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The Shift to Online Classes During the Covid-19 Pandemic: Benefits, Challenges, and Required Improvements from the Students' Perspective

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Abstract: The Covid-19 pandemic has radically changed and disrupted education; colleges and universities have closed their campuses, and many have shifted to online courses. In the pre-pandemic era, online classes were associated with several benefits and challenges, and the pandemic might have brought additional benefits and obstacles. This research examined students' perceptions of online classes during the pandemic. The study looked at four aspects: perceived benefits of online classes; perceived challenges; beliefs and an overall evaluation; and potential improvements. An online questionnaire was administered to some first- and second-year undergraduate students at a College in China. It combined a set of 23 closed-ended and open-ended questions and 342 valid and complete responses were collected. Perceived benefits included creating a digital learning community, improving students' digital learning skills, and staying connected during tough times. Challenges comprised adaptability issues due to the sudden shift to online classes, time-management issues, being distracted by social media plus technological obstacles. Regarding beliefs, students believed that a blended model that combines both classroom and online modes is necessary for the post-pandemic era. To enhance the sustainability of online classes in the post-pandemic era, a set of improvements are explored and suggested.

Keywords: Online classes; shift; education during pandemic; Covid-19 impact on students; sustainability of online learning; students' perceptions, blended-learning

1. Introduction

1.1 Overview

The Covid-19 pandemic has dramatically changed – and disrupted – education as we know it; academic institutions have been shut all over the world. In an attempt to curb the spread of the virus, governments have temporarily closed schools, colleges and university campuses, affecting more than 60% of the student population globally (UNESCO, 2020). In the wake of the pandemic, universities around the world have adopted a wide range of tactics like switching some courses online, delaying the starting dates of some programs, extending intake application deadlines, and deferring some unconditional offers of 2020 to the following years (QS, 2020).

The disruption caused by Covid-19 has pushed academic institutions to focus their efforts on facilitating a swift, rapid, and unexpected transition to online education and assessment (Jack and Smyth, 2020). The result of these efforts is a substantive rise in e-learning, whereby teaching and learning activities are taking place remotely via digital platforms. In an ongoing survey conducted by QS Top Universities Ranking, almost half of the participating universities stated that they have switched some of their scheduled courses online, and the trend is expected only to grow (QS, 2020).

On the 4th of February 2020, the Ministry of Education of China decided to implement a full transition to online teaching and learning (MinistryofEducation, 2020). The decision urged universities to develop online courses with reformed content and innovative teaching methods within a relatively short period (Xinhua, 2020). By the first week of May 2020 and at an unprecedented scale, 1454 Chinese colleges and universities participated in the preparation of almost 1.1 million online courses that were delivered through 12.26 million classes. Around 1.03 million teachers and more than 17.75 million students participated in these courses (MinistryofEducation, 2020). Both theoretical and experimental disciplines were addressed in the courses including a wide range of subjects like engineering, arts, education, philosophy, medicine, law, agriculture, and literature (MinistryofEducation, 2020).

Many universities have already conducted a smooth and successful transition to online education. For instance, Zhejiang University has utilised the DingTalk ZJU platform and has managed to convert more than 5000 undergraduate and postgraduate programs into online courses within two weeks. The DingTalk ZJU – which is a

live streaming app – documented a total audience of around 300,000 (Zhaohui, 2020). A similar transition was adopted in the universities of Greece (Giannoulas et al., 2021), West Sumatera (Fauzi et al., 2021), Australia (Lin and Nguyen, 2021), Poland (Migocka-Patrzałek et al., 2021), and other countries, where classroom lectures and activities were replaced by the online mode.

Some experts point out that the sudden and unexpected shift to online learning with insufficient training, inadequate bandwidth, and humble preparation has resulted in poor student experiences that cannot be sustainable (Lederman, 2020a; Lederman, 2020b). Others believe the shift has created a “new normal” that has brought priceless experience and achievements. These include ensuring continuity of the educational process by bridging the gap of not attending school, strengthening the learner-lecturer interactions via online one-to-one communication, and boosting students’ confidence as they were able to express themselves in a new learning environment (Lin and Nguyen, 2021; Zhaohui, 2020; Worth, 2020). The new online learning experience has changed the state of teaching and learning from “mono” and “teacher-centred” to “interactive” and “student-centred” and is necessary to create a hybrid model where the information technology and online activities will be an integral component of the education process.

1.2 Aims and objectives

Many previous studies in the literature have explored students’ perceptions regarding the benefits and challenges brought by online classes. However, these studies looked at regular settings before 2020 – before the Covid-19 pandemic – where the classroom model dominated other models and approaches. In 2020, the Covid-19 pandemic forced a new reality where online classes became the norm, the dominant and maybe the only available teaching and learning mode. On the 26th of February 2020, online courses replaced the traditional classroom teaching and learning settings in most Chinese universities. **This study aims to examine students’ experiences and perceptions of online classes during the Covid-19 pandemic.** Objectives are; to explore benefits brought by online classes from students’ perspective; to examine associated challenges and how they compare to challenges of regular classroom settings; to look at students’ beliefs and attitudes about online classes especially when compared with classroom classes; and finally, to propose a set of improvements and suggestions.

The future of education is subject to other pandemics and emergencies. This study is important as its findings may be used to boost the preparedness for these potential future emergencies, pandemics, and uncertainties. The post-pandemic era will witness a new reality where a blended model that combines both classroom and online models might be adopted. An online model that brings challenges and obstacles without appropriate solutions might not be sustainable in the long term. So, the findings of the study may be used to improve the online model of the post-pandemic era and to enhance its sustainability.

The present study aims to answer the following research questions:

1. What benefits did online classes bring to students during the lockdown period?
2. What challenges did students encounter with the online experience?
3. What are students’ beliefs, attitudes, and overall evaluation of online classes especially when compared with face-to-face classes?
4. What improvements are required, needed to enhance the online classes experience?

2. Literature review

2.1 Benefits

When compared to the classroom mode, online classes feature extensive flexibility that is essential during the pandemic (Lin and Hsieh, 2001). Students have more control over learning materials; they may choose the appropriate access time, sequence, pace, and amount of information and may follow a more individualised approach. Storing audio, video, electronic notes, slides, and guidelines on online platforms that can be accessed at any time – and anywhere – enhances the online settings’ flexibility. Having more control over the learning process is linked to better academic performance (Hung et al., 2010; Wang and Beasley, 2002). Online classes and relevant tools are easily accessible via a wide range of technologies that can be effortlessly operated and adopted by both students and teachers (Fauzi et al., 2021). Another benefit is that online classes feature a greater outreach and ensure better access to education particularly for students with disabilities and those with medical conditions, like being infected with Covid-19 and other diseases (Migocka-Patrzałek et al., 2021).

During the Covid-19 pandemic, many students felt isolated and disconnected. Online classes create a sense of community where students can embrace discomfort and share worries with their peers and teachers. Online classes have constituted a shelter from negative news, pressures, and worries linked to the pandemic (Lederman, 2020a). A strong sense of belonging to the knowledge community is essential for effective knowledge building (Goodyear and Zenios, 2007). Online classes during the pandemic may offer a fun and relaxing experience while improving the mental and psychological welling of students (Lederman, 2020a; Lederman, 2020b). Also, Lin and Nguyen (2021) explain how the new online learning environment boosted learner-lecturer interactions by sending emails regularly. Writing regular emails helped some students to maintain a level of motivation especially when tutors send positive replies.

Some teachers and instructors point out that chat groups, video conferencing, voting tools, and document sharing spaces make it more effective and efficient for them to reach out to students. They emphasize that they will continue to adopt the online model in the post-pandemic era. Lin and Nguyen (2021) point out that students were required to engage in online forums and discussions and were asked to express themselves in a relatively unfamiliar space. These expectations and tasks pushed students to allocate more hours of online time to enhance their English writing and speaking skills, which were comparatively improved. Finally, Giannoulas et al. (2021) refer to the positive impact of online classes on improving students' information and communications technology use (ICT), while İlin (2019) discusses that online classes can enhance students' preparedness for future careers.

2.2 Challenges and obstacles

The digital pedagogy and readiness of students to enroll in online classes constitute a major challenge. While some students may have the required skills and knowledge about using technological devices, software, and the internet, others may be less techno-savvy (Hung et al., 2010; Tsai and Tsai, 2003). In online courses, students with higher computer, internet, and online communication self-efficacy perform better than those with humble digital skills. The same criteria also apply to teachers, faculty and staff (Tsai and Tsai, 2003). Familiarity with hardware and software associated with online learning might hinder not only students' comprehension but also their satisfaction (Kumar, 2015). Students' – and teachers' – digital skills can indeed be improved, however, the sudden shift to the online setting during the pandemic left a relatively narrow window for such improvements and training.

The Covid-19 pandemic has significantly widened the digital divide; many students cannot equally engage in the online learning process simply because they do not have home-based access to adequate technological devices and/or stable internet connections. The digital gap exists in both developed and developing countries; however, it is more prominent in the latter (UnitedNations, 2020). Students from poor and less-affluent families are left behind because of the substantial costs of digital devices and data plans (Tam and Elazar, 2020).

Another technology-related aspect is that the intensified use of digital technologies might raise security concerns. During the Covid-19 pandemic, phishing scams and online fraud cases have significantly increased, and many academic institutions suffered from online attacks (UnitedNations, 2020). Also, the shift to online learning could significantly increase screen time, especially when most of the students already spend long periods in front of their mobile and/or laptop screens in non-education related activities. These include gaming, socialising, online shopping, and reading news (ITU-News, 2020). Looking at and sitting in front of screens for extended periods is associated with several health issues such as computer vision syndrome, sleep disorders, chronic neck, back, shoulder, and muscle pain (Pandika, 2016).

Students' nature of participation and engagement in online classes constitute a significant challenge that is governed by many factors. While some students actively engage in discussions and arguments, others prefer to only listen and observe (Vonderwell and Zachariah, 2005). In their study on 96 undergraduate students, Wise et al. (2013) found that students spend around 75% of their time listening and observing. The size of the online class is also linked to the extent to which students are willing to participate; small- and medium-sized classes feature more participation than large-sized classes (Parks-Stamm, Zafonte and Palenque, 2017).

Adaptability constitutes another major challenge. Shifting from face-to-face to an online environment requires time to allow students to adapt and get accustomed to the new setting. Again, the unexpected shift to online mode may not offer sufficient time for such adaptability, especially for students with traditional mindsets who typically resist sudden changes (Kebritchi, Lipschuetz and Santiago, 2017; Kumar, 2015).

During the lockdown, many students left their dorms and went back to their family homes, where family members are squeezed into a few rooms. Due to space limitations and competition with other members in their households, students might not have a private or quiet study space (Reidy, 2020). Moreover, students might be distracted with family-related activities and responsibilities, such as taking care of a sick family member or helping in household tasks. Also, while some parents might be supportive and helpful, others could negatively impact students' ability to learn (Zaremba, 2019).

Traditionally, classroom lectures can last for around three hours, where students constantly have face-to-face interactions with their teachers. However, in prolonged online classes, students might feel bored or even distracted (Gewin, 2020). Digital distraction during online classes is common among students as they spend years of their lives building the idea that mobile phones and laptop screens' main function is to passively consume rapidly changing media content (Worth, 2020). What complicated the issue is that during the Covid-19 pandemic negative – and sometimes fake – pandemic-related news, statistics, conspiracy theories, maps, charts, and information were circulating via digital platforms (Carmichael and Spring, 2020; Easton, 2020). These constituted additional distractions that might impose mental pressure on students and hence affect their ability to stay focused. To learn effectively via digital tools, students must spend persistent cognitive efforts battling temptations and digital distractions (Worth, 2020).

Because of the sudden shift to online evaluation and assessment, students are facing a degree of disruption accompanied by worries and concerns about their future. Performing a valid, fair, and secure assessment may be difficult (Kaup et al., 2020), and lab, practical and performance tests cannot be conducted online (Sahu, 2020).

The mental and psychological well-being of students during the pandemic might be negatively affected. The lack of physical support from teachers, peers, and in-campus student services plus new pedagogy techniques, worries, fears, isolation, depressions, and anxieties linked to the Covid-19 may hinder the ability of students to perform to their full potential (Kaup et al., 2020).

The expectations and thoughts of students can also be challenging. Some students may expect instant feedbacks on their assignments or may request a swift response to their emails. They may debate their grades and request further detailed feedbacks. Others may not take the online course or assignment deadlines seriously (Luyt, 2013; Lyons, 2004).

2.3 Conducting online courses

There are different methods through which online courses are conducted in universities. Some courses offer a set of pre-recorded video and audio lectures, slides and relevant materials, whereas others require students to attend live lectures via apps and software like Zoom and Microsoft Teams (Migocka-Patrzałek et al., 2021; Lin and Nguyen, 2021; Giannoulas et al., 2021). In China, live-streaming apps like DingTalk, Tencent Meetings, and Tencent QQ are commonly used, especially during the Covid-19 pandemic. DingTalk was originally developed as an internal communication platform for commercial use in an office setting. During the pandemic, the platform became popular in the educational field and was recommended to students and teachers by the IT departments of different universities.

In the Hunan Railway Professional Technology College, and since the earliest months of the pandemic outbreak, students were grouped into different online classes via DingTalk and got invitations to use the app. DingTalk was mostly used for conducting live lectures, and students' attendance was compulsory. Besides live streaming, the app offered several features. For instance, the 'Save Playback' allows lectures to be recorded, whereas the 'Support Go Live' allows participants to interact using the microphone, and through the 'Thumb-up' feature students can raise their hands and give likes. Recordings of lectures, slides, tasks, materials and online copies of textbooks were uploaded to an online cloud platform, to which students have access and through which they submitted their assignments and homework. These were necessary especially when students could not have access to paper copies of textbooks as these were only available at the campus.

3. Methods

3.1 Context and participants

To explore students' perceptions, the study used an online questionnaire. In May 2020, the questionnaire was administrated to 342 undergraduate students of the Business English and Ecommerce majors at the Economics

and Trading department of the Hunan Railway Professional Technology College in China. This group of students were selected because online learning activities constitute an essential part of their studies, and they are expected to engage in professional online tasks in their future career. Online classes started from the 26th of February 2020, each class lasted for two teaching hours, where each teaching hour equals 45 minutes. Online classes were conducted using the DingTalk platform, and students were allowed to interact with their teachers – and to some extent with their peers. Teachers embedded some student-engaging activities where students participated in dialogues and expressed their opinions at the end of each lecture. Outside lectures, students were also allowed to communicate with their teachers via emails and other chatting platforms offered via DingTalk. All classes were recorded and stored to allow students to access them asynchronously. Similarly, all slides, videos, notes, reading, and other learning-related materials were stored. The size of online classes ranged from 32 to 110 students, who had an average of 25 hours of live-streaming lectures per week.

3.2 Data collection

The questionnaire was developed via the WJX.CN platform using its ‘Star Survey’ tool. The platform is renowned in China and is used by different academic, financial, and research institutions including the universities of Peking, Tsinghua, and Shanghai Jiao Tong. A survey link was created and then distributed to students via the online study group. The data collection process lasted for one month, from the 26th of May to the 25th of June 2020. Since online courses started on the 26th of February 2020, students had experienced online classes for at least three months before participating in the study. The survey was available in Mandarin; China’s official language. To test its legibility, readability, and comprehension, the survey was tested with a small group of 16 students and 3 teachers. Participants’ feedback was used to revise and upgrade the survey before full implementation.

The survey began with a participant information sheet, explaining the nature of the survey and its purpose. Seeking transparent, meaningful, and realistic answers, participation in the survey was anonymous, and students were not asked to provide any contact details like names, emails, addresses, or contact numbers. All students were expected to respond to the survey. Also, they were asked not to speed through questions and to think carefully before providing each answer.

The questionnaire comprised a combination of 23 closed-ended and open-ended questions that were classified into four inquiries. The first inquiry explored benefits perceived by students from online classes during the pandemic, while the second inquiry examined the perceived challenges and obstacles. Two lists of benefits and challenges were presented and from which students were able to select. Students were able to select all applicable options. The third inquiry looked at students’ beliefs, views, satisfaction, and overall evaluation of online classes, especially when compared with classroom ones. The final inquiry presented a set of potential improvements that could be applied to online classes and the online teaching and learning model in the future and explored the extent to which students agreed or disagreed with them.

The design of the survey and selecting its elements was based on existing and validated knowledge in the field. Insights were collected from online learning-related literature like Kebritchi, Lipschuetz and Santiago, (2017), Song et al. (2004), Rost (2019), İlin (2019) and the Covid-19 related challenges as discussed by Lederman (2020a), Lederman (2020b), Sahu (2020), Gewin (2020), and others. Equally, the survey was influenced by the Information and Communication Technology (ICT) Familiarity and Wellbeing questionnaires of the Organisation for Economic Cooperation and Development (OECD) and the Digital Experience Survey of Higher Education Students in the UK, see OECD (2018b), OECD (2018a), OECD (2018c), and Langer-Crame et al. (2019) respectively.

Open-ended questions were included to obtain more in-depth information regarding students’ perceptions of online classes during the pandemic. Answers to these questions enriched findings and added additional items that were not originally presented by the researcher. In other words, the open-ended questions documented additional benefits, challenges, and improvements of which the researcher was not aware.

In total, 342 complete and valid responses were collected. The literature suggests that the quality of collected data declines when surveys take longer than 20 minutes to answer, and the optimum threshold is 15 to 20 minutes (Versta, 2011). The questionnaire’s average response time was 16 minutes.

3.3 Data analysis

The quantitative data collected through the online survey were analysed and presented using Microsoft Excel and the analytics tool offered by the WJX.CN platform. A content analysis approach was adopted to process responses to open-ended questions of the questionnaire. Content analysis is defined as a research method that systematically and objectively offers valid inferences from verbal, visual, or written data (Bengtsson, 2016). It reduces the volume of text gathered, distinguishes, and classifies categories together and attempts to find some understanding of responses to open-ended questions (Richards and Morse, 2019; Silverman, 2019). Most importantly, to achieve trustworthiness, the researcher should, where possible stay 'true' and 'close' to the text without changing its original meaning (Bengtsson, 2016). Also, to achieve reliability, the authority of the researcher should be precluded (Berelson, 1952). Elo et al. (2014) suggest that ensuring the credibility of the content analysis process comprises the selection of a meaningful and suitable unit of analysis, and a unit can be a word, a letter, or a sentence. The unit of analysis should not be too broad as it will then be difficult to manage, also it should not be too narrow as this may result in fragmentation. Rather, a unit of analysis should be sufficiently large to be considered as a whole but small enough to be meaningful. In line with the previous definition and guidelines, the author selected a set of units of analysis for each open-ended question and then counted the number of responses mentioning each unit. Units like 'quitter and calmer environment', 'poor class management', and 'stressful and confused' were selected and tracked in students' responses. The content analysis process allowed responses to open-ended questions to be filtered, summarised, classified and represented in tables with neither changing their content nor personal intervention from the researcher. It is worth mentioning that the content analysis approach adopted in this study does not follow the strictest methodology, still, it constitutes a valid one following the broader notion and definition of content analysis as discussed in Bengtsson (2016).

