education is challenging traditional teaching, but on the other hand, it is also providing dynamic and innovative opportunities for student learning (O'Flaherty & Phillips, 2015). A health crisis can deeply affect the classroom teaching, so the use of social media should be considered pedagogically (Ulla & Perales, 2021). It should also be noted that in virtual environments it is very important that teachers try to "reduce" the sense of distance as much as possible (Vlachopoulos & Makri, 2019). Regular communication with the teacher through technologies allows the student greater flexibility and freedom to work and be engaged. Students may see this flexibility as a kind of time management benefit, which can lead to greater autonomy and responsibility for their learning (Rueda et al., 2017). In the same line of reasoning, Arbaugh et al. (2010) argue that this opportunity can result in benefits such as flexibility in managing family commitments as well as scheduling other work-related activities.

3.2 Modern applications – management courses

Regarding modern applications in the field of Management, there are two main strategic orientations (Table 3): a quantitative and a qualitative one. The quantitative aspect encompasses areas such as accounting and information systems management, while the qualitative aspect encompasses areas such as marketing and human resources management. Studying accounting, in the view of Lopes and Soares (2018) becomes more accessible through interactive videos than through books. According to Arbaugh et al. (2009), these types of subjects taught online tend to be a sharing of the teacher's professional experiences. Regarding the information systems management area, the same author mentions that e-learning is increasingly in vogue for this type of courses given its technological aspect. However, in courses with a more theoretical component, such as marketing and human resource management, it is essential that the activities proposed by teachers are dynamic, such as solving real case studies (Huang & Lin, 2017).

Table 3 - Characteristics and types of methods applied in the different areas of management.

Management areas	Characteristics	Method type
Accounting and Finance	Mostly analytical and quantitative characteristics	Learn at home, practice in the classroom
Marketing	Mostly qualitative characteristics	Teachers should analyze the profile and learning styles of the students to bring about discussion exercises
Information Systems Management	Mostly analytical and quantitative characteristics	Learn at home, practice in the classroom
Human Resources Management	Mostly qualitative characteristics	Students are expected to practice knowledge and skills through a structure, yet flexible framework that provides activities before, during and after the class.

4. Bibliometric analysis - Results and discussion

This section initially discusses the general results obtained after a detailed analysis of the documents in the sample. It is important to mention that the research difficulty resulting from the scarcity of studies applied to management courses is a relevant justification for the development of this study. It is also relevant to understand the evolution of the topic under study; for example, some terms such as "distance learning" and "DE" have been equated in recent times, and there is now the possibility of adopting them in HEIs following the experience of the pandemic.

4.1 DE: evolution of the contributions

The 400 publications focused on are from scientific journals available on the Scopus platform between the years 1980 and 2020, as can be seen in Figure 2. For this 40-year period, it can be stated that the published scientific production has an average annual growth rate of 14.67%. For an identical proportion of articles, it can be seen that from 1980 to 2005 (25 years) there is moderate growth, and from 2005 to 2017 (12 years) there is faster growth. However, due to the pandemic context of Covid-19 and the consequent restrictions imposed on teaching, the peak of these scientific publications was in 2020, the highest since the beginning of the 21st century.

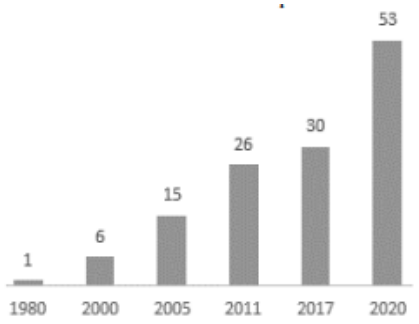

Figure 2 - Evolution of the annual scientific production on the DE modality (authors' construction based on Bibliometrix).

It is important to emphasize that all validated scientific production is conceived according to a set of studies and research; therefore, it is necessary to mention and take into consideration the source of all this knowledge, which naturally comes from the authors of the publications. According to Table 4, some authors that appear in the literature review (section 3) and that are highly cited can be highlighted, namely the following: Lage et al. (2000); Bernard et al. (2004); Garrison & Kanuka (2004); Rovai & Jordan (2004); Sun et al. (2008); López-Pérez et al. (2011); and O'Flaherty & Phillips (2015). Moreover, references to the 14 studies presented in Table 4 (together representing 3.5% of the total sample of 400 documents) – particularly the studies of Garrison & Kanuka (2004), Sun et al. (2008) and Lage et al. (2000) – represent 50.7% of all 16525 citations found in Scopus, which shows that these are the works with the greatest impact on the subject. These results also reveal the dispersion of the citations, showing that a small group of authors' works have the greatest impact in this field.