4. Results

4.1 Perceived benefits

The first inquiry examined the benefits and advantages of online classes as perceived by students. Table 1 presents these benefits and sorts them by the most selected ones. The most significant benefit from students' perspective was creating a digital community where questions can be posted, followed by enhancing students' familiarity with digital learning technologies, with almost 92% and 90% respectively. Creating a sense of community, belonging, connecting, and embracing discomfort with others plus feeling supported during tough times were also significant benefits perceived by at least 70% of students. Moreover, at least half of the students stated that online classes offered shelter from daily negative news, made them less fragile, and boosted their preparedness for similar future emergencies and uncertainties. Thirty nine percent of students agreed that practising during online classes made them feel more confident and prepared for their future careers, whereas around 29% disagreed on perceiving such benefits. At the same time, 33% of students had neutrally responded to the item as they neither agreed nor disagreed to perceiving it.

Table 1: Perceived benefits of online classes during the pandemic

Perceived benefits and advantages (n=342)	Agree	Disagree	Neither agree nor disagree
Online classes created a digital community where I was able to post questions and inquires, and share materials	314 (91.81%)	16 (4.68%)	12 (3.51%)
Online classes enhanced my familiarity with digital learning technologies and allowed access to further learning materials	308 (90.06%)	20 (5.85%)	14 (4.09%)
Online classes made me feel connected with others during the pandemic, they created a sense of community	248 (72.51%)	40 (11.7%)	54 (15.79%)
Online classes made me embrace discomfort together with other students	248 (72.51%)	40 (11.7%)	54 (15.79%)
Online classed featured a study-life balance during the pandemic	244 (71.35%)	60 (17.54%)	38 (11.11%)
Online classes made me feel supported in such tough times	238 (69.59%)	54 (15.79%)	50 (14.62%)
Online classes featured a relaxing and fun experience that enriched my life during the pandemic	200 (58.48%)	70 (20.47%)	72 (21.05%)
Online classes improved my mental and psychological welling	192 (56.14%)	82 (23.98%)	68 (19.88%)

Perceived benefits and advantages (n=342)	Agree	Disagree	Neither agree nor disagree
Online classes offered an escape from daily pressures and reduced my exposure to the massive amount of negative news	192 (56.14%)	98 (28.65%)	52 (15.2%)
Online classes made me feel less fragile and more ready for similar future uncertainties and circumstances	190 (55.56%)	82 (23.98%)	70 (20.47%)
Practising during online classes made me feel more confident and prepared for my future career	132 (38.6%)	98 (28.65%)	112 (32.75%)

In addition to the benefits presented in Table 1, an open-ended question asked students to think of additional benefits brought by online classes during the pandemic. Students stated that they perceived further benefits including strengthening self-learning skills and self-discipline, flexibility, convenience. Student A commented “online classes facilitate a gradual transition to modernisation...they are enriching the content of courses”, while student B stated “online classes allowed me to exercise my mental endurance during such tough times”. Benefits derived from the open-ended question are listed in Table 2.

Table 2: additional benefits perceived by students and expressed through an open-ended question

Perceived benefits expressed through the open-ended question (n=342)	Frequency of mentioning each benefit
Online classes featured flexibility, convenience, and more control over the learning process	90
Online classes strengthened my self-learning skills and self-discipline	60
The pandemic abrupted the educational process while online classes bridge the gap and featured continuity	46
Online classes allowed me to watch playbacks and to repeatedly access recorded materials	30
Online classes featured a quieter and calmer environment	6

4.2 Perceived Challenges

The second inquiry was related to challenges perceived by students and that negatively impacted their learning experience during online classes. Table 3 presents these challenges and sorts them by the most selected ones. Each of the top three challenges was selected by more than half of the 342 students. The sudden shift to the online mode meant that additional time was required to get accustomed to the new learning delivery method, and this challenge ranked first and was selected by around 75% of students. The second most selected category was having time-management issues, while the third challenge was being distracted by social media, surfing the internet, and other online activities during online classes, with 59% and 58.5% respectively. Other significant challenges were related to demanding assignments and technical issues with 46.8% and 44.4% of students selecting these categories. Moreover, around 43% of respondents found the design of online classes boring and were sometimes bored or absent-minded. Surprisingly, categories that were directly linked to Covid-19 did not impose significant challenges. For instance, less than 10% of students were worried or paranoid about their health. Likewise, almost the whole sample stated that they were neither sick nor living with a sick family member.

Table 3: perceived challenges of online classes during the pandemic

Perceived challenges (n=342)	Agree	Disagree	Neither agree nor disagree
Adaptability issues: the sudden shift to online classes meant that I need additional study time to get accustomed to the new learning style and technology	258 (75.44%)	64 (18.71%)	20 (5.85%)
I had time-management issues	202 (59.06%)	80 (23.39%)	60 (17.54%)
During the online class, I was distracted by social media, surfing the internet, or other online activities	200 (58.48%)	102 (29.82%)	40 (11.7%)
Homework and assignments were very demanding while my time was very limited during the pandemic	160 (46.78%)	140 (40.94%)	42 (12.28%)
I met technical issues with one or more of the following: hardware, software, internet connection	152 (44.44%)	148 (43.27%)	42 (12.28%)
The design of the online class and its activities were boring, and sometimes, I was absent-minded	146 (42.69%)	138 (40.35%)	58 (16.96%)

Perceived challenges (n=342)	Agree	Disagree	Neither agree nor disagree
I met Covid 10-related financial difficulties	130 (38.01%)	182 (53.22%)	30 (8.77%)
I cannot sit for long continuous periods in front of the screen	128 (37.43%)	182 (53.22%)	32 (9.36%)
I was shy to introduce myself and participate in the online classes	128 (37.43%)	152 (44.44%)	62 (18.13%)
I had many responsibilities to take care of, and the online classes did not afford me the flexibility	122 (35.67%)	144 (42.11%)	76 (22.22%)
My digital pedagogy is relatively limited and not enough to meet the requirements of the online classes	104 (30.41%)	176 (51.46%)	62 (18.13%)
Due to the lack of self-discipline, I cannot learn independently and the presence of a teacher in the class is vital to me	98 (28.65%)	190 (55.56%)	54 (15.79%)
In the absence of face-to-face interactions with both my classmates and the teacher, I was not able to practice my spelling and communication skills	92 (26.9%)	230 (67.25%)	20 (5.85%)
The Teacher's digital pedagogy was relatively limited and that degraded the quality of the online course	88 (25.73%)	208 (60.82%)	46 (13.45%)
I was worried and paranoid about the potential impacts of the pandemic on my future career	84 (24.56%)	212 (61.99%)	46 (13.45%)
During the online classes, the presence of teacher was dominant while much less space was given to me and other students to interact and engage	80 (23.39%)	216 (63.16%)	46 (13.45%)
In contrast to face-to-face classes, online classes did not feature a sense of community, and the interaction with classmates and teachers was very poor	78 (22.81%)	208 (60.82%)	56 (16.37%)
The shift to online classes was sudden and unexpected, and I was not prepared for such a fortuitous transformation	78 (22.81%)	232 (67.84%)	32 (9.36%)
I did not have a quiet or adequate personal space during the online classes, and I was surrounded by external distractions	64 (18.71%)	230 (67.25%)	48 (14.04%)
My family met Covid19-related financial difficulties	60 (17.54%)	226 (66.08%)	56 (16.37%)
Instructions, guidelines, and teachers' expectations were not clear to me	28 (8.19%)	288 (84.21%)	26 (7.6%)
I was worried and paranoid about my health all the time	26 (7.6%)	280 (81.87%)	36 (10.53%)
Conflicts between family members and domestic violence imposed serious distractions that hindered my ability to learn	22 (6.43%)	306 (89.47%)	14 (4.09%)
I was very sick as I was infected by Covid	0 (0%)	336 (98.25%)	6 (1.75%)
A member of my family was very sick	0 (0%)	340 (99.42%)	2 (0.58%)

An in-depth exploration of technology-related challenges is presented in Table 4. Suffering from back pain and/or digital eye strain due to sitting for prolonged periods in front of the screen was the most prominent challenge, with 272 students perceiving this issue. However, each other technology-related challenge was perceived by less than 25% of respondents. Only 25% of students found it hard to access online study-related materials and 16% did not have Wi-Fi. Only 16 out of 342 students did not have personal digital devices for study purposes.

Table 4: perceived technology-related challenges

Perceived technology-related challenges (n=342)	Agree	Disagree	Neither agree nor disagree
I suffered from back pain and/or digital eye strain due to sitting for prolonged periods in front of the screen	272 (79.53%)	56 (16.37%)	14 (4.09%)
It was hard to access study-related resources such as online libraries and online databases	82 (23.98%)	242 (70.76%)	18 (5.26%)
I could not reach out for help regarding technological difficulties and issues	80 (23.39%)	236 (69.01%)	26 (7.6%)

Perceived technology-related challenges (n=342)	Agree	Disagree	Neither agree nor disagree
I met problems with the software like the online learning platform/ PowerPoint/others	72 (21.05%)	242 (70.76%)	28 (8.19%)
I met problems with the hardware like microphone/camera/keyboard/others	68 (19.88%)	250 (73.1%)	24 (7.02%)
I did not have a stable internet connection that meets the requirements of synchronous activities such as live video streaming	60 (17.54%)	266 (77.78%)	16 (4.68%)
I did not have Wi-fi, and it was expensive to purchase data	58 (16.96%)	278 (81.29%)	6 (1.75%)
I did not have a stable internet connection that meets the requirements of asynchronous activities such as searching for homework-related information	48 (14.04%)	278 (81.29%)	16 (4.68%)
The electricity supply was not stable in my area	46 (13.45%)	274 (80.12%)	22 (6.43%)
It was hard to navigate through course-related materials such as slides, recordings, and feedbacks	44 (12.87%)	278 (81.29%)	20 (5.85%)
I did not have a personal digital device and I was using others' device	16 (4.68%)	324 (94.74%)	2 (0.58%)
I met online security issues such as pandemic-related fraud, spy, etc..	2 (0.58%)	334 (97.67%)	6 (1.75%)

Figure 1 shows that 6% of students met technical issues that they could not solve. However, almost half of the respondents used their knowledge to solve technical issues, while almost one-third of students solved technical problems with the help of friends, family members, teachers, or IT staff.

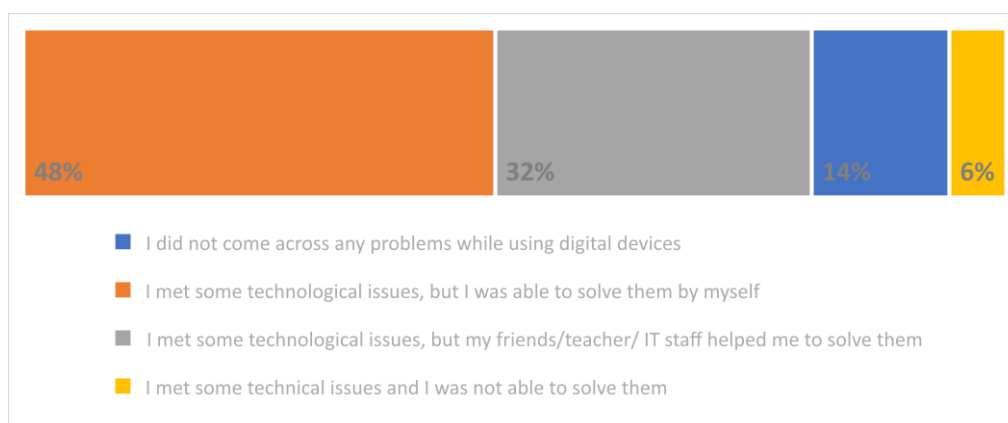


Figure 1: students' approaches to dealing with technological issues

Figure 2 illustrates that only around 13% of students had a study space that was affected by a significant level of surrounding distractions. The rest of the students did not perceive external distractions; they either had their private study space or shared distraction-free spaces with others.

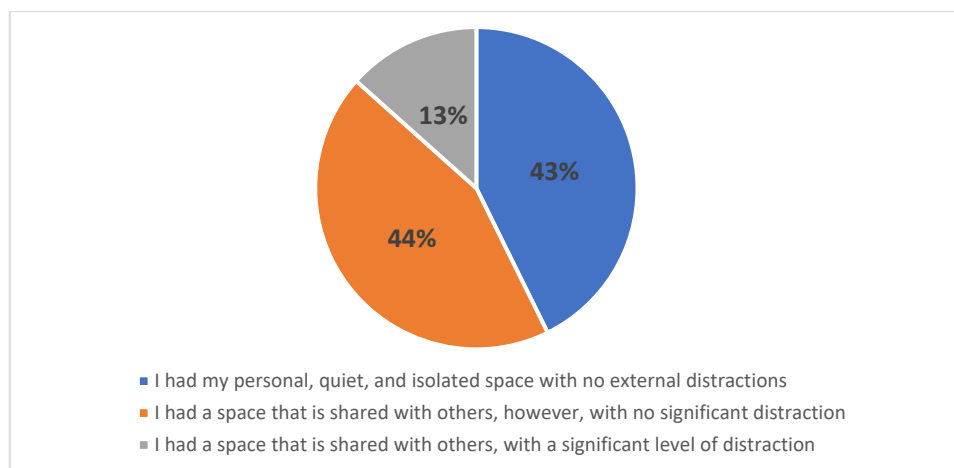


Figure 2: students' approaches to dealing with technological issues

Finally, an open-ended question allowed students to discuss further perceived challenges, and these are listed in Table 5. These include poor real-time communication at all levels; concerns and doubts about the accuracy and validity of lecture content especially in the absence of textbooks; feeling stressed or confused; poor management of the class; using several platforms and apps for several subjects; and finally, the inability to take online classes seriously. One of the students commented "I am used to my textbooks and now I have serious doubts about the integrity and validity of lectures' content".

Table 5: additional challenges perceived by students and expressed through an open-ended question

Perceived challenges expressed through the open-ended question (n=342)	Frequency of mentioning each challenge
Poor in-time communication with teachers and students	64
I cannot take online classes seriously	34
I have concerns about the validity and accuracy of content in the absence of textbooks	16
Different classes mean using several platforms and apps which is demanding and confusing	16
Poor class management	12
Online classes make me stressed and confused	10

4.3 Beliefs, attitudes, views, and an overall evaluation

The third inquiry examined students' beliefs, attitudes, and overall evaluation regarding online classes, especially when compared with face-to-face ones, see Table 6. Notably, more than half of the students stated that they did not take online classes as seriously as they take face-to-face ones. Also, they revealed that online classes did not meet their expectations as they were expecting a more engaging and exciting experience. However, 60% of students disagreed that the college was not fully prepared for the unexpected shift to online classes. Most students agreed that online classes suit some subjects more than others.

Outside online classes, the engagement with classmates was stronger than the interaction with teachers or family members. More than 90% of respondents stated that outside online classes, they used online platforms to engage in course-related discussions with classmates, compared to 70% of those who sought help from teachers or family members. Almost 47% of students believed that during online classes, teachers know little about students and the extent to which they are engaged, compared to 53% who held an opposite belief.

Table 6: Students' beliefs and attributes towards online classes

Students' beliefs and attitudes towards online classes (n=342)	Strongly disagree	Disagree	Agree	Strongly Agree
Online classes did not meet my expectations, and I was expecting a more exciting and engaging experience	20 (5.85%)	126 (36.84%)	172 (50.29%)	24 (7.02%)
I did not take the online classes as serious as I take the face-to-face ones	20 (5.85%)	124 (36.26%)	172 (50.29%)	26 (7.6%)
I felt that my institution was not fully prepared for the unexpected shift to online classes	32 (9.36%)	176 (51.46%)	112 (32.75%)	22 (6.43%)

Students' beliefs and attitudes towards online classes (n=342)	Strongly disagree	Disagree	Agree	Strongly Agree
Online classes fit some subjects more than others	2 (0.58%)	20 (5.85%)	250 (73.1%)	70 (20.47%)
During online classes, teachers know little about students and the extent to which they are engaged	18 (5.26%)	166 (48.54%)	136 (39.77%)	22 (6.43%)
During online classes, I listened carefully and took notes	8 (2.34%)	36 (10.53%)	248 (72.51%)	50 (14.62%)
Outside the online class, I sought course-related help from the teacher or family members	8 (2.34%)	98 (28.65%)	220 (64.33%)	16 (4.68%)
Outside the online class, I used online platforms to engage in course-related discussions with my classmates	2 (0.58%)	28 (8.19%)	278 (81.29%)	34 (9.94%)

Figure 3 illustrates the overall impact of online classes on students' day-to-day life and schedule during the Covid pandemic. Half of the students believed that online classes had complemented their daily life by enriching their schedules and filling the gap of not attending school. In contrast, 24% of respondents stated that online classes had complicated their life by disturbing their already busy daily schedule and requiring them to make additional – unexpected – arrangements. The rest of the students – 26% - stated that online classes had neither complemented nor complicated their life during the pandemic. Also, Figure 3 exhibits around 37% of students stated online classes enhanced their ability to learn, whereas exactly similar proportion stated the opposite; online classes degraded their ability to learn.