Table 4 - Major impact works (authors' construction based on Bibliometrix).

Autho(s), Year	Title	Journal	Total Citations	% Accumulated
Garrison DR, 2004	Blended learning: Uncovering its transformative potential in higher education	*Internet and Higher Education*	1675	10,1%
Sun PC, 2008	What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction	*Computers and Education*	1157	17,1%
Lage MJ, 2000	Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment	*Journal of Economic Education*	1092	23,7%
O'Flaherty J, 2015	The use of flipped classrooms in higher education: A scoping review	*Internet and Higher Education*	752	28,3%
Bernard RM, 2004	How Does Distance Education Compare With Classroom Instruction? A Meta-Analysis of the Empirical Literature	*Review of Educational Research*	688	32,5%
Alavi M, 1994	Computer-Mediated Collaborative Learning: An Empirical Evaluation	*MIS Quarterly*	679	36,6%
Strayer JF, 2013	How learning in an inverted classroom influences cooperation, innovation and task orientation	*Learning Environments Research*	648	40,5%
Rovai AP, 2004	Blended Learning and Sense of Community: A Comparative Analysis with Traditional and Fully Online Graduate Courses	*International Review of Research in Open and Distance Learning*	428	43,1%
Rovai AP, 2002	Sense of community, perceived cognitive learning, and persistence in asynchronous learning networks	*Internet and Higher Education*	384	45,4%
Lpez-Prez MV, 2011	Blended learning in higher education: Students' perceptions and their relation to outcomes	*Computers and Education*	325	47,4%
Morris LV, 2005	Tracking student behavior, persistence, and achievement in online courses	*Internet and Higher Education*	213	48,7%
Bolliger DU, 2009	Factors influencing faculty satisfaction with online teaching and learning in higher education	*Distance Education*	160	49,6%
Guri-Rosenblit S, 2005	'Distance education' and 'e-learning': Not the same thing	*Higher Education*	144	50,5%
Stoessel K, 2015	Sociodemographic Diversity and Distance Education: Who Drops Out from Academic Programs and Why?	*Research in Higher Education*	40	50,7%
	Other		8140	100%
	Total		16525	

From Table 4, the degree of importance involved in the authors' publications can also be interpreted, considering the number of citations and the year in which the work was released. For example, an increase in the number of worldwide publications on e-learning is to be expected during the Covid-19 pandemic period or, on the other hand, an increase in citations of older publications that imply or indicate the importance of e-learning in education (Idwan et al, 2021; Husin et al, 2022). For example, Garrison (2017) states that e-learning can be considered a disruptive technology. This author's arguments are quite compatible with this disruptive scenario since we had to implement e-learning after a pandemic. It is natural that this and other articles are now being "revisited" and evaluated from a different perspective.

Still about authors, Lotka's law (1926) holds that for a larger number of scientific publications, there is a smaller number of authors, and the reverse is also true. Considering the 400 publications extracted, Table 5 confirms that a very significant part of the authors (94.4%) is dedicated exclusively to one publication on the theme under study and, on the other hand, only one author (0.1%) – Rovai, A.P. – produces more than a dozen publications.

Another basic law of bibliometrics, Bradford's law (1948, cited by Machado et al., 2016), considers that the journals with the largest number of articles published on a given subject generate a higher degree of specialization and relevance in that area. Table 6 shows a higher concentration of articles per journal (10 journals in total) in its first half (five journals), registering a notable difference thereafter.

The journals at the top of the ranking are mostly related to the Internet, technology, and DE. The most productive journal in the area, the journal "Internet and Higher Education," accounts for analyses on the effects of the Internet and information technology (IT) in many contexts in higher education. Moreover, it is devoted to advances in innovations or best practices in online teaching, learning, management, and administration. The scientific area of the remaining journals is also education and technology, but a very significant part already encompasses several levels of education, which may be an indicator of the maturation of the theme, now with new contours due to the pandemic context.

From the 400 publications extracted, some generic keywords resulted, as shown in Table 7. The relevance of these keywords is determined by the number of occurrences found in the publications, i.e., there is a small number of words that are used more frequently, as suggested by Zipf's law (1949, cited by Araújo, 2006). It should be noted that these particular keywords are not highlighted by the authors, as they only indicate the subject of the document and therefore do not specify any theme (in this case, management). The first three keywords are notably the most relevant in the group, as they directly represent the central focus of the study. Given its multiplicity and ambiguity of meanings, the fourth keyword (education) is already notably less relevant than the first, and so on.

Table 5 - Authors' productivity according to Lotka's law (authors' construction based on Bibliometrix).

Documents written	N. of authors	Proportion of authors
1	836	0.944
2	42	0.047
3	4	0.005
4	3	0.003
13	1	0.001

Table 6 - Main journals (authors' construction based on Bibliometrix).

Journals	Amount of articles
Internet and Higher Education	35
International Review of Research in Open and Distance Learning	25
Turkish Online Journal of Distance Education	16
Distance Education	13
Computers and Education	12
International Journal of Information and Communication Technology Education	7
Journal of Computing in Higher Education	7
British Journal of Educational Technology	6
International Journal of Distance Education Technologies	6
Journal of Geography in Higher Education	6
Other	60
Total	193

Table 7 – Most frequent keywords (authors' construction based on Bibliometrix).

Words	Occurrences
Higher education	135
Distance education	98
Students	80
Education	51
Teaching	47
E-Learning	46
Online systems	25
Learning systems	24
Internet	23

At a geographical level, many countries promote and collaborate in the dissemination of articles on DE to the scientific community. It is true that some countries (some more than others) have been pressured by the population itself, because, for the most part, they are in favor of more and better conditions and alternatives in the learning process. According to Estelami and Rezvani (2011), the access to educational content at any time from any location allows students to deal with time and geographic constraints that, in other circumstances, would prevent them from attending traditional face-to-face classes.

As already mentioned in the literature review (section 3), every continent has at least one country that stands out or has stood out regarding the evolution of the DE modality and, consequently, has collaborated in the dissemination of scientific production. Taking the 400 publications focused on, that trend can be confirmed (Figure 3), highlighting the American continent, to which most scientific productivity corresponds, and, in contrast, the African continent, which has less scientific productivity. Moreover, almost all countries mentioned in the literature review (section 3) present a considerable level of scientific productivity, considering the number of documents produced, namely the following: USA, Australia, Turkey, South Africa and India.

The results suggest, therefore, certain connections to aspects such as the level of development of the countries, their size, and the increase in scientific production in the countries. For example, both the USA and Australia are highly developed countries, which enables easy access to technology. Regarding countries such as South Africa and India, the results may indicate that although they are still at a lower level of development, they are large countries where technology facilitates access to education. Both situations may influence their annual scientific production.

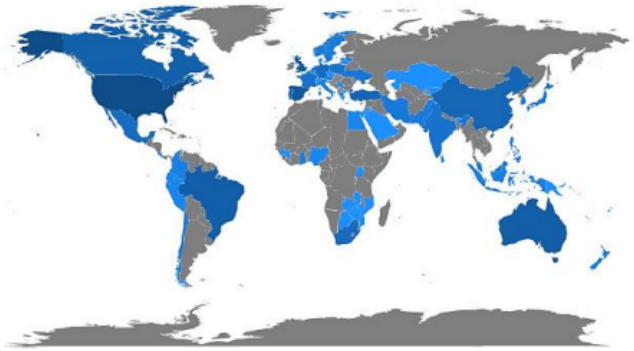

Figure 3 - Scientific production in the countries (source Bibliometrix 2021).

4.2 More in-depth results – DE on management courses

It is important to mention that the previous section of the bibliometric analysis is extensive to distance courses in higher education, in various areas of knowledge (see Figure 1). From this stage on, and with reference to the same 400 articles, a brief analysis will be made, where terms associated with management are already more evident and susceptible to interpretation.