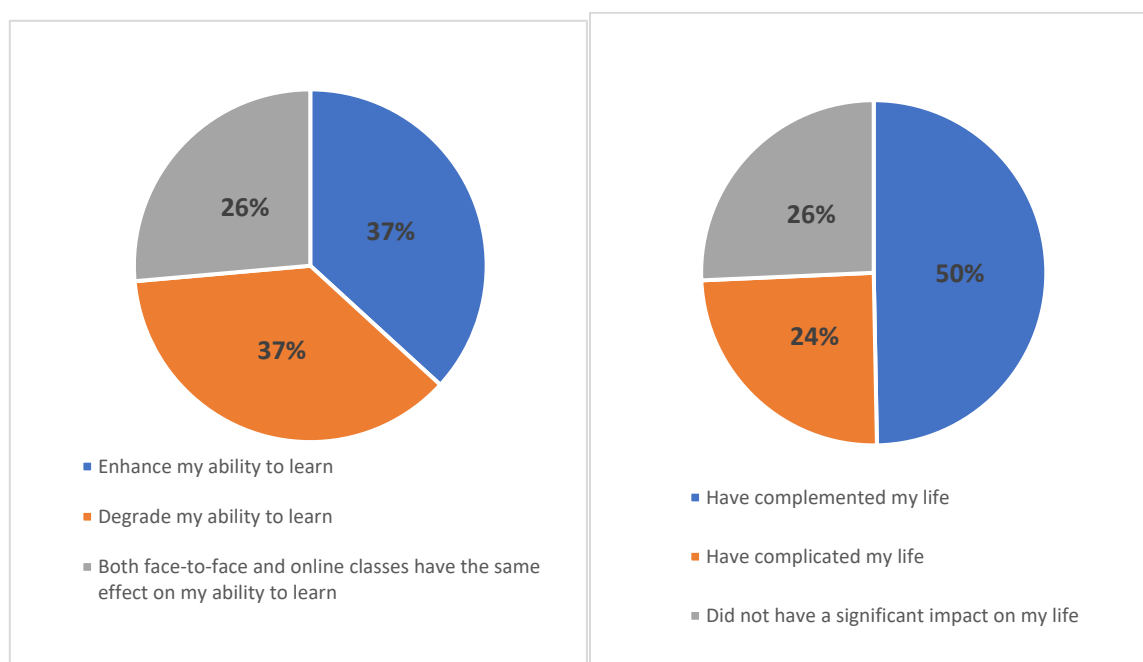


Figure 3: impacts of online classes on students' life and ability to learn

Figure 4 demonstrates that the majority of students believed classroom and online classes complement one another and are both important for future education. Only around 14% pointed out that the online model could become the new norm and could completely substitute the classroom model after the Covid-19 pandemic. The same trend persisted, and students' beliefs did not significantly change even if improvements are to be applied to the currently used online model.

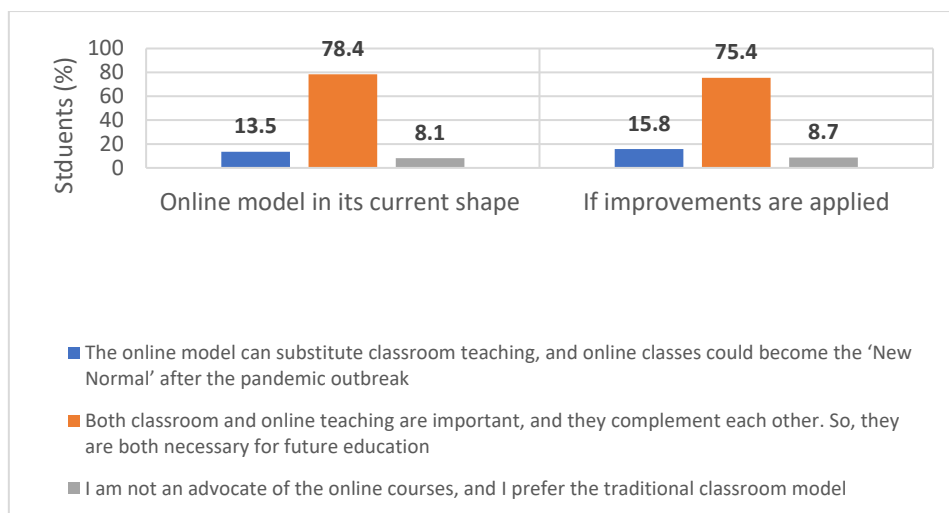


Figure 4: the most preferred mode from the students' perspective

Regarding their overall satisfaction, Figure 5 shows half of the students stated that they were equally satisfied by classroom and online learning, while around 40% were more satisfied with classroom settings. Only around 7% were more satisfied with online settings.

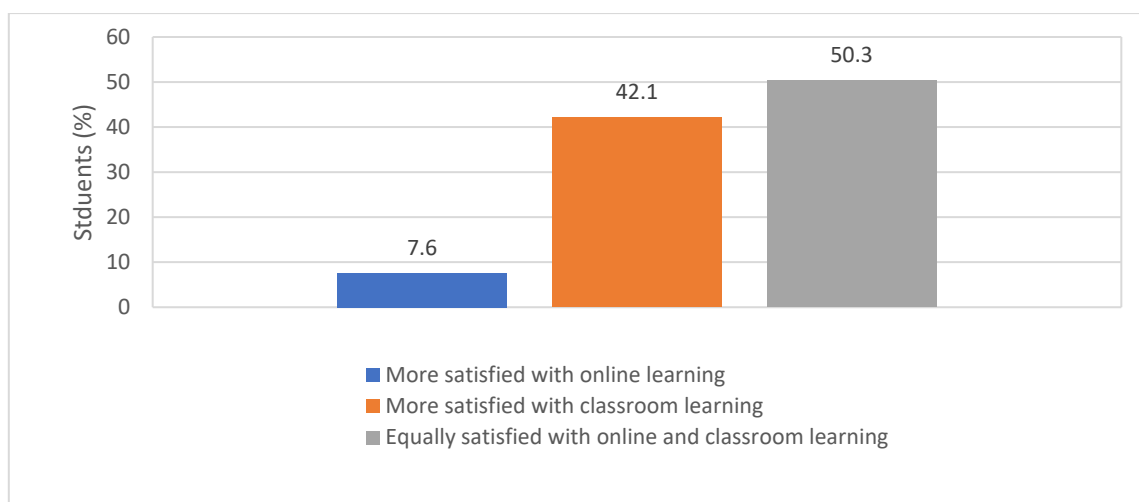


Figure 5: the most preferred mode from the students' perspective

4.4 Improvements

In the forth inquiry, a set of potential improvements was presented to students as in Figure 6. Most students agreed on all proposed improvements asserting their importance. For example, 75% of students agreed that teachers should discuss the mental, physical, and psychological wellbeing of their students, while an additional 20% strongly agreed on the same category. Around 90% of students advocated online activities to facilitate more participation and interaction with both peers and teachers. Similarly, almost 95% at least agreed that teachers should show more empathy during emergencies and tough times. Other proposed improvements on which students agreed included that teachers should be approachable via communication channels outside the designated online classes and the need to offer financial grants or loans to allow purchasing study-related technology devices and/or internet data.

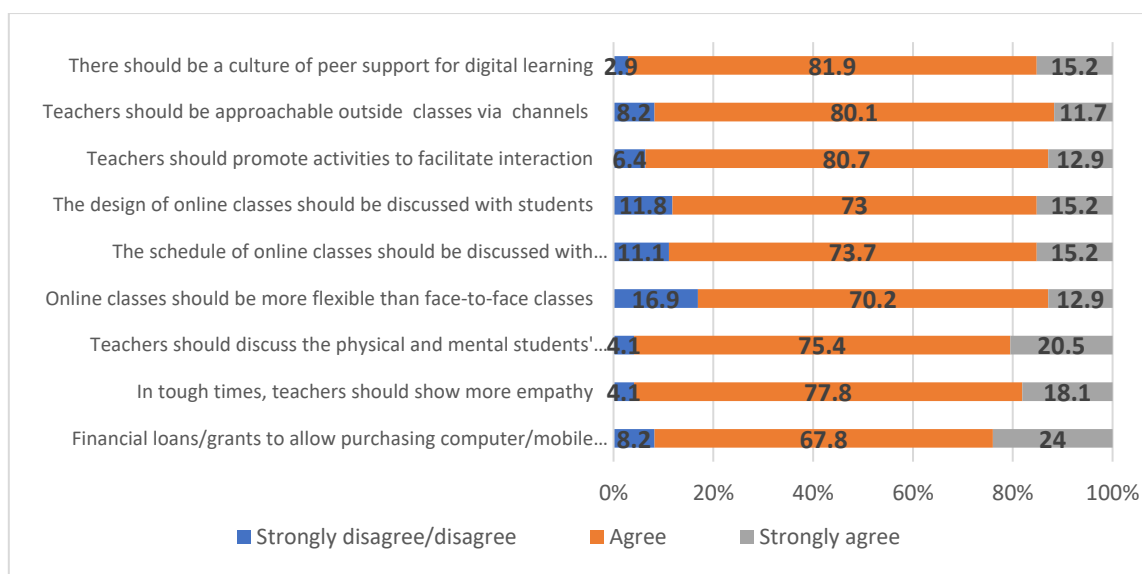


Figure 6: proposed improvements and the extent to which students agreed on them

Finally, regarding the design and delivery, Figure 7 illustrates that almost 80% of students advocated short online classes and more student-directed study time, compared to only around 20% who preferred long classes and less student-direct study time. Also, Figure 7 shows that asynchronous learning activities were more popular among respondents, where around 55% preferred recorded lectures and notes, compared to 44% who advocated synchronous activities like live video streaming and presentations.

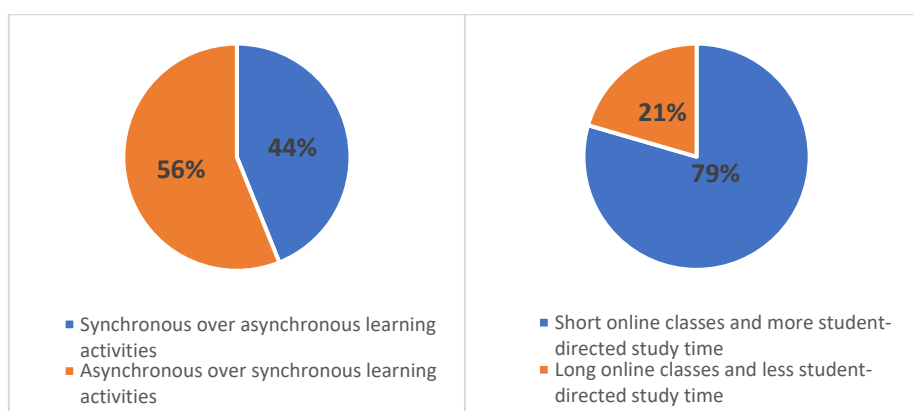


Figure 7: students' preferences regarding the design and delivery of online classes

In the open-ended question, students were asked to think of additional improvements that were not included in the inquiry list. They suggested a variety of additional improvements as listed in Table 7. Student A commented "instead of turning off their cameras, teachers should show us their face", while student B commented "students should be encouraged to engage, and the blame culture should be replaced with encouragement culture".

Table 7: additional improvements suggested by students through the open-ended question

Improvement suggested through the open-ended question (n=342)	Frequency of mentioning each improvement
Faster and more stable internet connection	34
Unification of online platforms and apps across different subjects	30
Improving the design of the online platform, fewer crashes, more user-friendly interface	28
Providing recorded lectures in advance and devoting online classes to answering students' questions	20
Classes that feature more fun and entertainment	18
More training to enhance digital pedagogy of both teachers and students	16
Classes that feature simplicity and clarity of expectations, information, and guidelines	16

Improvement suggested through the open-ended question (n=342)	Frequency of mentioning each improvement
Shifting from teacher-centred to student-centred classes	12
More focus on methods to boost students' interest in online classes	8
Developing a tool to track the learning status of students	6
The provision of textbooks	6

5. Discussion

5.1 A reflection on the results

Online classes during the pandemic brought several benefits that were significantly perceived by the majority of students. They featured a study-life balance plus a certain level of flexibility while allowing students to feel connected to a digital community where they can interact with teachers and other students. At the same time, the majority of students suggested that the design and schedule of online classes should be discussed with them, while activities that enhance the interaction and engagement among students should be implemented. Similar findings are presented by Beldarrain (2006); her study explains that the student of the 21st century demands an educational experience that is not bound by time or space and yet facilitates interaction with teachers and peers.

Almost all students stated that online classes enhanced their familiarity with digital learning technologies. This perceived benefit is also documented in Ilin (2019). However, he found that online learning improves the technological knowledge of learners and equips them with skills that are necessary for their future careers. In the present study, this specific benefit was relatively controversial and gained mixed views, was at least half of students either did not agree or was not sure whether practising during online classes made them more confident and prepared for their future career. This finding raises some concerns about the online model and its capability of equipping students with skills that are required for their future careers. This specific point is very relevant in the present study because all responding students belong to the Business English and e-commerce majors and participating in online – and face-to-face – business meetings or negotiation, exhibitions, and trade fairs are very common duties of their future role. These professional activities usually require a certain level of fluency in English as a spoken language plus familiarity with digital devices. To summarise, some issues need to be addressed to guarantee online classes can positively contribute to students' employability and associated required skills.

Academics, teachers, and experts in the higher education field suggested that students might face new pandemic-related challenges that could degrade their experience with online classes. These include mental pressures, worries about their health, financial pressure, worries about the future, being sick, living with a sick family member, and not having adequate study space (Lederman, 2020a; Lederman, 2020b). The present study showed that these challenges were not significant and each of them was perceived by less than 30% of respondents. In contrast, other non-pandemic related challenges such as time management issues, being distracted by other online activities, and the need for additional study time to adapt to the new learning style were more prominent. Being distracted by social media, surfing the internet, and other online activities during online classes constituted one of the most significant challenges for students. This finding in specific resembles findings of other similar studies in the field. For instance, Karal, Cebi and Turgut (2011) discuss that students tend to merely focus on online lessons in the presence of teachers in real classroom settings, while they tend to be more distracted by other activities in online settings. Finally, the digital divide was not significant in the study and most students had technological devices and used them in online classes. Students showed competency in tackling technological issues and most of them were able to solve such issues.

5.2 A broader view

The Covid-19 pandemic has imposed radical changes on higher education around the world and has equally facilitated unprecedented experiences from which lessons can be learned. To keep up with the rapidly changing circumstances and unexpected events, the post-pandemic era should witness comprehensive reforms in education concepts and teaching platforms, methods, and relationships (Lingyun, 2020). Wu Yan, the director of the Higher Education Department of the Ministry of Education in China stated that "we can no longer and should not return to the state of teaching and learning of the pre-pandemic era... after colleges resume, online teaching and learning should become the new normal" (Wu, 2020). He emphasized that after controlling the pandemic, the internet and educational technologies should be integrated into the educational process, while online classes should go in parallel with classroom teaching. The findings of the study correspond to Wu's visions,

especially when students' answers showed a tendency to prefer a blended model that combines both classroom and online modes in the future.

The sudden shift to online classes meant that students needed additional study time to get accustomed to the new learning style and technology. This was the most significant challenge, and it could be avoided during future emergencies and uncertainties. In the future, universities will reopen their campuses and classroom will again be the dominant model. Findings of the present study encourage that online classes and activities could be systematically and regularly integrated into the curriculum and could accompany classroom lectures. In other words, online classes should not be limited to emergency settings, and measures of the 'emergency time' should be also adopted during 'normal times'. Adopting a 'blended mode' in normal times will; boost students' preparedness for unexpected circumstances during emergencies; enhance students' familiarity with the online learning style; and, allow the online teaching and learning culture to gradually thrive.

5.3 Improvements and suggestions

To facilitate the adoption of a sustainable blended model in the post-pandemic era, there should be profound changes in teachers' approaches and methods, students' mentality and skills, and universities' management and policies (Wu, 2020). The following list presents some improvements that respond to findings of the present study and can enhance the preparedness for future pandemics, emergencies, and uncertainties:

- Colleges and universities should be supported by convenient, flexible, and modern digital platforms and close coordination between the government, tech, and digital firms are required in this regard. It is necessary to develop digital teaching and learning platforms that feature personalisation and contextualisation, to suit students of different capabilities and to fit the requirements of different subjects (Ronghuai, 2020).
- Teachers should carefully select a live-streaming app that can fulfil the requirement of the online class. Some apps do not feature an extensive level of communication between students, while others do not have a playback function. For example, for English language learners, it is important to practice speaking and pronunciation skills not only with teachers but also with other students. The currently used apps such as Ding Talk should be upgraded to address academic requirements and to facilitate an enhanced level of student-to-student communication.
- While some classes may require lecturing, others may demand students to collaborate and engage with one another. So, teachers should let their pedagogy inform techniques that suit different pedagogical styles.
- Students could be engaged in designing the class format. In such a time where aspects of life are changing rapidly and unexpectedly, it is essential to give students some authority over learning (Boudreau, 2020).
- During emergencies, students spend most of their time at home with much less opportunity to interact with others. Icebreaking activities and online games are useful in this regard (Lederman, 2020a). So, teachers should design online classes that allow students to engage and socialise with each other.
- Teachers' expectations should be clear and available at the early stages (Boudreau, 2020).
- Concise sessions and brief lessons might be more effective and suitable especially when students are surrounded by many distractions in their homes, and where they might be required to do other household tasks.
- Using online calendars is useful for highlighting dates of classes, meetings, exams, and submission deadlines (Farah, 2020).
- Flexibility is very important during rapidly changing and unexpected circumstances and teachers should be able to swiftly modify or neglect methods and techniques that do not adequately work (Lederman, 2020a).
- Simplicity and clarity are important. In online learning, the teacher is less present to answer questions and queries of students, and the most of learning time is driven by tasks and activities that demand self-direction (Lederman, 2020b).
- Longer and student-driven assignments are useful for saving classes' time. Also, longer assignments with clear checkpoints buy teachers more time to plan future activities (Farah, 2020).
- A single digital platform where students can access the most recent course information like instructions, deadlines, and tasks is necessary to create stability and make students more comfortable (Boudreau, 2020).

- Individual touchpoints should not be forgotten, and teachers should be approachable outside online classes.
- To bridge the digital divide, and to ensure that no students are left out, disadvantaged students could be subsidised. Laptop loans or grants could be offered to disadvantaged students and universities could negotiate deals with network providers to offer – discounted or free – data plans (Zhaohui, 2020).

5.4 Limitations

Students' responses might be subjective, biased, or influenced by external factors such as their overall satisfaction, wellbeing, or relationship with their instructors. Another limitation is that the questionnaire was administrated to a group of students who belong to the same country, province, institution, academic level, and discipline. In other words, findings might be bound to the selected sample and context and hence cannot be generalised. Also, the digital gap among students in poor provinces might be more evident than the gap between students in rich provinces. Further, the study did not test the reliability or validity of results, and statistical analysis and econometric modelling are required for such a purpose. Future studies could adopt a broader perspective by examining perceptions of students from different countries, universities, disciplines, and academic levels. Finally, future studies could closely research topics of online examination and assessment in pandemic settings, as the present study did not reflect on these aspects.

6. Conclusion

The Covid-19 pandemic has radically changed and disrupted education; universities have closed their campuses, and many have shifted to online courses. In the pre-pandemic era, online classes are associated with several benefits and challenges, and the pandemic might have brought additional benefits and obstacles. An online questionnaire was administrated to students of the Business English and Ecommerce majors at the Economics and Trading department of Hunan Railway Professional Technology College in China.

Online classes during the Covid-19 pandemic brought several benefits like creating a digital learning community, improving students' digital learning skills, and staying connected during tough times. Challenges comprised adaptability issues due to the sudden shift to online classes, time-management issues, being distracted by social media plus technological obstacles. Regarding beliefs, students believed that a blended model that combines both classroom and online modes is necessary for the post-pandemic era.