Considering the most used and relevant keywords cited by the authors, the mapping presented in Figure 4 can be produced. Note that these keywords, unlike the

generic ones (Table 7), seek to specify the topic of DE for the management area.

Upon observing Figure 4 above, the size of the keywords "higher education" and "DE" is much larger than the others, since they are cited more frequently, and the importance of the others depends on the specific context in which they are used. On the other hand, regarding the distance of the different lines presented, it is widely accepted that, in a pandemic context, the keyword "innovation", for example, is closer to "higher education" than the latter is to "quality", because the quality practiced in HEIs is only truly established after a set of prevented attitudes, namely those that derive from the capacity of reinvention and innovation and, therefore, the literature on "innovation" is quite strongly linked to the literature on "higher education" in this study.

Figure 4 above also reveals the keyword "management" linked to the generic words "DE" and "higher education". A considerable part of the remaining words that are scattered in Figure 4 above are mentioned in the literature review (section 3).

Unlike Figure 4, where it was possible to obtain the most relevant words from the authors in a dispersed way, Dendrograms have the advantage of forming interconnections and, in this way, the themes are easily grouped and organized, as can be seen in Figure 5.

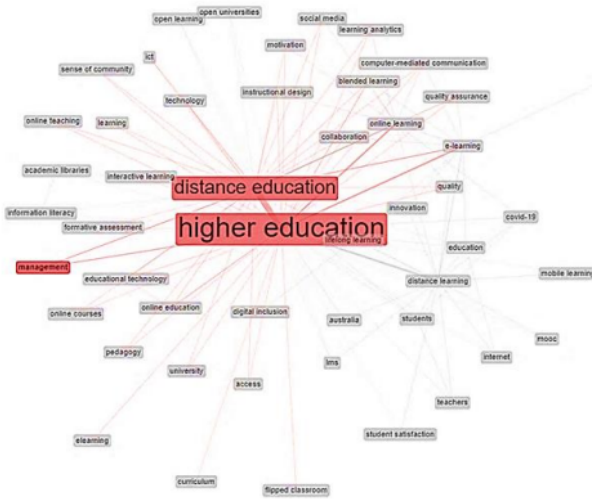

Figure 4 - Authors' most relevant keywords (source Bibliometrix 2021).

However, Andrews (2003) points out that the aim is not to find perfect interconnections between clusters, but rather to find an ideal number of clusters to facilitate future research. It should be noted that in Figure 5, the words "innovation" and "online teaching" appear on the same "branch" as "quality assurance" and "students", or if you like, "motivation" and "collaboration", which form another "branch" and culminate in "student satisfaction".

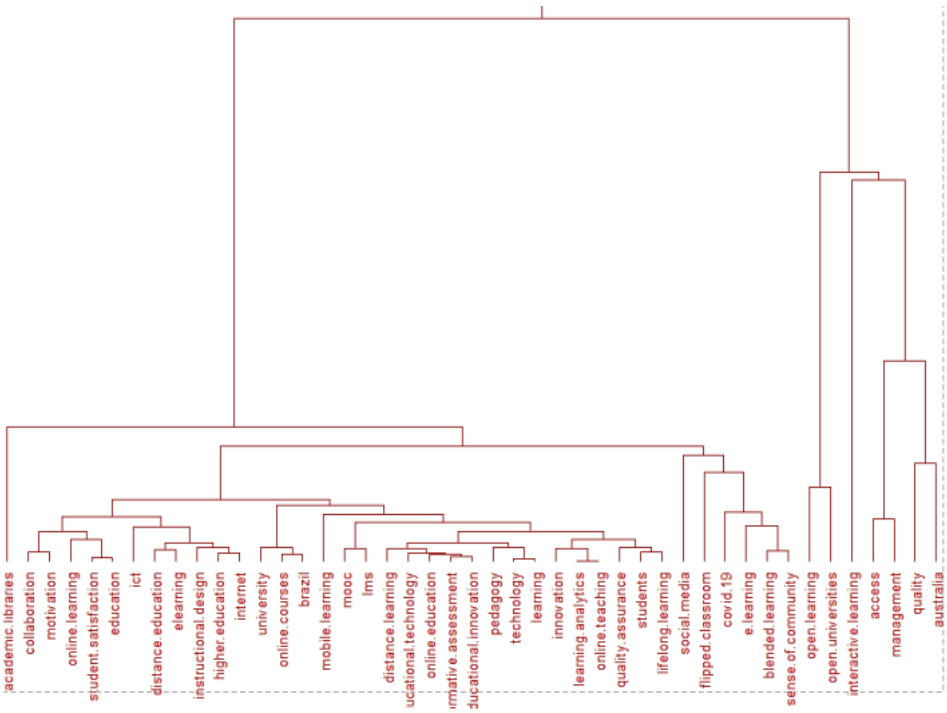

Figure 5 - Dendrogram (source Bibliometrix 2021).

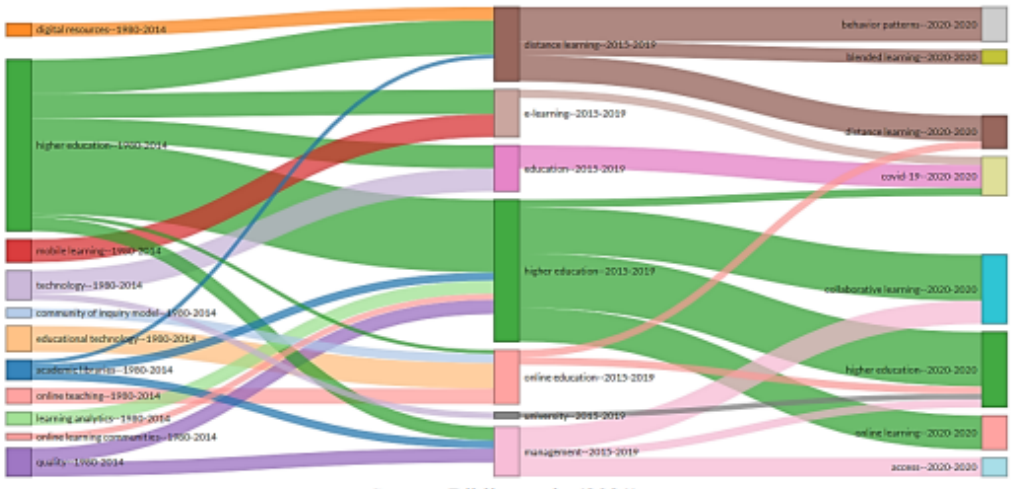

Figure 6 - Thematic evolution (source Bibliometrix 2021).

Finally, within the scope of the keywords, they can also be reorganized according to a thematic evolution in years (time slices) and in number of words, as illustrated in Figure 6.

Observation of Figure 6 above enables some conclusions to be inferred:

- The term "higher education", in darker green, runs through the entire length of the graph and is therefore considered a constant.
- The term "digital resources", in orange, has evolved over the years and is linked to the term "distance learning", in brown, which is also associated with the term "higher education", thus suggesting new possibilities, namely the application of new methodologies, such as "blended learning".
- The term "management", in light pink, is linked, among others, to the terms "higher education" and "collaborative learning", which expresses the interaction in the (active) learning of students, either in more theoretical curricular units or in more practical ones.
- The term "management" is also linked to the expression "open access", which may suggest a tendency to make information and materials from this rich and broad area of study available in open resources with universal access.

5. New avenues and concluding remarks

Resistance and prejudice towards the DE modality could, in an unexpected and sudden context such as the Covid-19 pandemic, have hindered better teacher performance. However, even in the absence of an established protocol and the existence of certain drawbacks (such as sharing a device or space to attend virtual classes), HEIs were generally able to maintain the level of motivation on the part of students (Castro, Moreira, & Carvalho, 2021). It follows that the fact that students prefer face-to-face interaction does not determine that online contact is a weakness in higher education, but rather a challenge, as suggested by the transactional distance theory formulated by Moore and Kearsley (2005), which emphasizes that distance is mainly a pedagogical phenomenon. It is certain that there has been mutual learning between the parties to enable new practices that imply digitalization, such as, for example, the integration of social networks, and, therefore, the aforementioned challenge is already beginning to be relativized by some students.