Previous studies looked at the benefits and challenges associated with online classes during regular settings. This study added new findings by looking at benefits and challenges during pandemic settings, by examining students' experience with online classes during the lockdown. The study presented a comprehensive set of potential improvements and allowed students – through open-ended questions – to express their opinions.

Shifting to online classes during the Covid-19 pandemic constituted unprecedented experience and brought priceless lessons from which we should learn. The post-pandemic era will bring new emergencies, pandemics, and uncertainties. A blended model that combines online and face-to-face classes could be adopted to; boost students' preparedness for unexpected circumstances during emergencies; enhance students' familiarity with the online learning style; and, allow the online teaching and learning culture to gradually thrive. Researchers could consider developing digital teaching and learning platforms and apps that feature personalisation and contextualisation, to suit students of different capabilities and to fit the requirements of different subjects. Researchers are encouraged to update the currently-used live-streaming apps and platforms to make them more academic-oriented and in a way that features an extensive level of communication between students. To guarantee a sustainable and adequate online model in the post-pandemic era, improvements are required at different levels.

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Exploring Romanian Engineering Students' Perceptions of Covid-19 Emergency e-Learning Situation. A Mixed-Method Case Study

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Abstract: The Covid-19 pandemic is the most disturbing event in the lifetime of most of our planet's citizens. The lockdown measures directly impacted many areas of our lives, including the educational sector, because locking down countries meant implicitly locking down the educational system. Moreover, what was first considered a temporary solution for an extraordinary situation began to look more and more like a medium to long-term general rule. Nevertheless, the questions are: are we all ready to move the entire educational process online and fully understand the challenges and implications for all stakeholders involved? This two-part research aims to provide some answers to these questions by identifying and analyzing the perceptions of Romanian engineering students enrolled at "Gheorghe Asachi" Technical University of Iasi (TUIASI) regarding the changes registered in the past year once the emergency e-learning situation started. The first part of the research was conducted between April and May 2020 through an online survey among 134 engineering students. It aimed at identifying the students' perception of the online learning systems provided by their university, considering the significant speed with which changes were imposed. In addition, this research phase focused on students' access to resources and knowledge to use and integrate online learning into their study routine. The second part of the research was carried out after almost a year of e-learning between March and April 2021 and consisted of six online focus groups with 36 students and aimed at identifying the main advantages and challenges students experience throughout the online educational process. The research revealed that although students are digital natives, they still have difficulties harnessing e-learning's advantages and integrating them into their study routine. Another significant aspect refers to the changing role of the professor perceived not only as an instructor but as a mentor during a time of crisis. The study results can offer higher education institutions insight and valuable information that can be used in designing and implementing online and hybrid activities and classes that better fit the students' needs and expectations in terms of e-learning.

Keywords: online learning; emergency e-learning; virtual teaching; Covid-19; technostress; teaching culture

1. Introduction

The Covid-19 pandemic is a massive global health crisis that has disrupted all areas of our lives, changing patterns of behaviors and forcing us to find new coping mechanisms (Bavel et al., 2020). In this context, the educational system was forced to convert to "emergency mode" and adapt and identify solutions to carry out the educational process and implement measures to protect students and academia from Covid-19.

Neither online learning nor distance learning were new concepts for higher education institutions, as the use of Information and Communication Technologies to deliver educational content and learning support has become, even before the Covid-19 pandemic, the accepted norm for many institutions in the higher education sector across the world (Latchem, 2017; Sharma et al., 2020; Johnson et al., 2021). Moreover, various e-learning advocates consider that it can significantly positively impact the quality of education, students' performance, and engagement levels (Shen and Ho, 2020).

What is significant and worth exploring is the context and the way higher education institutions transitioned to fully online mode and radically transformed their educational processes, as universities, even the ones that previously were reluctant to change their educational approach, had no option but to shift entirely to online teaching-learning (Dhawan, 2020; Hodges et al., 2020; Tian, Zheng and Chao, 2020).

At the beginning of the emergency e-learning, most universities focused more on course continuity and less on online learning best practices. Therefore, this “emergency mode” does not come without consequences: on the one hand, forced e-learning can be seen as an opportunity to “convince the unconvinced” of the advantages offered by e-learning (Kulikowski, Przytuła and Sułkowski, 2021). However, on the other hand, these changes were implemented almost without proper planning and design and did not fully take advantage of the affordances and possibilities of the online format. As a result, there is a significant risk to seal the perception of e-learning detractors that e-learning is just a weak alternative option for traditional education.

Considering all the above, the current study investigates the perceptions and attitudes of “Gheorghe Asachi” Technical University of Iasi students towards e-learning and how these evolved throughout the emergency e-learning period considering that the research stages were conducted one year apart. The research took place between April 2020 and April 2021. It involved two phases: the first phase consisted of quantitative research conducted between April and May 2020 after almost two months of online learning. The research aimed to evaluate the students’ perceptions and expectations toward using online technology for learning in terms of access to resources and knowledge and their perception of the impact on their overall academic performance.

The second phase of the research consisted of a qualitative study conducted between March and April 2021, after almost a year of emergency e-learning. It focused on evaluating the students’ perception regarding the advantages and challenges imposed during this time and their willingness to continue in an online format. The students included in the second phase of the research were both 2nd and 3rd year students who participated in the first stage of the research and 1st year students who had started studying exclusively online.

2. Contextual background

2.1 E-learning Usage In Romanian Higher Education Institutions

As a member of the European Union, the Romanian Higher Education system is aligned with the European Higher Education Area, the Bologna Agreement (Curaj et al., 2015), and the national policies concerning education and digitalization are directed by the EU level decisions (Goldbach and Hamza-Lup, 2017). In this context, digital inclusion has been one of the main priorities on the Romanian Ministry of Education and Research agenda and several major educational programs were centered around developing the ICT infrastructure and internet connection for Romanian education institutions. In addition, several other major educational programs focused on training professors, developing quality online resources, and providing access to online learning spaces (Grosseck, Holotescu and Andone, 2020). This was done because, starting with 2014, the European Council has recommended the EU Member States to focus on improving teachers’ digital skills: “The rapid spread of digital learning tools and open educational resources also creates the need for teachers to gain a sufficient understanding of them in order to develop relevant digital skills and use them effectively and appropriately in teaching. These new tools can also help to ensure equal access to high-quality education for all” (EU 2014, online).

Regarding internet access, Romania has 15.35 million internet users and an overall Internet penetration rate, as of January 2020, of 80% (Kemp, 2020). However, the data shows that 83% of urban households have an internet connection, while only 67% of rural areas households have one. This shows that there is a significant gap between the urban and rural areas, and this has the potential to generate massive disruption in the educational process, accentuating the Urban-Rural Divide (Stoica and Ilas, 2013) or the general inequality of opportunities in education (Edelhauser and Lupu-Dima, 2020; Hosszu and Rughinis, 2020).

Regarding the use of technology and digital tools in Romanian higher education institutions prior to 2020, previous research shows that starting with 1995, 58% of Romanian universities declared that they use some type of e-learning solutions in didactic and non-didactic activities for their distance learning (DL) education programs (Edelhauser and Lupu-Dima, 2020). However, the aforementioned studies also revealed that online learning activities implemented before the Covid-19 pandemic were mostly focused on the online presentation of learning materials and short online tests (Traistaru and Cotoc, 2013; Grabara and Bosun, 2014) and that the majority of university professors had limited knowledge regarding the process of adapting the course content and activities to the requirements of the fully online environment.

In this context, the swift adjustments imposed by the new Covid-19 context were challenging for all parties involved: universities, professors, and students, as the transition was done under time constraints without proper preparation and neither party knew what to expect or how long this temporary solution will be in place.

2.2 The Impact of Covid-19 on Romanian Higher Education

Starting with March 11, 2020, all Romanian universities suspended face-to-face teaching activities and followed the trend in education systems worldwide by shifting to “emergency e-learning” protocols (Murphy, 2021).

Analyzing the national context and the developments, experts from Bucharest University, Faculty of Psychology and Educational Sciences, considered that the forced online teaching has been done at “different speeds” from one community to another, from one school/university to another (University of Bucharest, 2020). Because although Romania has a centralized education system, universities have autonomy in terms of their mission, institutional strategy, structure, activities, organization, and functioning. In this context, the strategies for translating the educational activities from face-to-face to online teaching were significantly different from one university to another. This aspect is confirmed by other studies highlighting that the emergency e-learning responses to Covid-19 occurred primarily on an institution-by-institution or system-by-system basis all over the world (Murphy, 2021).

During the first stage of the transition from face-to-face to fully online classes, changes were fast-paced. The transition consisted mainly in either accessing third-party platforms, such as Microsoft Teams, Google Classroom, or Zoom, or using their in house Learning Management Systems on Moodle or Blackboard to move all their classes online without having proper time to design and adjust the course contents and activities for an online environment.

Consequently, this phase focused primarily on identifying technological and logistical solutions and professors were left out of the equation, so they had to start to prepare and deliver classes from home, without proper planning and organization, facing various practical and technical challenges, and often lacking proper technical support (Hodges et al., 2020; Rapanta et al., 2020). For technical university professors, the challenges were even more significant as many of their disciplines required careful planning and design and hardware or access to laboratories during the teaching process (Samantray, 2020).

Several authors have recognized the professors’ level of digital literacy to be a critical factor in the successful transition to online learning (Ali, 2020; Chung, Subramaniam and Christ Dass, 2020; Naji et al., 2020; Rapanta et al., 2020), as digital literacy goes beyond knowing how to use devices and applications. Because teaching during the Covid-19 pandemic is not only about teaching in extraordinary times but also about developing an understanding of who professors are and how they teach their disciplines in a new context and setting (Smith and Hornsby, 2020). Furthermore, many professors, forced to use e-learning without previous practice and instruction in e-learning tools and techniques, ended up feeling that they would need to compromise their standards and deliver low-quality classes (Kulikowski, Przytuła and Sułkowski, 2021).

At the same time, a study conducted with Romanian university professors revealed that only one-third of them have participated in digital knowledge improvement courses in the last five years and over 50% of them consider that they need to improve their IT knowledge to cope with online learning (Ionescu et al., 2020). As a result, many universities developed resources platforms and workshops designed to educate educators on this process.

Furthermore, just like universities had different strategies for the online learning process, professors from the same university had different approaches for their classes, which led to students’ perception of inconsistency and lack of structure at the beginning of the process.

3. Research methodology

The past 12 months, starting with March 2020, have been filled with numerous research articles analyzing various aspects of the impact of the Covid-19 pandemic on almost all aspects of our lives, from buying behavior to coping mechanisms and from entertainment to education.

The present study comes to enrich the body of research conducted to evaluate the impact of the emergency e-learning imposed by the Covid-19 pandemic on students worldwide (Edelhauser and Lupu-Dima, 2020; Händel

et al., 2020; Nur Agung, Surtikanti and Quinones, 2020; Odriozola-González et al., 2020; Adnan et al., 2020; Bączek et al., 2021; Calhoun et al., 2020; Iyer, Aziz and Ojcius, 2020; Kapasia et al., 2020; Lovrić et al., 2020; Al Rawashdeh et al., 2021) and in Romania (Tartavulea et al., 2020; Dospinescu et al. 2020; Stavre and Ilie-Prica, 2020; Obrad, 2020). Furthermore, the research brings added value because it employs both quantitative and qualitative research methods and is conducted in two different stages of the emergency e-learning process: at the beginning (April-May 2020) and after over a year of online learning (March-April 2021).

Another relevant aspect of novelty is that the second stage of the research involved both students who experienced entirely face-to-face learning and participated in the first stage of the study and 1st year students who enrolled in October 2020 and had online classes with just one face-to-face laboratory.

The effectiveness of the online learning process depends on a mixture of elements such as access to resources and knowledge in using ICT equipment, the students' ability to focus and self-discipline, the designed and prepared learning material, the lecturer's engagement in the online environment, the lecturer-student or student-student interaction (Aristovnik et al., 2020; Bao, 2020). Considering this and the fact that there is a significant difference between traditional e-learning and emergency e-learning, we believe it is essential to analyze and evaluate the students' perception of their online learning experience and use the results to change and improve the educational process, both in terms of the general approach and in terms of specific activities. Because this emergency e-learning crisis was an exceptional situation, but e-learning is "here to stay" in academia. With all its challenges and implications, this period can provide valuable lessons, especially for institutions implementing online learning for the first time.

This research was carried out to answer two main questions, one for each stage of the study, both focusing on the students perspective over their online learning experience:

1. April - May 2020 - What are students' perceptions and expectations of using online technologies during the Covid-19 pandemic?
2. March – April 2021 - What are the students' perceptions regarding the overall e-learning experience and the advantages and disadvantages of the online education process?

3.1 Phase 1 (April - May 2020) – Quantitative research

The first stage of the research took place between April and May 2020 and consisted of a web-based questionnaire comprising of 43 questions, mostly 5-point Likert scale type (Strongly agree, Agree, Neutral, Disagree, Strongly disagree).

Because the translation from face-to-face teaching to fully online classes was done very fast and most Romanian universities did not previously provide distance or online learning, the research goal was to identify the students' general perspective regarding the online learning process. Therefore, the questions included in the questionnaire covered various aspects regarding access to resources and knowledge to use online learning platforms, perception over easiness of study, control over the studying process, compatibility with personal study style, and impact over academic performance.

The validity and reliability of the questionnaire were assessed using SPSS Software. The validity was tested using the Pearson correlation method, while reliability was tested using Cronbach's alpha method.

Using the Pearson Correlation analysis, the scale's validity was tested, and the results indicated that all six items included in the questionnaire (Control, Compatibility, Resources, Ease, Knowledge and Satisfaction) were statistically validated, the significance level (sig. = 0.000) having a lower level than the 0.05 threshold (Table 1).

Table 1: Items' Validity - Correlations

		Control	Compatibility	Resources	Ease	Knowledge	Performance
Control	Pearson Correlation	1	.523**	.263**	.762**	.319**	.439**
	Sig. (2-tailed)		.000	.002	.000	.000	.000
	N	134	134	134	134	134	134
Compatibility	Pearson Correlation	.523**	1	.241**	.549**	.185*	.506**
	Sig. (2-tailed)	.000		.005	.000	.032	.000
	N	134	134	134	134	134	134
Resources	Pearson Correlation	.263**	.241**	1	.290**	.587**	.350**
	Sig. (2-tailed)	.002	.005		.001	.000	.000
	N	134	134	134	134	134	134
Ease	Pearson Correlation	.762**	.549**	.290**	1	.267**	.489**
	Sig. (2-tailed)	.000	.000	.001		.002	.000
	N	134	134	134	134	134	134
Knowledge	Pearson Correlation	.319**	.185*	.587**	.267**	1	.312**
	Sig. (2-tailed)	.000	.032	.000	.002		.000
	N	134	134	134	134	134	134
Satisfaction	Pearson Correlation	.439**	.506**	.350**	.489**	.312**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	134	134	134	134	134	134

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

In order to test the scale's internal consistency, a reliability analysis was conducted. Based on the rules developed by George and Mallery (2003), the value for Cronbach's alpha is 0.806 (greater than 0.8), meaning the current scale made of 6 items has a high consistency.

Table 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Ease	17.98	10.954	.688	.745
Control	17.83	11.542	.675	.749
Compatibility	17.84	12.244	.568	.775
Resources	17.13	13.606	.441	.802
Knowledge	17.08	14.241	.437	.802
Satisfaction	17.51	13.019	.587	.772

The questionnaire was applied online using Google forms and was completed by 206 students from all over Romania, out of which 134 students from "Gheorghe Asachi" Technical University of Iasi, both from bachelor and master programs. The questionnaire was posted online on faculties intranet and sent to student organizations and other professors. Both the professors disseminating the questionnaire and the students received precise information about the research goal. Students were informed that participation is entirely voluntary and anonymous and that their answers will be used to identify solutions for improving the online learning experience. No incentives were offered to gain respondents, and the students could stop filling in the questionnaire at any time. They gave their consent to participate in the study by completing the questionnaire. The average time necessary to answer the questionnaire was 12 minutes.

Table 3: Respondents profile

	Category	Percentage
Study level	Bachelor	83.58%
	Master	16.42%
Gender	Female	70.15%
	Male	29.85%
Age	Under 22	56.72%
	Over 23	43.28%
E-learning experience	No experience	14.9%
	Somewhat experienced	60.4%
	Experienced	24.6%

More than 80% of respondents were bachelor students, out of which 70.15% (94 students) were female. The data aligns with the 2021 statistics regarding the male/female proportion for post-secondary educational institutions, where most Romanian students are female – 69.3% compared to male – 30.7 (Statista, 2021). The data provided by the Romanian ministry of education reports for 2016-2020 show that the male/female proportion for bachelor programs favors 9% to 14% of female students. For master programs, female students are 21% higher than male students (EDU, 2020).

When asked to evaluate their previous e-learning experience, only 14.9% (20 students) declared they had no experience, and 24.6% (33 students) considered themselves experienced. In comparison, the rest of 60.4% (81 students) declared that they are somewhat experienced. This question is relevant as the analysis revealed a significant statistical association between the respondents' level of e-learning experience and their perceived easiness to study using online platforms ($\text{sig}=0.033$) or their perceived control over all aspects of their education ($\text{sig}=0.030$).

3.2 Phase 2 (March – April 2021) – Qualitative research

The second stage of the research took place between March and April 2021 and consisted of 6 online focus groups with 36 students (24 F and 12 M) from "Gheorghe Asachi" Technical University of Iasi enrolled in bachelor programs. The focus groups were conducted online via Zoom, a proprietary video teleconferencing software used successfully in other qualitative research studies (Archibald et al., 2019). They consisted of 7 open-ended questions derived from the main research question covering various aspects of their online learning experience.

Five focus groups were conducted with 2nd and 3rd year students who participated in the first stage of the research by completing the questionnaire. One focus group included only 1st year students, enrolled in October 2020 which began their studies online with only one face-to-face laboratory each semester.

The research team considered that a qualitative design through focus groups was the most appropriate option for this stage of the research, as the method allows in-depth exploration of respondents' experience and perceptions (Berg, 2009) and provides the unique opportunity to obtain rich group interaction data (Stahl, Tremblay and LeRouge, 2011).

The aim of the qualitative research through focus groups was to identify and evaluate the students' perception after over a year of online learning and pinpoint the main advantages and challenges perceived by students. Therefore, the research team developed and refined a focus group guide based on the results obtained in the first stage of the study, the literature review, and the pilot testing with a student.