This study contributes to a better understanding of the evolution of DE in general and, particularly in the context of management courses. With the results obtained from the bibliometric analysis, it should be noted that:

- The main generic themes explicitly referenced are higher education, DE and students. In the set of topics that have gained importance in recent decades with the integration of DE in HEIs, the issues related to innovation, quality assurance, motivation, collaboration, and student satisfaction stand out. These topics seem not to appear at random and may contribute to a better understanding of how studies on this subject in higher education work and evolve. The issues of pedagogical innovation, new ways of collaborating and improving student satisfaction seem to be crucial, and, along with this, an old topic that is always brought up when DE is talked about, the quality of this teaching that requires evaluation and the creation and maintenance of standards that make it reliable, remains in vogue.
- It is possible to see that the social sciences, computer science, and business, management and accounting are the areas most studied by the authors (see Figure 1), which are also very closely related to the management area.

Regarding management and related areas, it is not surprising that the computer science area appears in this context; it seems more like a current trend to study more general themes in management and especially in accounting due to the characteristics of the respective curricula.

- From the set of journals included, the one that appears as the most relevant is called Internet and Higher Education. The journal is interdisciplinary; however, it has a strong connection with IT (subarea of management). Nowadays, the use of the Internet as an instructional tool in higher education is crucial. Due to the pandemic, the emergence of online instruction has created new challenges for teachers and students to work together, solving problems common to both parties.
- The volume of publications has not been constant over time, with the largest number of publications in the most recent period, which can be justified by the occurrence of the pandemic and the increased use of this type of teaching that increases the interest of researchers.
- There is a strong geographical asymmetry of the authors of the publications, particularly from Australia and three Anglo-Saxon countries, namely USA, Canada, and the UK, which contrasts with a very significant part of African countries and some Asian and South American countries. Aspects related to the maturity of education systems and access to technology may justify the trend in the three leading countries in the Northern Hemisphere and Oceania. The size of the countries and cost of DE (substantially lower than face-to-face) may also justify its prevalence being detected through studies in South American (Brazil), Asian (India) or African (South Africa) countries.

It is worth highlighting some results from this analysis, namely regarding words that have gained a new prominence in the HEIs' practices and, furthermore, the temporal and circumstantial contextualization of this most recent period, which was characterized by a rapid transition to digitalization models in several sectors where teaching is included.

The pandemic has intensified new forms and terms of adaptation within the scope of the DE that HEIs were familiar with; that is, there has been a clear revolution with respect to technology, assessment systems, and teaching strategies in terms of this teaching–learning model. It was found that innovation is gaining more and more space in HEIs and can be seen as an ally regarding the learning of the parties involved in the process, in the sense of enabling new practices that imply digitalization. Li et al (2023) share this view, saying that different teaching formats enable teachers to create enriching experiences, especially group work. The bibliometric analysis reinforces the importance of motivation and collaboration, not only in this transition which has been deeply marked by the pandemic, but in all circumstances that aim to keep students satisfied and confident.

Finally, the greater temporal prominence already shown by the bibliometric analysis to the year 2020 may evidence that several authors have readapted and updated some of their works due to this disruptive year. One can certainly expect these to be studies coming from countries such as Australia or English-speaking countries such as the USA.

5.1 Limitations and possible future research

This study has some limitations. Regarding bibliometrics, since the databases have different profiles, the researcher must find the one that gathers more authors and relevant journals available for the topic under study. For a first exploratory study, one considered Scopus as the most appropriate database. In addition, there are articles published by more reputable authors that may be unavailable. It is also advisable to check that the article does not discretely "sidestep" the topic (false positives). Furthermore, the main limitation of this study can be seen as a potential contribution to the scientific community, because the perceived difficulty in finding scientific articles that address the subject of management and its courses can be seen as a stimulus for greater scientific production in this area.

It would be interesting, as future research, to develop a complementary study to the one carried out, targeting teachers, since they represent a central and even structural part of higher education. It would be interesting to understand what has changed, and if anything has changed, in their thinking and perception after the digital experience caused by the pandemic, as well as to analyze the evolution of these studies and trends in the post-pandemic period.