Each focus group started with an introduction and a brief presentation of the research aim and procedure and continued with the questions inquiring students about their perception toward the overall e-learning experience, their expectation at the beginning of the academic year, the level of satisfaction with the classes and the evaluation process, the main advantages perceived and the challenges encountered throughout the experience. The last question referred to their preferred option to study for the 2021-2022 academic year. The transcripts resulting from the focus groups were further analyzed using thematic analysis as the research team focused on students' experience and perception over the online learning period. In order to have an inter-coder agreement, the authors have read one transcript and conducted line-by-line coding of one transcript together. After this, the other transcripts were coded in pairs. A deductive approach was used to establish the general categories at the beginning and an inductive approach was used to develop the themes and subthemes. The

ultimate core themes and subthemes were agreed by all authors and consisted of (1) Educational impact, (2) Personal impact, (3) Perceived advantages and challenges. The last question regarding their preference for the 2021-2022 academic year was not included as a separate theme in the analysis.

4. Results and discussions

4.1 Quantitative study

The questionnaire was completed by 134 students from “Gheorghe Asachi” Technical University of Iasi. The profile of the respondents is presented in the table below.

Considering that this phase of the research took place at the beginning of the emergency e-learning period, the questions included in the questionnaire focused on elements such as the availability of resources and knowledge to use online learning platforms, students perception over different aspects related to online learning such as compatibility with other aspects of their education or easiness to study and control over their studies. Table 4 presents an overview of the students’ perceptions regarding the previously mentioned aspects.

Table 4: Students’ perception towards using online technology

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have the necessary resources to use an online learning platform (Resources).	0.75 %	8.21 %	16.42%	45.52%	29.10 %
I have the necessary knowledge to use an online learning platform (Knowledge).	1.49 %	2.24 %	15.67%	56.72%	23.88 %
Using an online learning platform makes it easier for me to study (Ease).	7.46 %	26.12 %	27.61%	26.87%	11.94 %
Using an online learning platform is compatible with all aspects of my education (Compatibility).	5.22 %	18.66 %	33.58%	32.09%	10.45 %
Using an online learning platform gives me greater control over my study (Control).	2.99 %	25.37 %	26.87%	33.58%	11.19 %
I am satisfied with the performance of the online learning platforms (Satisfaction).	1.49 %	11.19 %	26.87%	50.75%	9.70 %

All students from “Gheorghe Asachi” Technical University of Iasi participating voluntarily in the study declared that they are currently using Google Classroom or Microsoft Teams as their primary online learning platforms.

In terms of access to resources and knowledge, 74.63 % of students opted for Agree and Strongly agree with the statement “During this pandemic, I have the necessary resources to use a virtual platform” and 80.6 % opted for Agree and Strongly agree with the statement, “I have the knowledge necessary to use a virtual platform”. These statements confirm the overall importance of technology for students and the ease of use as their everyday life and practices have been entwined with social media, smartphones, tablets, and Internet use (Boulianne and Theocharis, 2018; livari et al. 2020).

However, when evaluating the impact of the online learning process in terms of facilitating the study, only 38.81 % of students opted for Agree and Strongly agree with the statement “Using a virtual platform in the university makes it easier for me to study”. In comparison, 33.58 % chose Disagree and Strongly disagree for the same statement. The study results are consistent with other studies comparing e-learning with face-to-face teaching, which revealed that e-learning has a lower impact than face-to-face learning (Ionescu et al., 2020; Bali and Liu, 2018). This can be directly related to the fact that although university students are digital natives, they are not fully prepared to harness the advantages of e-learning due to a lack of skills in time management and self-directed learning (Parkes, Stein and Reading, 2015). These outcomes are further confirmed by the results obtained after conducting the focus groups in the second stage of the research, highlighting that further improvements in the online teaching-learning process are needed for students to better integrate online e-learning into their study routine.

The Chi-Square test done to evaluate the relationship between the students’ level of previous experience with e-learning and their perception over easiness of study during online learning showed a significant dependence between the two (sig = 0.033, lower than the 0.05 threshold).

Table 5: Experience * Ease Crosstabulation

			Ease					Total
			Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Experience	Experienced	Count	3	6	7	11	6	33
		% of Total	2.2%	4.5%	5.2%	8.2%	4.5%	24.6%
	No experience	Count	4	8	2	6	0	20
		% of Total	3.0%	6.0%	1.5%	4.5%	0.0%	14.9%
	Some-what experienced	Count	3	21	28	19	10	81
		% of Total	2.2%	15.7%	20.9%	14.2%	7.5%	60.4%
Total	Count		10	35	37	36	16	134
	% of Total		7.5%	26.1%	27.6%	26.9%	11.9%	100.0%

Table 6: Chi-Square Tests (Experience*Ease)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.705 ^a	8	.033
Likelihood Ratio	18.482	8	.018
N of Valid Cases	134		

a. 4 cells (26.7%) have an expected count of less than 5. The minimum expected count is 1.49.

At the same time, 44.78 % of respondents opted for Agree and Strongly agree with the statement “Using a virtual platform technology in the university gives me greater control over my study”, which is understandable considering that one of the main advantages of the online environment is flexibility and the study was conducted at the beginning of the pandemic when students were still struggling to adapt to changes and find a rhythm in the new digital context. However, in the second phase of the study, the focus groups discussions revealed that although they felt fully motivated and organized at the beginning of the emergency e-learning period, they lost their motivation and began to feel less and less in control of their educational journey.

When analyzing the correlation between the respondents’ level of experience with online learning and their perceived control over their study during online learning, the Chi – Square test significance level (sig = 0.030) was lower than the 0.05 threshold, suggesting a dependence (significant statistical association).

Table 7: Experience * Control Crosstabulation

			Control					Total
			Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Experience	Experienced	Count	2	5	11	7	8	33
		% of Total	1.5%	3.7%	8.2%	5.2%	6.0%	24.6%
	No experience	Count	1	8	6	5	0	20
		% of Total	0.7%	6.0%	4.5%	3.7%	0.0%	14.9%
	Some-what experienced	Count	1	21	19	33	7	81
		% of Total	0.7%	15.7%	14.2%	24.6%	5.2%	60.4%
Total	Count		4	34	36	45	15	134
	% of Total		3.0%	25.4%	26.9%	33.6%	11.2%	100.0%

Table 8: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.049 ^a	8	.030
Likelihood Ratio	18.156	8	.020
N of Valid Cases	134		

a. 5 cells (33.3%) have an expected count of less than 5. The minimum expected count is .60.

In terms of overall satisfaction with the use of online learning platforms, 60.45 % of respondents declared that they Agree and Strongly agree with the statement “I am satisfied with the performance of the online learning

platforms". The students' answers need to be correlated with the general perception that this is a temporary situation and that face-to-face interactions will be resumed shortly. Another relevant aspect refers to the fact that most students moved back home with their families during this specific time frame, which provided some extra comfort, which was confirmed in the second stage of this research.

4.2 Qualitative study

The second stage of the research took place between March and April 2021 and consisted of 6 online focus groups with 36 students (24 F and 12 M) from "Gheorghe Asachi" Technical University of Iasi enrolled in bachelor programs from 1st year to 3rd year students. This part of the study aimed to evaluate the student's experience with the online learning platforms after almost a year of usage. The focus group guide consisted of seven questions covering three core themes and the subsequent subthemes (1) Educational impact, (2) Personal impact and, (3) Perceived advantages and challenges, as shown in Table 9.

Table 9: Focus group themes and subthemes

Main theme	Subtheme
(1) Educational impact	Content understanding
	Workload
	Student focus
	Time management and organization
	Evaluation process
	Professor - student communication
	Student – student communication
(2) Emotional impact	Lack of sense of community
	Student motivation
	Technostress
(3) Perceived advantages and challenges	Comfort
	Flexibility
	Adaptability
	Technical challenges

4.2.1 Educational impact

The first part of the focus group discussions was centred around various aspects of their online learning experience. Throughout the six focus group discussions, seven subthemes emerged, namely: (1) Content understanding, (2) Student focus, (3) Workload, (4) Time management and organization, (5) Evaluation process, (6) Professor-student communication and (7) Student-student communication. Some of the subthemes included in this theme are also relevant for the Emotional impact theme, such as professor - student communication and student – student communication, as these are also elements related to the senses of community and belonging.

The participants had diverse opinions with significant differences between 1st year students and 2nd or 3rd year students in terms of content understanding. This result can be explained because 1st year students had limited experience with face-to-face classes, as they started the year online and only had one face-to-face laboratory each semester. However, all participants agreed that for some disciplines, e-learning works better than for others which is understandable considering that many technical disciplines require hardware or lab equipment in the teaching/learning process. Moreover, this also affects the students' workload and time management, as they declared that they require extra time to learn specific disciplines. Another interesting perspective offered by the students participating in the focus groups was that the online environment favours students who are not very keen to learn and provides disadvantages for students who are more focused on their education due to the increased efforts.

"For some disciplines, it's almost impossible to learn if it's only online. At first, I didn't really grasp, but if you really want to learn something, I feel that I have to work double the time to understand what the teacher told us during the online lecture."

Another aspect related to workload mentioned in all focus groups was that online classes had the same timeline as regular face-to-face classes. Also, the professors' online teaching styles varied significantly, which impacted the students' ability to maintain concentration and focus throughout the day. This aspect is confirmed by other studies done during the Covid-19 pandemic, which highlighted that, in terms of frequency and duration of classes, most students consider that the optimal length for an online class is 45 minutes and that they can focus

for a maximum of two to four hours of online classes a day (Muthuprasad et al., 2021). The students included in the focus groups had two and some of them three days a week with six to eight hours of online classes. Many of them affirmed that they find themselves easily distracted during their online lectures and unable to focus after a certain amount of time. A relevant aspect in this context is that most Romanian universities had exclusively synchronous classes on the same timeline as the previous face-to-face classes.

"I have days when we have so many classes that at the end of the day I have a headache and sore eyes."

"It's not that I don't like a class or a professor, I'm having difficulties focusing even when it's a subject that I really enjoy and I regret it because I feel that I'm missing something important. But there are so many distractions around: if I get a phone notification, I'll stop and check my phone."

The participants in the study, especially 2nd and 3rd year students, stated that they feel overwhelmed by the increased number of individual homework and projects they had to deliver as part of their online activity and evaluation. In addition, several other studies mention the increased academic workload of students during online classes in the form of various types of assignments (Armstrong-Mensah et al., 2020; Giray, 2021) which shows that this was a growing trend in universities all over the world.

Furthermore, connected with this aspect, students also listed the difficulty of cooperating with their colleagues when working to create and deliver group assignments and projects, an aspect mentioned in other studies as well and connected with the lack of on-site socialization (Alsoud and Ahmad, 2021; Hebebcı, Bertiz and Alan, 2020).

"I always feel like I'm working on my own and that I am somehow alone. We use the WhatsApp and Facebook groups to communicate and exchange info about assignments and projects, but it's not the same".

One of the results of this part of the study revealed that almost all students miss face-to-face classes and live interactions with their professors and colleagues. The result is in line with other studies analyzing the students' perception of face-to-face learning in comparison with online or hybrid learning conducted before and during the Covid-19 pandemic (Castle and McGuire, 2010; Giannoulas et al., 2021; Ionescu et al., 2020; Muthuprasad et al., 2021). Another relevant aspect, also confirmed by previous studies, is that students' engagement and satisfaction are directly connected with the ability to have personal dialogues with professors and peers (Chigeza and Halbert 2014; Nortvig, Petersen and Balle, 2018; Giray, 2021).

Another important aspect that impacts the student-professor and student-student interaction is the visibility of other people's faces, as most students choose to keep their cameras closed during classes either by choice or because the online platform does not accept a high number of cameras being open at the same time.

The lack of professor-student interaction and lack of professor's support was constantly mentioned as a motive for dissatisfaction throughout the focus groups with 2nd and 3rd year students, which is in line with previous studies conducted on the matter. However, during the focus groups with 1st year students, one exciting result focused on the professor's role and how some professors managed to connect with the students and provide much-needed academic and organizational support. The perception that arose referred to the changing role of the professor, not only as an instructor, but as a mentor during a time of crisis. This result highlights the strong connection between the students' emotional state and their academic performance.

"I have to admit that the professors were way greater than what I was expecting and I was impressed with the way the professors (1st year tutors) attached to us and helped us out anytime we had a problem or a question".

This also confirms that the quality of teaching, and implicitly, the quality of learning, particularly during emergency e-learning, depends on emphatic interactions between professors and students and is driven by professors' motivations and interests.

4.2.2 Emotional impact

The emotional impact theme was highly debated during the focus groups discussions and is analyzed under three subthemes, namely (1) Lack of sense of community, (2) Student motivation and, (3) Technostress.

Most participants' responses throughout the focus groups were centered around their perception of lack of sense of community and disconnection from professors and colleagues, which influenced their motivation and self-discipline to carry on with their studies.

When asked what aspect of their university experience they missed most, all students ranked first social interactions and colleagues, highlighting the importance of the overall students' experience and the university community. Other previous studies highlight the concern over students' lack of sense of community during online learning classes both before the Covid-19 (Joksimovic et al., 2015) and during the pandemic (Giray, 2021; Muthuprasad et al., 2021). In addition, these studies reveal the importance of the sense of community for students' well-being and overall engagement and the impact on their social, psychological, and academic outcomes (Gopalan and Brady, 2020).

"When this started, we thought it's going to be like a short vacation, and then we'll get back to normal. But now that there is a "new normal", I don't like it. I never thought I was going to miss school so much. All I wonder is when will we return to school?"

Many participants declared that they felt fully motivated and organized at the beginning of the emergency e-learning period, but they lost their motivation at some point and began to feel less and less focused and willing to make an effort. This is highlighted by other studies that emphasize that after a period of online learning, students begin to lose their focus and miss deadlines for different tasks (Gherghes et al., 2021). This can also explain the studies revealing that online courses have a 10% to 20% higher failed retention rate than traditional classroom environments (Herbert, 2006).

The aspects of motivation and self-discipline are mentioned in previous research regarding online learning, as this learning environment comes with extra challenges. The challenges are more significant for students who have low self-regulating or self-motivation capacities when it comes to learning, as they tend to face extra difficulties in engaging and succeeding in the online learning process (Dabbagh and Kitsantas, 2004; Golladay, Prybutok and Huff, 2000) and so they begin to skip classes or fail on assignments. In this context, the professor's role becomes crucial, as several studies reveal that the teachers' support is one of the most critical factors in fostering student motivation and engagement (Allen et al., 2013; Chiu, 2021; Roorda et al., 2011)

During the focus groups discussions, most 2nd and 3rd year students used words and expressions such as anxiety, fatigue, demotivation, lack of productivity, inability to focus, all aspects relevant to technostress, the stress induced due to technology and defined as the "problem of adaptation that individual experiences, when he or she is unable to cope with new technology" (Tarafdar, 2007). The prolonged hours spent in front of the computer, the increased number of assignments, and the sense of isolation felt by students after almost a year of online learning contributed to technostress. The emergency e-learning environment, even in a synchronous format, provides a less personal connection than face-to-face instruction. This combination of increased mental health stress and less contact with professors and peers must be an essential consideration for pedagogical planning (Murphy, 2021). And there is extensive research highlighting that this type of technology that induces stress is affecting all members of the academic community: students, professors, and staff (Charles et al. 2020; Penado Abilleira et al., 2020), showing that universities need to provide better solutions to monitor and provide support for this specific matter.

4.2.3 Perceived advantages and challenges

The perceived advantage theme is discussed under three subthemes, namely (1) Comfort, (2) Flexibility, and (3) Adaptability. The first two subthemes were pointed out in different variations by all students. For example, the idea that they can continue living and working in their cities while also continuing their university education gives them comfort. Another positive aspect listed by students referred to the fact that they manage to save time by studying online, as they don't need to commute anymore.

All students mentioned family and friends that having them close during the emergency e-learning period was a significant source of comfort. More than half of the students mentioned the perceived flexibility and relaxed atmosphere of some classes.

The third subtheme was somewhat surprising for the research team and emerged during the 1st year students' focus group when students declared that they perceive this experience as a test for their capacity to adapt and succeed in exceptional situations.

"I'm looking at this as an opportunity to keep up with technology, adapt to exceptional situations and learn how to do things differently. Who knows, maybe I'll start an online business."

When asked about specific challenges, most of the students participating in the focus groups initially discussed only the technical challenges encountered. However, the main technical challenges listed by participants referred to internet access and connectivity, problems with the devices (camera/microphone), or the inability to connect and use the online platform selected by the professor. These results align with previous studies in which students listed the aspects of access to internet connection or infrastructure as the main challenges encountered during online learning (Giray, 2021). However, during the focus groups discussions, other challenges emerged and were included in other themes and subthemes, such as the high number of assignments and projects, the inability to focus due to distractions, the doubled time and effort put into understanding certain subjects or the lack of motivation due to sense of disconnection from the "student life."

"I often have problems with the internet connection during online lectures and I keep getting disconnected and it's frustrating and some professors don't believe me."

"My microphone does not work and I have to write on chat or rely on my colleagues to tell the professor that I am present when he asks me a question and I am not able to answer it"

The challenges listed by students are confirmed by other studies and analyses done in the past year (Khalil, Mansour and Fadda, 2020; Chung, Subramaniam and Christ Dass, 2020; Casey, 2020), which also pinpoint the fact that this swift translation to e-learning has the potential to not only reveal but deepen the gap and inequalities between students. This may also be connected with the fact that students from rural areas who remained home during online learning could only access the online learning platforms through mobile internet.

Regarding preferences for the next academic year, only three students participating in the focus groups opted for fully online classes, the rest choosing entirely face-to-face or hybrid options. The results partially confirm previous studies which reveal the order of preference among students: hybrid, face-to-face, and e-learning (EDUCAUSE, 2020). It is not surprising that most students chose entirely face-to-face, as this is the most standard model for Romanian students. However, what was surprising was that over 50% of participants said that they prefer to have evaluations and exams in an online format, the most common explanation being that they feel there is less pressure and stress during the online exams.

5. Conclusions

Online teaching was one of the main trends in education even before the emergency e-learning situation imposed by the Covid-19 pandemic. However, the Covid-19 and the aftermath bring significant changes and challenges for academia, and the experience from the past year has plenty of lessons to be learned in terms of vulnerabilities and opportunities for all stakeholders involved in the process.

This mixed-method research aims to provide a valuable image of the students' perception of the overall e-learning experience providing information from two different moments of the Covid-19 emergency e-learning process: at the beginning (April – May 2020) and after almost a year of online learning (March – April 2021). The study also involves students who experienced fully face-to-face classes and students who only had one face-to-face laboratory and the rest exclusively online.

On the plus side, the study revealed that students have the necessary resources and knowledge to study using online platforms and to use digital tools and methods, as 74.63 % declared that they have the necessary resources to use a virtual platform and 80.6 % declared that they know how to use a virtual platform. However, the fact that students have digital competencies and access to technology does not necessarily mean that they use a complex variety of digital tools or that they are fully exploiting all options to enhance all aspects of the teaching-learning process. So universities should provide access and instruction for digital tools to facilitate collaborative work among students and students, and professors. This highlights an aspect nominated in other studies, that universities need to tap into students' tech-savviness and translate it to make them more capable of handling the rigor involved in online learning (Sarbotam and Dan, 2020).

The research revealed a statistically significant association between the students' level of previous e-learning experience and their perceived easiness of studying using online platforms (sig=0.033) or their perceived control over all aspects of their education (sig=0.030). This result is in line with other studies highlighting that students

who were used to online or blended learning managed to harness better the advantages provided by e-learning during Covid-19. At the same time, during the second stage of the research, the discussions with 1st year students revealed that although they started the academic year entirely online and had no previous e-learning experience, they managed to adapt and even enjoy the experience due to their professors' and tutors' involvement.

During the qualitative research stage, many students declared that although they felt motivated and organized at the beginning of the online learning period in March 2020, they lost their motivation and started feeling less and less in control of their studies as the Covid-19 e-learning period progressed. The difficulty to remain on task and maintain focus and self-motivation through-out the online-learning period is confirmed by other studies (Kalman, Esparza and Weston, 2020; Giray, 2021) and highlights another relevant aspect, namely the fact that improving access to information does not necessarily translate to knowledge and skill acquisition, as professors are essential in guiding these processes for students (Njenga and Fourie, 2008). Related to the same aspect, the study revealed a change in the perception of the professors' role as it is no longer perceived just as an instructor and deliverer of information but as a facilitator and mentor. And this can put even more pressure on professors who are already forced to rethink and redesign their curricula and teaching pedagogies and instruments for the online environment.

The study also pointed out several drawbacks perceived by students that can be considered when designing and delivering online classes and highlighted the importance of community and social interactions as an intrinsic part of the learning process. The prolonged social distancing and the lack or limited interactions with professors and colleagues took a toll on students' motivation and overall mental health. So, although online education can provide many advantages in terms of flexibility and access, universities must develop strategies to encourage collaboration between students and create opportunities for connection. Because the results of the study highlight once again the importance of the overall "students experience" that goes beyond the academic aspects, and finding solutions to build a sense of community when designing and implementing e-learning should be a pivotal point of the process.

The lesson to be learned in this context is that we are all in this together, equally affected and equally responsible. The way we decide to approach our teaching and learning environment sets the tone for how we will come out of this pandemic and this emergency e-learning experience. Because this may be an exceptional situation, but e-learning is "here to stay" in academia, and when properly designed, it can bring significant benefits to all parties involved.

The research has several limitations because it included only students from "Gheorghe Asachi" Technical University of Iasi. Further research could be done to cover a higher number of students from different universities. Another aspect not included in this particular study but is highly relevant is the professors' perception of the online teaching experience. They are also facing challenges and difficulties in this process, which impacts their motivation and performance. Plus, as revealed by this study, the professor's role and job characteristics are changing under the influence of this new context, and so future research should focus on this relevant unintended consequence of this situation.

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Education and COVID-19: Learning Arabic Language and Perspectives

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Abstract: The study discusses the online teaching and learning of Arabic in order to evaluate students' difficulties and the way in which to approach this language in an interactive way, overcoming the barriers of computer screens. Nevertheless, e-learning is the future of education and it is crucial to offer a quality education, implementing emotional learning consciousness within the academic community. The COVID-19 pandemic impacted practically every country in the world. It created an extremely difficult global situation, and humanity found itself faced with an emergency state of working online and swiftly adapting its routine to a new reality. This was certainly the case in Spain when, in mid-March 2020, students were forced to study from home and teachers to teach at a distance. COVID-19 - and its related restrictions arrived suddenly, and there was little to no time to acclimatise to the new way of studying. The objective of this study is to analyse the difficulties faced by students of Arabic as a foreign language, and to offer some recommendations to improve online teaching, applying the communicative framework, combined with the importance of introducing the psychology theories and emotional education which is key to obtaining positive results. First, the topic is introduced, then the way to teach and learn the Arabic language online is discussed. Afterwards, the methodology is defined, highlighting the relation between emotional education and the Communicative Approach. A hypothetical-deductive method is applied to this analysis. A questionnaire is responded to by students of the Arabic language in Spanish universities in order to get an insight into their difficulties when learning online. A qualitative study is carried out in order to analyse the problems faced by the students and offer some possible recommendations to improve the quality teaching of Arabic as a foreign language, based on the perceptions of the students, taking into account the social context experienced during the 2020-2021 academic year.

Keywords: Learning Arabic Language, COVID-19, Psycholinguistics, Dynamics of Language, Teaching Arabic, Emotional Communication

1. Introduction

When the COVID-19 virus was first identified in Wuhan, China, in December 2019, a feeling of concern reached all corners of the world, though, little did people realise just how huge an impact COVID-19 would have. It later became apparent that, in a large part due to the relative freedom of movement between countries, the virus would spread alarmingly quickly. Indeed, just a few short months later, many countries found themselves in the midst of an uncontrollable situation, as the unknown virus began to seriously threaten the lives of the citizens all around the world. Given the distinct lack of warning, scientists - though not for the want of trying - were unable to find a quick remedy, and societies were left ill-prepared to face this crisis.

The first official cases of covid-19 in Spain were confirmed in March 2020 and a matter of days later, the central government took the decision to impose a total lockdown (Cabrera, 2020, p. 115). This was a completely unknown situation for the majority of Europeans, and one which created a feeling of insecurity, stress and perplexity. University students were not exempt from this feeling as they were, from one day to the next, forced out of their lecture theatres and onto their computers to embark on their distance-learning journey. As explained by Priyo Atmojo and Nugroho (2020, p.50): "This pandemic causes the fully online language learning to occur in a sudden and completely unprepared situation".

Even under normal conditions, studying the Arabic language is an immense challenge for students at Spanish universities. When opting to study this language, the Spanish learners are fully aware from the outset that they are attempting to grasp a Semitic language – a language with a completely different alphabet and characters, vocabulary with different roots, and considerably more complicated grammatical structures than other Latin languages such as French and Italian. The already-daunting challenge of learning Arabic is intensified even further when adding the COVID-19 complications, and online learning, to the equation. Even though the classes are done by videoconference, thus offering the students the possibility to practice, ask and interact with the teacher and classmates live, the computer screen creates an additional, unwanted obstacle, as Octavio (2021, p. 45) states: with the arrival of the post-COVID era, it could be necessary to modify the archaic structures on

which our current educational system is based. This situation has been discussed in detail by several specialists including Rapanta, et al. (2020, p.923) who commented: “The COVID-19 pandemic has raised significant challenges for the higher education community worldwide. A particular challenge has been the urgent and unexpected request for previously face-to-face university courses to be taught online”.

Universities were presented with the task of, in a just few short days, adapting the necessary online platforms in order to offer classes respecting the usual schedule, only now they would be held in virtual classrooms (Cabrera, 2020). This online mode permits the continuity of teaching directly through screens, virtually and – rather importantly – live. Each university in Spain opted for the fully virtual or online learning, although some other possibilities were proposed during the second wave of COVID-19. This is reported by Priyo Atmojo and Nugroho (2020, p.52): “The widespread use of online learning inevitably brings students into alternative places for online language learning (Plaisance, 2018). Online language learning (OLL) may point various learning adjustments, namely a web-facilitated learning, a hybrid or blended learning, and a fully virtual or online learning”.

In Spain, the glaringly obvious factor that has changed is the shift from the traditional face-to-face classes to an online mode, but many further difficulties arose as it progressed (Area-Moreira, et al., 2021). A case in point is related to technological knowledge and equipment; some students experienced difficulties attending the online sessions due to Internet and Wi-Fi problems, while others encountered troubles with the platforms. However, it was only a minority who suffered from these problems. A much more common issue is in fact a mental one. Students find themselves in the near-impossible situation of trying to concentrate for hours on end in front of a screen; interest can easily be lost, especially given that classes can be taking place in large groups with infrequent involvement of the participants. Octavio considers that the lack of real and effective digital competence within the classroom became clearer when the traditional face-to-face class model was replaced with an “emergency” online teaching model (2021, p. 48).

This article offers an opportunity to reflect on the needs of students of Arabic as a foreign language. As it is a different and difficult language to learn, it is hugely important to accompany students in online teaching and it also gives educators the opportunity to introduce emotional mechanisms in order to offer an attractive learning environment, despite the difficulties encountered due to the nature of the language and the new way of teaching.

1.1 Research Problem

This study analyses the problems encountered by Arabic language students in Spain to investigate their needs and offer possible recommendations that could improve education in the linguistic field to achieve a quality education, which is one of the objectives of sustainable development. It is part of the role of the modern-day teacher to detect the problems encountered in class in order to offer solutions that allow education to be improved and promote emotional education, which is important for successful results and, above all, to train citizens to be capable of reflecting and adapting to the changes that arise in life. E-learning causes several difficulties: the discomfort of spending hours in front of the screen, little participation by some students, low levels of concentration and the lack of motivation to encourage reflection of the methodologies that could help to engage the student in the class (Teräs, et al. 2020, p. 863).

E-learning is not a passing fashion, but it is the future of teaching and it is time to prepare ourselves to produce a quality education for future generations. Several other factors that slow down the teacher’s dynamic must also be considered, such as the reduced time of the classes, the increased need to translate into another language to achieve some goals due to the few hours per week of Arabic class and the way of evaluating the learners, as well as the necessity to include technology-based pedagogy (Al-Awawdech and Alshtaiwi, 2020, p. 11551).

The biggest questions posed in this research is: what are the problems encountered by students of the Arabic language? And what will be the best way to correct these failures and help improve the e-learning that is the future of teaching?

The following section analyses the factors that have hindered the teaching and learning of the Arabic language online.

2. Literature review

2.1 Learning Arabic language

Arabic teaching has abruptly changed from the face-to-face mode to the online mode and several points should be taken into account in order to offer possible explanations regarding the difficulties encountered by the students.

Communication in language classes at university tends to be direct. The teacher is the sender of the information or the message and the students are recipients (vertical communication) and when it comes to language and culture classes both parties play an active role in the class (horizontal communication). However, being forced to partake in online classes typically has a negative influence on student motivation and interest, further complicating the environment in which the class takes place (Coman, et al., 2020). This point is explained by Priyo Atmojo and Nugroho (2020, p.78) as follows: "In online learning, it is also hard to strengthen the emotional bond between the teacher and the students. It is due to the absence of physical touch and interaction in online learning".

The screen as a channel for broadcasting information quite clearly hinders the enthusiasm of students and creates a barrier between the student and their teacher as well as between the student and their classmates, which is a factor that impedes fluid communication, and that requires a certain air of technological solutionism (Trujillo Sáez, Merino and Gabarrón Pérez 2019, p. 154). In order for communication to remain effective, this handicap must be overcome, and systems must be improved by specialists in the educational field. Reimers and Schleicher (2020, p.7) explain it like this: "Education leaders should adopt a proactive approach to contributing to the mitigation of the impact of the Pandemic and to prevent learning loss during the period of necessary social distancing".

Once communication has been lost with a single student, for whatever reason – and there are several causes, such as misunderstanding, poor signal or purely the difficulty of the topic discussed – communication can quickly be lost with the rest of the participants. Trying to re-establish the initial lost connection requires some time and can in turn lead to other members losing interest as their attention wanders to other, non-related topics and their attention can be diverted by distractions such as a mobile phone. Recapturing focus demands innovation through the implementation of different creative processes (Octavio, 2021). With this loss of concentration, the train of thought is lost, and regaining it requires a great effort. In this case, extrinsic motivation is required, which means that the students expect something to happen to motivate them (Van Nguyen and Haòk, 2021). If each student expects an external incentive to mentally reconnect and follow the flow of the class, the teacher is faced with different personalities with different characters and a variety of interests. Student expectations can also be varied, as explained by Rapanta, et al. (2020, p. 929): "Simplify; cut back expectations; help reduce anxiety. Students will simultaneously be having to adapt to new ways of teaching and learning and deal with all the logistical complications and emotional stress of the pandemic and its associated lockdown".

It seems that the responsibility returns to the student to improve their concentration skills and not allow their attention to be diverted by other distractions, but the teacher must also cater to each individual student's interests and teach the language in a dynamic way that makes it more personal and relatable for the learner in a fun and stimulating way. This is a far from straightforward task. In addition, attentively listening to classmates provides a huge benefit, as students are given the opportunity to take advantage of the mistakes of others and promote deductive learning. However, it is difficult for this learning method to be applied and controlled through screens (Pérez-López, Vásquez Atochero and Cambero Rivero, 2021), especially when students opt not to turn on their cameras, making it even more difficult for the teacher to perceive what has and has not been understood.

Fortunately, there are several useful platforms which allow for group work to be carried out. By dividing the class into several reduced, private groups, bonding and closeness between students is enabled, providing the option of speaking directly with their peers in order to debate, exchange ideas and complete exercises together. These are activities which generally stimulate students who do not want to speak in class from behind a screen (Amutan, et al. 2020).

Not only does learning Arabic require a huge exertion during the timetabled lessons, but students must also make a conscious effort outside of the scheduled hours. Extra studying in the students' own time and reviewing to reinforce vocabulary learning, for example, and not just revising the day before an exam is more than recommended: it is essential. Further difficulties arise here. The material in Arabic must be clearly explained, enabling unsupervised studying. The material is often written only in Arabic and the student may well become discouraged should they have to translate everything into their native language. Therefore, effective communication through email is needed so that the student knows exactly what to do in their own time for self-study sessions.

Another issue arises here, which is that the teacher can be forced to translate the classes into other languages so that the students do not get left behind, especially given that time is even more restricted when teaching online (Vermes, 2010), although other scholars consider it a beneficial option for language teaching (Dagilienė, 2012, p.128). An ideal teaching methodology does not include translating into other languages, something which is feasible in face-to-face sessions given that the teacher can use various objects, methods, or non-verbal communication to help get the message through. Online classes, however, do not facilitate this communication and as a consequence translation is often used; a recurring problem especially with beginner levels, and even more so in Arabic. Without these translations, the student is faced with a language which is extremely difficult to understand and that can quickly lead to a loss of attention and interest; once the frustration sets in, it is difficult to keep up with the lesson right until the end (Coman, et al. 2020). For these reasons, the importance of looking for, and using, various communicative and interactive tools helps to capture and maintain the students' attention cannot be underestimated. Rapanta, et al. (2020, p. 925) explain: "Online learning and teaching involve making use of a diverse array of tools, resources, pedagogical approaches, roles, organizational arrangements and forms of interaction, monitoring and support—with many possible combinations of substitution and integration".

Therefore, both the teacher and the student must be flexible, open-minded and willing to learn these tools, as discussed: "In the COVID-19 emergency situation, teachers have, almost overnight, been asked to become both designers and tutors, using tools which few have fluently mastered" (Rapanta, et al., 2020, p. 926).

Faced with these challenges and a rapidly changing role, teachers have a far greater task.

2.2 Teaching Arabic language

The teachers have the great responsibility of transmitting information whilst at the same time arousing the interest of the student, thus all information must be well-presented, understandable and practical. Of course, the collaboration of the student is vital if the outcome is to be a positive one. University professors have had to adapt quickly and seamlessly to the online platforms and a brand-new set of technological systems (Maican and Cocorada, 2021). Ideally, Arabic teaching should adapt to this technology for effective communication in the classroom.

The teacher must make the effort to create extra material, especially audio and visual content, to allow the new concepts to be easily understood. Students born in the 21st Century are used to having large amounts of information thrown at them and the easier and more accessible it is, the better it is for them. Hence, platforms such as PowerPoint - with descriptive images and videos with easy-to-absorb illustrations - are key to helping the student study alone at home. A variety of resources can help teachers, such as glossaries, word banks, sample or model responses, sentence starters and clear and concise instructions (TNTP, 2020).

Effective use of materials in online teaching is a key ingredient, as it is a constructive way to present content accurately. Suitable materials are accurate in content, accessible to students and adequate to their level of autonomy; moreover, they should fit within the overall learning design (Pokhrel and Chhetri, 2021, p.139). Some materials might have the desired effect because they are thought-provoking and stimulate reflection, others because they require interaction, others because they present the content clearly, etc. The same could be said for students producing material; it can be an intriguing and useful activity as long as it is strategically placed in the course syllabus. Distance learning offers numerous ways of efficiently transmitting information.

The most effective form is often said to be the synchronous mode so that direct contact with the student is constantly maintained, though features of the asynchronous mode are, on occasion, also recommended (Perveen, 2020). In Spanish universities, individual tutorials are often offered, and it is a benefit that the student

can take advantage of to resolve any problems or misunderstandings that they might be reluctant to bring up in a full class with their peers. In addition, the creation of PDF documents and video compilations detailing the vocabulary studied in class are simple but effective ways of informing students and aiding their learning after the class, despite the communication being via email rather than direct.

Another issue to be addressed in this article is the assessment of students. One of the primary concerns is exams, with the length of the exams in front of a screen prompting complaints from a number of students. One methodology that many universities are following is to set time limits for each individual question. Some potential barriers can be overcome by creating pre-test practices so that students can train prior to the day of the exam. Repetition is one way of helping students improve this part (Ghazi-Saidi and Ansaldo, 2017) and some methods include creating online quizzes in the forms of multiple choice and true or false questions. Online written exams are said to be particularly frustrating for the majority of Arabic language students.

For students tackling their end of degree projects, communication can be sped up by using a wider variety of tools. As these projects are completed individually or in very small groups, it is possible to use the mobile telephone to facilitate communication, for instance holding question-and-answer sessions through the instant messaging application *WhatsApp* to give personal feedback.

It goes without saying that creativity is essential on the teacher's part, though the students must play their part by responding positively to the proposals (Cimermanova, 2015, p. 1971). Thorough preparation by the professor is highly important. However, the teacher's groundwork for an online class requires significantly more time, effort and inventiveness than face-to-face classes in order to give as much detail as possible to students, as clearly as possible, to suit a variety of contexts and learning styles.

The importance of student participation is obvious; hence, teachers must find creative, inventive ways to adapt the material, provoke dynamic exchanges, and challenge the student to participate and not lose their interest (Ellis, et al., 2019, p.1).

This brings us back to direct translation. This methodology is far from the most effective for achieving excellent results in language class because the student gets too used to, and possibly reliant upon, translation; it is a traditional method, but a method which makes it difficult to improve one's level of the Arabic language, as explained by Correa (2014, p.163): "The reality is that, after only six or seven semesters of language instruction, students are very limited in what they can do with language". Thus, the students' self-discipline to exclusively use the target language, in this case Arabic, is fundamental, despite the fact that online learning makes this difficult with the beginner levels.