References

Abrami, P. C., Bernard, R. M., Bures, E. M., Borokhovski, E., & Tamim, R. M. (2011). Interaction in distance education and online learning: Using evidence and theory to improve practice. Journal of Computing in Higher Education, 23(2–3), 82–103. https://doi.org/10.1007/s12528-011-9043-x

Abudaqa, A., Hilmi, M. F., AlMujaini , H., Alzahmi, R. A., & Ahmed, G. (2021). Students' perception of e-Learning during the Covid Pandemic: a fresh evidence from United Arab Emirates (UAE). Journal of E-Learning and Knowledge Society, 17(3), 110-118.

Andrews, J. E. (2003). An author co-citation analysis of medical informatics. Journal of the Medical Library

Association, 91(1), 47–56.

Anohina, A. (2005). Analysis of the terminology used in the field of virtual learning. Educational Technology and Society, 8(3), 91–102.

Araújo, C. (2006). Bibliometria: evolução histórica e questões atuais. https://seer.ufrgs.br/EmQuestao/article/view/16/5

Arbaugh, J. B., Desai, A., Rau, B., & Sridhar, B. S. (2010). A review of research on online and blended learning in the management disciplines: 1994-2009. Organizational Management Journal, 7(1), 39–55. https://doi:10.1057/omj.2010.5

Arbaugh, J. B., Godfrey, M. R., Johnson, M., Pollack, B. L., Niendorf, B., & Wresch, W. (2009). Research in online and blended learning in the business disciplines: Key findings and possible future directions. Internet and Higher Education, 12(2), 71–87. https://doi.org/10.1016/j.iheduc.2009.06.006

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., Wallet, P. A., Fiset, M., & Huang, B. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. Review of Educational Research, 74(3), 379–439. https://doi.org/10.3102/00346543074003379

Biju, S., More, B., Armathlingam, S., V P S Veluri , M., & Nurakmar Sh Ismail, S. (2022). Modelling academic delivery challenges during COVID-19: a binary logistic approach. Journal of E-Learning and Knowledge Society, 18(1), 11-22.

Bonk, C. J. (2020). Pandemic ponderings, 30 years to today: synchronous signals, saviors, or survivors?, Distance Education, 41(4), 589–599. https://doi.org/10.1080/01587919.2020.1821610

Castro, C., Moreira, S., & Carvalho, L. (2021). Perceção dos estudantes de gestão sobre o Ensino a Distância no Ensino Superior: Um estudo exploratório em contexto pandémico. paper presented at the 7.º Congresso Nacional de Práticas Pedagógicas no Ensino Superior, July, Aveiro, Portugal.

Chen, Y., Wang, Y., & Chen, N. (2014). Computers & Education Is FLIP enough ? Or should we usethe FLIPPED model instead ? Computers & Education, 79, 16–27. https://doi.org/10.1016/j.compedu.2014.07.004 Costa, T., Lopes, S., Fernández-Limós, F., Amante, M. J., & Lopes, P. F. (2012). A Bibliometria e a Avaliação da Produção Científica: indicadores e ferramentas. paper presented at the 11º Congresso Nacional de Bibliotecários, Arquivistas e Documentalistas, 18 Oct, Lisbon, Portugal.

Estelami, H., & Rezvani, Z. (2011). Structural and perceptual determinants of the price of online business education. Journal of Product & Brand Management, 20(2), 158–165. https://doi.org/10.1108/10610421111121152

Evans, J., & Haase, I. (2001). Online business education in the twenty-first century: an analysis of potential target markets, Internet Research, 11(3), 246–260. https://doi.org/10.1108/10662240110396432

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. Internet and Higher Education, 7(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001

Garrison, D.R. (2017). E-learning in the 21st Century: A Community of Inquiry Framework for Research and Practice. 3rd ed., Routledge, London, LND.

Holmberg, B. (1997). Distance-education theory again. Open Learning, 12(1), 31–39. https://doi.org/10.1080/0268051970120105

Huang, C. K., & Lin, C. Y. (2017). Flipping business education: Transformative use of team-based learning in human resource management classrooms. Journal of Educational Technology & Society, 20(1), 323–336.

Husin, N. A., Abdul Razak, N., Khairi, M. S. H., & Mohamad Nazeri, N. S. (2022). Full enforcement of e-Learning during first movement control operation of COVID-19 pandemic: are Malaysian university students ready?. Journal of E-Learning and Knowledge Society, 18(1), 87-93.