In summary, the common goal is to achieve a high quality of teaching and this is attained through a great deal of effort from both sides: the teacher as the person responsible for transmitting the information and the student as the recipient of it. The teacher can provide socio-emotional support, innovation of education, discipline, incorporation of technology, individual tutoring and small learning groups to facilitate equal process in critical subjects which are fundamentally important (IESALC, 2020, p.6), and the student must collaborate - otherwise, the communication system fails. Interaction is essential in language classes (Deli Girik Allo, 2020), and pushing students to participate is more than recommended, as Guofang (2020, p.41) comments, promoting meaningful interaction in the classroom and engaging students in the assessment process are important. In this way, an equal and inclusive education can be provided for everybody (IESALC, 2020). The student must participate in this process to prepare or review the material that is written or orally communicated (Rapanta, et al., 2020, p.928).

Taking everything into consideration, the difference between face-to-face classes and online classes is limited to the following points: "[...] three key differences between face-to-face and online learning include (1) space and presence, (2) self-presentation, and (3) interaction" (Rapanta, et al., 2020). Therefore, online teaching and learning require careful consideration with regards to how technology can facilitate the types of interaction being sought.

3. Methodological framework

Various specialists studied theoretical approaches to language learning and acquisition, and contributed significantly to the study of language as a scientific discipline. Some of the noteworthy studies include:

Bloomfield (Structuralism), Skinner (Behaviourism), Chomsky (Innatism) and Halliday (Socio-linguistic approach). These are extremely important theories of language learning (Assaiquli, 2013). In this analysis we focus on the contribution of the second linguist (Skinner, 1957) who advocates for the practice of the language in a favourable environment to be acquired. According to Assaiquli: "Thus, for the behaviourists, imitation and practice are the essential mechanisms for the language to be acquired or learned" (2013, p.38). Students in Spain do not live in an environment that favours the practice of the Arabic language, as there is very little contact with the target language; typically, the only reference they have is the teacher who listens for a limited period, which can vary depending on the amount of time offered by the university. This time should be used to maximise practice with phonetics, syntax and morphology; therefore, translating Arabic into a foreign language is not the best way to acquire the language (Dagilienè, 2012). The lack of exposure to the target language can be seen as a huge barrier for learners of Arabic. Students of the Arabic language do not have a great deal of opportunities to listen to and read in the target language in their day-to-day lives as can be done with other languages such as English, which is almost unavoidable; there is a huge amount of exposure to the English language due to its dominant presence in media, entertainment and commercial products in countries throughout the world. Arabic learners are limited to being exposed to Arabic in class if an extra effort is not made by the learners to search for additional resources. The pedagogical and virtual materials in Arabic are scarce compared to languages such as English and, to a lesser extent, Spanish and French.

The second reference mentioned in this section is Halliday (1975 cited in Assaiquli, 2013) who claims that language is learnt through understanding the cultural context. For the author, the meaning of words is built thanks to the understanding of the cultural context, and culture is interpreted in semiotic terms. It is a reality in which professors regularly find themselves when it comes to teaching Arabic as a foreign language. It is difficult to understand the denotation of words if the social context is not understood; hence, understanding the connection between the teaching of the language and the culture is essential for the proper functioning of the class. Some Spanish universities offer reasonable hours for teaching both areas, whereas others do not due to time constrictions. Here, too, time is a key to achieving goals, and online teaching – for now – is making it even more difficult to succeed, especially when the student becomes so easily distracted. For this reason, capturing the interest of the student is important and their cooperation is essential (Hlas, Neyers and Molitor, 2019).

Our position is aligned with Skinner and Halliday, which is that practice and repetition within the class allow for the understanding of phonetics and structures; and the teaching of the sociocultural context helps the learner grasp a foreign language. Kóvacs (2017, p. 84) agrees, highlighting the importance of teaching language and culture at the same time using various types of authentic materials.

The language must be taught from the point of view of phonology, morphology, syntax, sociolinguistics and pragmatics (Ellis, et al., 2019), without forgetting the psycholinguistic side because the importance of classroom phenomena is motivation; the relation between psychological variables and language learning, and the intersection between educational practice in general and language teaching in particular. The issue of psychology in language teaching is an interesting one, and even more so in teaching the Arabic language online during the lockdown period of 2020-2021. Psychology in teaching covers several topics and we focus on behavioural psychology (Cherry, 2016), which is an area of psychology, defined by Hanim Rahmat (2018, p.3) as: "a branch of psychology that focuses on the study and alteration of people's behaviours, including their actions, emotions and thoughts". Many studies were subsequently generated focusing on various points related to mind and language such as linguistic coding or decoding of it, the factors that affect linguistic perception, understanding, production of the language and emotional education (Guslyakova y Guslyakova, 2020).

Psychology is helpful in understanding the way of teaching and the way of language acquisition by students. For this reason, teachers look for strategies to convey the message so that it is understandable and enjoyable at the same time. Therefore, emotional communication is essential for the student to perceive the message more easily and with greater interest. It is important to propose activities that allow dialogue and participation to enjoy learning. In Online classes this is made possible thanks to the division of the class into small groups so that the students feel comfortable enough to converse and create dialogue. Taking into account the psychological side in language class is important as Aksoy (2016, p.65) points out: "Knowledge of psychological factors involved in the process of language learning and teaching is indispensable for teachers of languages".

Several theories are combined when teaching a foreign language, from the most classic, which is focused on the structure of the language and semiotics, to the more modern ideas which have a larger emphasis on the way of

thinking of the student and the functioning of the brain. This study is not about analysing the set of theories, but combining them because each one contributes to high quality teaching. Skinner and Halliday's theories have been highlighted as they are fundamental for the teaching of any foreign language, and the theory of emotional education (Cohen, 2006, p. 27) is also emphasised as that allows us to understand the receiver of the information to optimise results.

According to Chou (2021) the psychology of education and positive emotions are important in improving the teaching-learning processes. Language is said to be closely connected to thought. This point is raised since the attitude of human beings towards any activity is conditioned by engagement and motivation and it is linked to the thought process. Hence, there is a need to study the elements that allow the acquisition of the language; the student's psychology is an essential component, as highlighted by Long, et al. (2011, p.6): "Pure' psychology tries to arrive at general theories that can help us understand basic areas such as learning, memory, motivation, etc. However, practical education is a complex situation and there are often many factors that interact or combine to give rise to a number of different effects".

A hypothetical-deductive method is applied to this analysis. It has been noted that students who have a tendency to study achieve good results regardless of the length of the class, while students who are less engaged in class, from the same group, complain about the difficulty of studying Arabic online and they find themselves losing concentration quickly. This hypothesis is defined as follows: "This process of identifying a theory, making a prediction that tests it, and then collecting data to see if the prediction is supported" (Long, et al., 2011, p.3). This statement is completely psychological because once the student has put up the barriers, keeping up with the class becomes more difficult, and without the student's motivation the teacher struggles to find a way to connect with them. The aim is to analyse this situation in order to propose some recommendations for the teaching of the Arabic as a foreign language.

A questionnaire is addressed to students in order to understand their motivations. A quantitative study measures the interest of students in studying the language online and assesses their concerns in order to obtain statistics that allow us to comprehend the principal concerns of the students.

Likewise, a qualitative study is carried out in order to describe the problems faced by the students and offer some possible solutions, based on the perceptions and emotions of the students regarding the new reality, taking into account the social context experienced in the year 2020-2021. As the authors (Long, et al., 2011, p.5) express: "The emotionalist model is primarily interested in looking at a situation from an individual's point of view, and is interested in perceptions and emotional reactions to situations".

The objective of the analysis is not merely based on a study of language skills (listening, speaking, reading and writing), but on understanding the student who is learning the Arabic language online during the pandemic. This pandemic has modified the routine of learners from the psycho-educational point of view, as the same authors claim: "When psychology is applied to a number of different areas in education, it has the potential to help us to understand what is happening, and to make more logical, informed decisions about the best way to organise the educational process" (2011, p.10).

Maslow (1962) considers self-confidence to be a need for survival alongside some other basic physiological needs. The author expresses the needs as follows: needs for self-realization (self-fulfilment); self-esteem needs (self-worth, success); social acceptance needs (affection, love); security needs (protection) and physiological needs (food, water, air). Fredrickson (2001) also presents positive emotions as ways to expand and develop their own skills. This is a requirement which is taken into account in the practical analysis.

A questionnaire completed by students is analysed in order to come to some conclusions about learning Arabic online and to prove the enormous importance of a motivation when learning a foreign language, such as Arabic.

4. Data collection and analysis

A questionnaire has been carried out through the Drive platform in order to find out the difficulties of the students. A total of 12 questions were asked and students were encouraged to answer with complete objectivity in order to gauge their true opinion. Some questions are open and offer an open space to answer, while others are closed questions and should be answered with a 'yes' or 'no' answer.

These 12 questions address various aspects related to virtual teaching. The first three refer to questions related to the consequences derived from the change from face-to-face to virtual classes, the degree of influence of online teaching on student motivation and the relationship between the duration of the classes and the student's level of concentration. The next three questions focus on content such as the visual quality of the published and/or projected material, and the usefulness of current digital platforms for communication and their use for interaction between students. From questions seven to nine, the questionnaire addresses the student's preferences and whether they are more inclined to favour visual digital material or traditional textbook exercises, the difficulties that the student studying Arabic at home may encounter and the amount of effort, if any, the learner makes to complete the additional, optional exercises provided by the professors on the online platforms. In the last block of questions, the questionnaire covers aspects related to the student's organization to improve their learning and progress: if they choose to study and review weekly or only revise before an exam.

The questionnaire was published online on December 4th, 2020 and withdrawn on the 31st of the same month. It was mainly distributed among the students of some Spanish universities, although it was open to any Arabic language student wishing to participate. The results of each question are displayed as a percentage. 101 students answered and the results obtained are detailed in the next section.

5. Results and discussion

The results obtained show that 59.4% consider that the change from face-to-face classes to the online mode has been difficult for them for the following reasons: the difficulty of staying focused online, concentration issues, problems with contributing and participating in class and comprehension difficulties when attempting to interact orally, external distractions and the capacity to concentrate decreasing since there are more stimulus and it is harder to focus on a screen for 6 hours a day. Other concerns include: loneliness in front of the screen, the lack of taking notes because everything is done through the computer, lack of social interaction, being confined to the house for days and not having social contact having a deep effect on mental health, interaction restrictions, difficulty to be 100% focused on a lesson from the beginning to the end.

Some students reflect that in terms of grammar and writing it has not been so testing, though there have been more problems related to pronunciation and not being able to see exactly how the professor pronounces a word. The difficulty is also due to the fact that a totally different alphabet is used in Arabic compared to the Spanish language and other commonly-used languages in Spain, such as English and French. The lack of interaction with the professors and the other students means that greater levels of concentration are required online in comparison to attending a class in person, as well as some inevitable technical difficulties. These are commonly-mentioned problems in literature reviews by various scholars (Pérez-López, Vásquez Atochero and Cambero Rivero, 2021). Some students have a more positive outlook and think that while it has been difficult in terms of taking notes, they have not noticed a huge difference and they are generally content with the results. Others believe that the more familiar with the online platforms and their functions they became, the easier the classes seemed. In addition, some students mention that the main problem was the general, unfortunate health situation created by the pandemic.

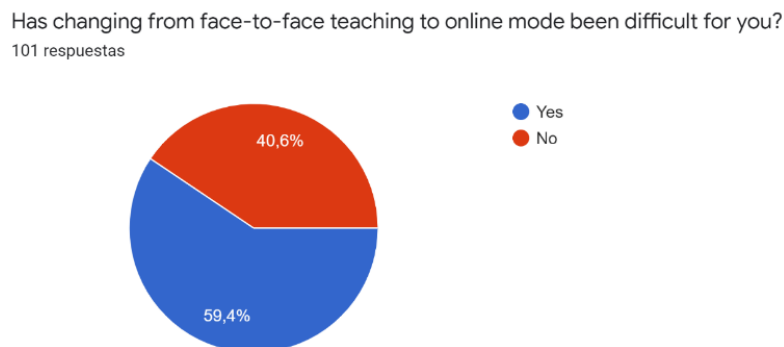


Figure 1: Changing from face-to-face teaching to online mode

As shown in figure 2, 64% of the students reported that their motivation did not decrease when learning the Arabic language in an online mode, compared to the traditional setting. Of the remaining respondents, some believe that paying attention is more trying; not physically seeing colleagues or being able to completely disconnect from the classes makes it even tougher. It has been argued by some students that language learning requires human interaction, and online classes lead to a considerable decrease in interaction and active participation, a point mentioned by Ollero Ramirez (2014) in her analysis. Others think that motivation has decreased in every subject, so it is not merely an issue of studying Arabic. The absence of the social aspect and studying together was the main factor for the decrease in motivation and the lack of concentration, as explained in the theoretical section. Therefore, emotional solutions to engage students is a necessity in pedagogy if educational quality is to be achieved.

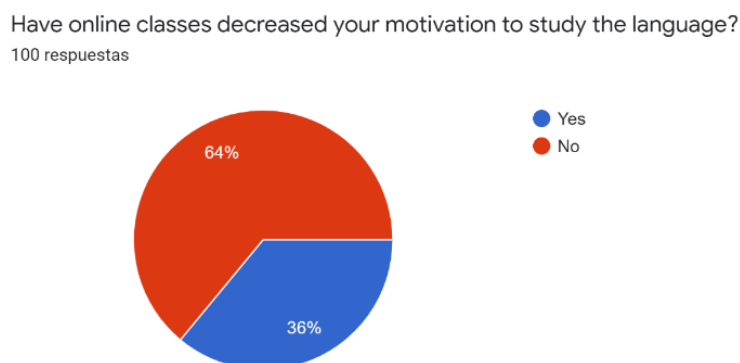


Figure 2: Motivation

Findings showed a substantial increase (67.3%) in the number of students who consider that it is difficult to concentrate. The main struggles, according to the interviewees, are the following: the sheer quantity of classes to attend online, the distractions at home and a lack of concentration in a family environment, and a general mental fatigue caused by the monotony of being in front of a computer screen all the day; an aspect observed in the theoretical part. Laremenko (2017) highlights the importance of introducing online games to motivate language learners.

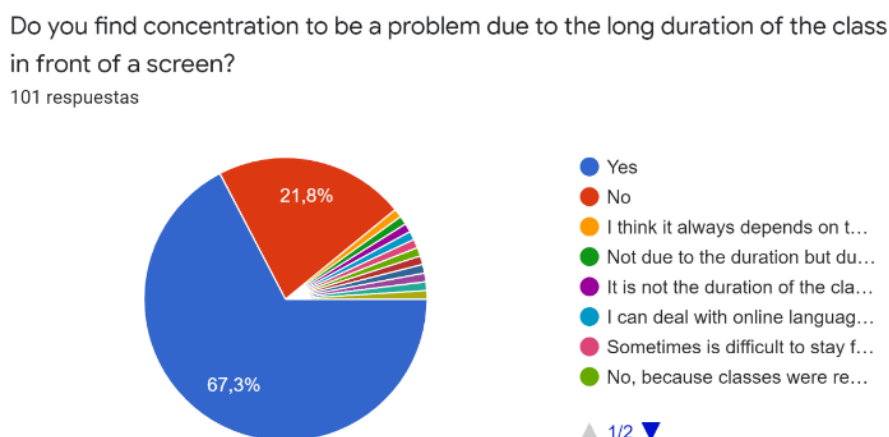


Figure 3: Concentration

Of the respondents, 88% indicate that the material posted, such as PowerPoint presentations, could be easily and clearly seen. Some suggest that videos are easier on the eye, while there are those who prefer the material physically, i.e., on paper. Thus, spending time creating audio-visual material is key to improving this aspect, even if this means that teachers having to dedicate a substantially greater amount of time and effort to their class preparation.

Can the material posted, such as Power Point presentations, be easily and clearly seen?

100 respuestas

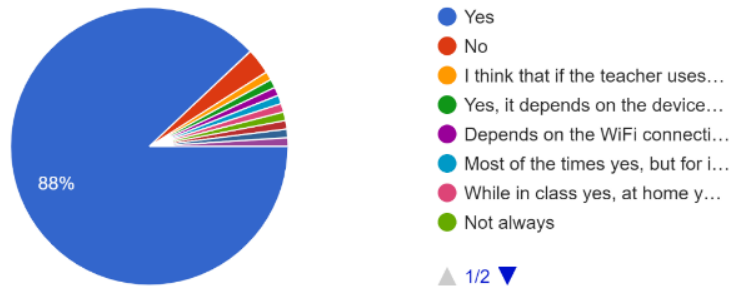


Figure 4: Material

56.4% of the students think that the online platforms are practical for engaging in conversations with colleagues and helping to improve communication. It is an essential element that must be taken into account when striving to improve the methods and dynamics in the Arabic-language classroom. This is a point which is analysed in the theoretical segment and reflected throughout the survey.

Are the online platforms practical for having conversations with your colleagues and improving communication?

101 respuestas

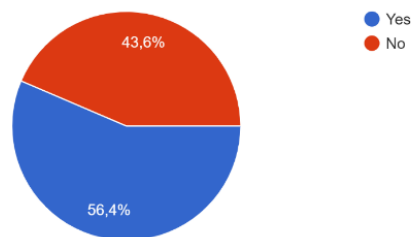


Figure 5: Communication

65.3% of the students consider it possible to maintain interaction with colleagues through the platforms. Educational emotion is crucial in improving and maximising interaction between students, and it can be achieved with the help of creativity and coordination between teachers. Emotional education is key to boosting the ability to solve problems flexibly and responsibly (Gallardo-López, 2018, p. 2).

Is it possible to maintain the interaction with your colleagues using the platforms?