Idwan, S., Fayyoumi, E., Hijazi, H., & Matar, I. (2021). COVID-19 Pandemic Endorses New Era of e-learning. Case Study: Hashemite University. Journal of E-Learning and Knowledge Society, 17(2), 56-65.

Keegan, D. J. (1980). On defining distance education. Distance Education, 1(1), 13–36. https://doi.org/10.1080/0158791800010102

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. Journal of Economic Education, 31(1), 30–43. https://doi.org/10.1080/00220480009596759

Li K. C., Wong, B. T. M., & Chan, H. T. (2023). Teaching and learning innovations for distance learning in the digital era: a literature review. Frontiers in Education, 8,

https://doi.org/10.3389/feduc.2023.1198034

Lopes, A. P., & Soares, F. (2018). Perception and performance in a flipped Financial Mathematics classroom. International Journal of Management Education, 16(1), 105–113. https://doi.org/10.1016/j.ijme.2018.01.001

López-Pérez, M. V., Pérez-López, M. C., & Rodríguez-Ariza, L. (2011). Blended learning in higher education: Students' perceptions and their relation to outcomes. Computers and Education, 56(3), 818–826. https://doi.org/10.1016/j.compedu.2010.10.023

Lotka, A.J. (1926).The Frequency Distribution of Scientific Productivity. Journal of the Washington Academy of Sciences, 16(12), 317–323.

Machado Jr., C., de Souza, M. T. S., Parisotto, I. R. dos S., & Palmisano, A. (2016). The laws of bibliometrics in different scientific databases/As leis da bibliometria em diferentes bases de dados científicos. Revista de Ciências da Administração, 18(44), 111–123. http://dx.doi.org/10.5007/2175-8077.2016v18n44p111

Moore, M. (1990). Recent contributions to the theory of distance education. Open Learning: The Journal of Open, Distance and e-Learning, 5(3), 10–15. https://doi.org/10.1080/0268051900050303

Moore, M. G., & Kearsley, G. (2005). Distance education: A systems view. 2nd ed., Thomson Wadsworth, Belmont.

Mukul, E., & Büyüközkan, G. (2023). Digital transformation in education: A systematic review of education 4.0. Technological Forecasting and Social Change, 194, https://doi.org/10.1016/j.techfore.2023.122664

Noori, A. (2021). Educational managers and higher education leaders should adapt and change policies in emergency cases and consider all aspects of teaching and learning in higher education. Heliyon, 7(10). https://doi.org/10.1016/j.heliyon.2021.e08113

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. Internet and Higher Education, 25, 85–95. https://doi.org/10.1016/j.iheduc.2015.02.002

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi, S. (2018). Online Education: Worldwide Status, Challenges, Trends, and Implications. Journal of Global Information Technology Management, 21(4), 233–241. https://doi.org/10.1080/1097198X.2018.1542262

Rovai, A. P., & Jordan, H. M. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. International Review of Research in Open and Distance Learning, 5(2), 1–13. https://doi.org/10.19173/irrodl.v5i2.192

Rueda, L., Benitez, J., & Braojos, J. (2017). From traditional education technologies to student satisfaction in Management education: A theory of the role of social media applications. Information and Management, 54(8), 1059–1071. https://doi.org/10.1016/j.im.2017.06.002

Simonson, M., Schlosser, C., & Orellana, A. (2011). Distance education research: A review of the literature. Journal of Computing in Higher Education, 23(2/3), 124–142. https://doi.org/10.1007/s12528-011-9045-8

Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers and Education, 50(4), 1183–1202. https://doi.org/10.1016/j.compedu.2006.11.007

Ulla, M. B., & Perales, W. F. (2021). Facebook as an integrated online learning support application during the COVID19 pandemic: Thai university students' experiences and perspectives. Heliyon, 7(11). https://doi.org/10.1016/j.heliyon.2021.e08317

Vlachopoulos, D., & Makri, A. (2019). Online communication and interaction in distance higher education: A framework study of good practice. International Review of Education, 65(4), 605–632. https://doi:10.100711159-019-09792-3

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