101 respuestas

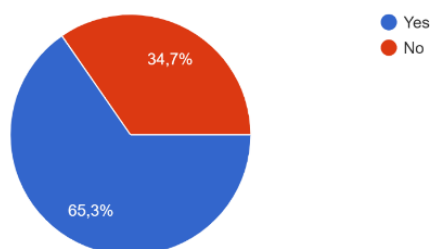


Figure 6 Interaction

60% of the respondents consider that the visual material (such as Power Points and videos) is more interesting for them than the exercises in the book, while the rest do not agree. Some students consider that videos with Arabic and Spanish subtitles and simple images that help memorize new words or expressions are welcome because it makes the class engaging, interesting and more easily understood. Others prefer a combination of the textbook and extra material. Visual material, in general, is helpful according to the students and some consider that short quizzes, such as Kahoot, are useful. As discussed in the previous section, time-consuming though it may be, it is a worthwhile effort to offer aesthetically pleasing and stimulating material which helps keep the all participants engaged for the duration of the lesson, as we have analysed it in the theoretical approach

Is the visual material (Power Points, videos) more interesting for you than the exercises in the book?
100 respuestas

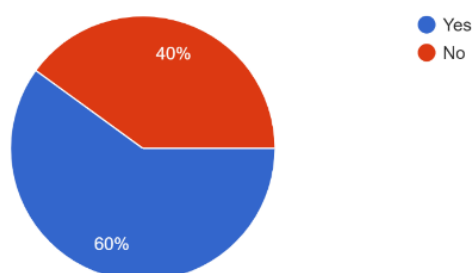


Figure 7: Visual Material

Only 32.7% of the students think that it is difficult to study at home due to the material being written in Arabic and there being difficulty in understanding the words and sentences. For some students, learning the content is less attainable because they are alone and sometimes there is no one to ask regarding specific issues; others claim that it's not so hard because there is access to online dictionaries. For some students, understanding the material is difficult even when attending class in person. Some students think that it was quite challenging to learn the basics of Arabic, but progressing from the basics is not so hard. In addition, teachers can always be asked to clarify any difficulties by email. For others, the videos are usually more difficult to fully understand. Once again, the need to accompany the students to provide quality teaching is plain to see, as we have seen in the literature review.

Is it difficult to study at home because the material is written in Arabic and it is difficult to understand the words and sentences?
101 respuestas

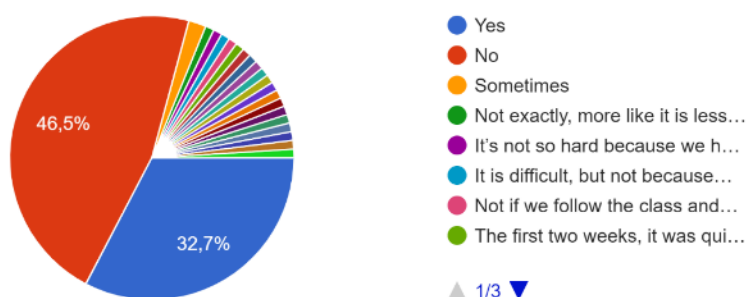


Figure 8: Arabic Material

A total of 70.3% of the students affirm that they take the time to study independently by listening to audios and/or reading vocabulary lists posted on the online university platform. Some students claim that they do not

have enough time to do so and they intend to find some time during the University holidays to recap everything and begin memorizing the vocabulary. Others do it sometimes but not always, since it is difficult for them to find the self-motivation without attending weekly classes in person. It is, once again, clearly shown that the support of teachers is more than necessary and motivation is key (Darling Hammond, et al., 2019) to help learners overcome these difficult times and continue their development and education.

In addition to the exercises set by the teachers, do you study independently to listen to the audios and / or read the vocabulary posted on the university platform?
101 respuestas

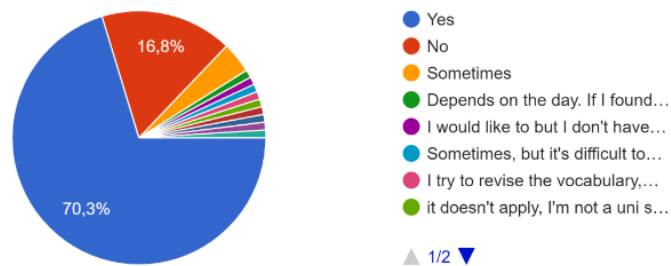


Figure 9: Study independently

When asked how many hours they spend at home reviewing and revising the lessons, the majority of students said that they study for one hour a week, a reasonable percentage between two and three hours a week, while a minority dedicate four hours a week to review and revision. Some students study just before the exams because they have other subjects, apart from Arabic, to dedicate their time to and it is high on impossible to fully commit to everything when having online classes. 57.4% of the respondents state that they review the content of the classes weekly, while and 42.6% admit that they do not do so.

This question is not concerned with students preparing the content before the classes, but reviewing and consolidating material from previous classes. Some linguists do, however, choose to push students to prepare the content before the class. It has been suggested by Algayres and Triantafyllou (2020, p.397): “The Flipped Classroom (FC) is an instrument method, where the traditional lecture and homework sessions are inverted. Online material is given to students in order to gain necessary knowledge before the class, while call time is devoted to application of this knowledge and reflection”.

There are, however, counter arguments to this idea, since students regularly require substantial support, professional guidance and reassurances from the professors. It has also been shown that the educators must carefully assign appropriate tasks which will aid the students’ development, arouse their interests and, fundamentally, not discourage them from studying Arabic.

Do you review the classes held every week?
101 respuestas

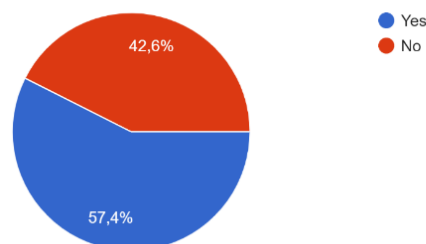


Figure 10: Review Classes

The following chart shows that 56% of the respondents study the language just before the exams. Some review a little during the year, but leave most of it until just before the exam. This further reinforces the viewpoint that the students require external support and motivation in order to be consistent with their work, and that they approach their studies with a positive attitude, as well as being engaged enough to fulfil their potential (Yengin, et al., 2010).

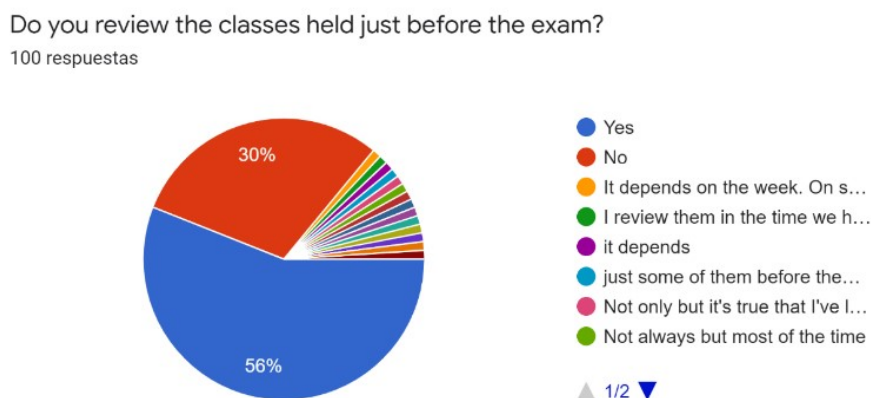


Figure 11: Exams

Some observations and recommendations with regard to the learning Arabic Online are exposed in the following section. The results obtained through these surveys shows a variability in the responses. Some 59.4% of the students consider that the new learning methods thrust upon them due to the COVID-19 pandemic have been difficult for various reasons. We highlight the issue of being in front of a screen for several hours at a time, the vulnerability to distractions at home, the lack of social interaction which negatively impacts the mood of the students, and some technological malfunctions. A high percentage consider that they have adapted to the new modality and that the situation is gradually becoming easier for them. Motivation to study the language has not decreased substantially, although a number of students consider that socialising and human interaction are essential to effective studying of the language. Concentration is another handicap to which the student is exposed when studying the Arabic language online and it is suggested that this is largely due to the amount of time per day spent in front of the computer that creates general fatigue, though this is not specifically or exclusively when studying the Arabic language. Audio-visual material is welcomed by most students, although paper material is equally valued; a combination of both – audio-visual and paper-based material – seems to be the most effective method. In addition to the traditional means of teaching, students appreciate the introduction of online games. More than half of the students consider that the platforms allow interaction between the teacher and their classmates, although some do not fully agree and consider that it is difficult for them to participate in discussions during online classes. The majority of the respondents (88%) agree that the material displayed on the platforms can be easily understood, even when presented in Arabic, because it is usually explained in advance and the teachers can always be contacted by email to ask or even use an electronic dictionary, while 12% consider the platform complicated to use and fully comprehend. Most of the students confirm that they consult the material posted on the university platform or sent by mail. The regularity in reviewing at home is variable, but a majority study the Arabic language for an hour a week, others less than 60 minutes and a decent percentage more than an hour. According to the answers, some students seem to be constant and others less so regarding self-study during the semesters.

These results lead us to believe that university students are still at an age and a stage in their development which calls for the help of teachers in order to tackle these problems competently. The responsibility of teachers to create a communicative environment in Arabic language class is essential, as well as the need to promote an emotional approach. This is all viable thanks to the teacher's emotional intelligence that promotes effective learning and academic performance (Guslyakova and Guslyakova, 2020, p. 782). In this way, the emotionality of the students is understood, and an attempt is made to create a connection that allows for the establishment of a pleasant learning environment with a little creativity and, therefore, the student is much less likely to disconnect from the class despite the potential fatigue caused by the overwhelming use of technology.

For this reason, it is imperative to encourage students in order to get their attention, as explained (Cui and Coleman, 2020, p.552): “Thus, the flipped classroom approach might improve student motivation, both intrinsic and extrinsic, as it creates such scenarios for students. And if the students are more motivated, they might be willing to complete a significant amount of learning activities both inside and outside the classroom”.

The general results of Arabic language students have not changed since switching to the online mode, in respect to their level of learning in face-to-face mode, and satisfactory results are usually reached; this year has not been an exception despite being surrounded by a feeling of insecurity in the face of Covid-19. Everything can be improved using a lot of creativity and stimulating pedagogy in a dynamic way, encouraging self-awareness and self-organization with psycholinguistic strategies.

6. Conclusions

In this study some problems encountered by students when studying the Arabic language online during the COVID-19 pandemic have been considered and analysed. General considerations have been presented, accompanied by a questionnaire which has been completed by students in order to get an insight into their online education and to obtain a clear idea of their opinion. Finally, the emotional aspects that must be taken into account for the organization and preparation of classes have been considered.

The overall goal is to improve the whole learning experience for students, and adapt and develop the design and structure of the courses, integrating psychological and pedagogical knowledge and self-awareness. This makes the student aware of the need to maintain a regular rhythm, as well as help them find strategies to succeed in language learning. Dynamic activities in class are highly valued as well as being a way of helping to keep all students focused and interested, introducing more games in class and interactive materials, despite material in Arabic being scarce. It is time for each teacher to adapt their content individually or in collaboration with their colleagues to overcome this lack of ready-made material. It is essential to play with creativity and generate communicative situations of all kinds so that the student can practice the language with their classmates in small groups, introducing cultural information with relevant topics to reflect on, favouring current affair issues in order to avoid too much repetition of content. Dividing the groups to make the activity more dynamic and personalised gives each learner a greater chance to practice, though the amount of time granted by each university must be taken into account when preparing these activities.

This strategy implements positive aspects of psychology to help students to gain self-confidence; they will be able to contribute more and create a positive feeling towards their learning, while avoiding unnecessary stress and panic which can be provoked when studying a difficult language. It is imperative to assist the students, supporting their efforts to be able to do more, to transmit positive feelings and pushing them to continue in difficult times, such as the global one experienced in the year 2020-2021. And so, it is absolutely necessary to continue improving the quality of online teaching of the Arabic language as a foreign language, and also to open students' minds so that they have a solid insight into the functioning of Arab countries from the sociological point of view. This is a key element that allows one to reflect on this globalized world; a world which at the same time lacks sufficient information from other civilizations. Not only is studying languages a task of memorising phonetics and grammar, but it is also related to understanding culture and awakening an emotional education, interest and transversal competence. Arabic language teachers could push towards reflection and bring students closer to foreign cultural environments that could be more understandable, and thereby produce more tolerant societies.

These psychological aspects help the students to acquire, retain and process the information easily; and above all, motivate them, which is key to encouraging participation, allowing the communication to be bilateral and effective. Motivation influences the proficiency of the language and it is important to change the conventional methodology to a dynamic one as much as possible to develop socio-emotional competence in language class.

The communicative approach, the social character of the language, creativity and empathy in class are crucial when transmitting a foreign language such as Arabic. Empathy can be transmitted to students by explaining and understanding the difficulties that each student may have, and not all members of a class will be able to assimilate the information in a homogeneous way. Some students excel in oral communication, whereas others are far more comfortable communicating in a written way. It is not necessary to develop all the skills at the same pace, though explaining and correcting mistakes is vital. The demands of the communicative approach cannot

be met if the student does not feel confident speaking; interaction with the classmates breaks down immediately. One thing that must be taken into account is the personality of each student and their potential obstructive barriers when speaking in public, as they vary from person to person and cannot be applied to all students equally. The teacher must be a competent observer to give appropriate feedback and advice to each student, and a positive reaction from the student is essential for effective communication and offering an integrating model and increase concentration and creativity.

It is obvious that the combination of the approaches mentioned in this work is stimulating, especially taking into account the current circumstances regarding the COVID-19 pandemic. Developing conventional skills (speaking, writing, listening) is a basic requirement that is generally acquired when increasingly innovative and interactive methods are sought. However, the communicative approach is essential for the student to practice the language in an appropriate context, taking into account the culture of the language taught. The psychological requirement, that helps create a pleasant environment for the student to relax and interact in class, can also not be forgotten; this psycholinguistic side is essential to consider, especially in Arabic class, due to the difficulty of the target language. As long as an adequate amount of class time is assigned by the universities, and the students cooperate, sufficient progress in the learning of the Arabic language can be made regardless of whether classes are carried out in person or online.

Following a communicative method for the student to master the Arabic language is an effective method in the language class, but developing emotional skills in education would allow the student to become even more involved in the learning process. In this way, it is possible that the interaction takes place in a pleasant environment, even if it is incredibly time-consuming for teachers to produce and prepare appropriate material and find the necessary emotional strategies. The results are rewarding for students, with the feeling of satisfaction that they are capable of communicating in a foreign language, as well as having a deeper understanding of cultural characteristics which had most likely been alien to them prior to the course. And that is a contribution to train responsible and committed individuals towards the global village in which they live, and transversal skills and effective communication are promoted in any language, not only in Arabic.

The research remains open to more proposals and methods that allow for the improvement of transversal skills for fluid communication between civilizations, and that drives interest in learning other languages that can be motivating in such a global society. In this way, it offers quality teaching and promising prospects for future generations. In this modest work, the problems related to learning the Arabic language through screens have been analysed, but there is still a long way to go to explore in order to offer pedagogical proposals for quality education.

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Designing an Arabic Speaking and Listening Skills E- Course: Resources, Activities and Students' Perceptions

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Abstract: This paper presents a fully online course model for teaching speaking and listening skills for students learning Arabic as a foreign language at the International Peace College South Africa on the NEO learning management platform. It also investigates the students' attitudes towards the course. The course was developed by the researcher during the first semester of 2020. This period coincided with South Africa's first wave of COVID-19, and the country's first strict lockdown. The syllabus consists of three components: listening, speaking and conversational Arabic. It includes various technology-enhanced activities and resources which were developed by using LMS features, Web 2.0 tools, and e-learning specifications such as Learning Tools Interoperability (LTI) and Shareable Content Object Reference Model (SCORM). The integration of technology in the course is based on an approach that combines Bloom's taxonomy and Technology Integration Matrix (TIM). Apart from the description of the course, this study used a thirty-item questionnaire to investigate the attitudes of thirty-one learners who participated in the course. They answered questions about the course's resources, activities as well as its impact on their language skills. Results from the questionnaire revealed that the respondents' attitudes towards the online course were positive and statistically significant at $p < .05$. The design and the approach adopted in this study can apply to any context of language teaching. It provides a myriad of technology-enhanced activities that can be effectively used to teach listening and speaking skills virtually. Foreign language teachers can adopt this approach in its entirety, or with idiosyncratic modifications to design their language courses, irrespective of the virtual learning ecology (VLE) they use.

Keywords: Technology-enhanced, AFL, Speaking, Listening, Fully online, NEO, Learning Management System (LMS)

1. Introduction

Since the outbreak of COVID-19 in 2019, lockdown was considered by the South African government to be the safest solution to curb the spread of the virus no matter the repercussions. For instance, lockdown orders due to COVID-19 have necessitated the need to transition to remote learning, especially since social distancing has become a priority as the world battles this virus. Educational institutions have started to find ways to bring their entire workflow into contact-free systems. Hence, remote learning is no longer a matter of choice; and all stakeholders need to work hard to achieve this goal (Ali, 2020; Ferri, Grifoni and Guzzo, 2020; van Cappelle et al., 2021). Many educators have been grateful to e-learning companies that put aside profitability during the pandemic to assist them in transitioning to e-learning. Providers of learning management systems such as Moodle, Cypher Learning, and Canvas raced to offer their software to schools around the world for free. Undoubtedly, these applications help educational institutions to deliver their content, but there are wider implications (Al Rawashdeh et al., 2021). While the valuable benefits of remote learning in such unprecedented circumstances are apparent, shifting education from a traditional classroom setting into a digital modality may not always be as simple as e-learning providers often claim. Problems arise not only in implementing a digital platform for content delivery, but also when addressing infrastructure, the digital literacy of students, instructors, and administrative staff; instructional design, and data access (Mpungose, 2020; Rapanta et al., 2020). The challenges related to abrupt transitions to online learning may differ across institutions, subjects, and modules.

The present study therefore focuses on the design of a fully online course for teaching Arabic as a foreign language at an institution of higher learning in the South African context. The design of fully online or blended modules is without a doubt exceedingly beneficial to foreign language learners in general. This is partly dictated by the fact that teaching a foreign language in a traditional environment can hardly equip the language learner with the necessary skills needed to develop linguistic competence. Learners need time to practice outside of the classroom. At the same time, controlled, engaging online materials certainly play a vital role in enhancing the language skills of students. The fact remains that online learning materials should not be implemented haphazardly (Ghani and Daud, 2018).

2. Statement of the Problem

When the first confirmed case of COVID-19 was reported in South Africa in March 2020, the country imposed strict quarantine and lockdown measures. The International Peace College South Africa, like all other tertiary institutions in the country, found itself in a scenario where emergency remote teaching was required. The restrictions have had a profound impact on the teaching of some Arabic language modules, especially ones that require more intensive cognitive abilities on the part of the learners, such as listening and speaking. The teaching of these skills requires the use of various effective activities in the classroom that cannot always be sufficiently replicated in synchronous Zoom sessions. Even in a traditional face-to-face classroom, a listening and speaking course centers on the use of conversations, simulations, debates, discussions, and multimedia activities that are normally conducted in a physical multimedia lab. Remote teaching and learning of language courses therefore need to consider how to replicate or replace such activities. Remote instruction should also utilize technology that ensures adequate use of appropriate language teaching methodologies, such as the communicative approach. Given that many teachers and learners are digitally literate necessitates instructional designers to create learning prototypes that incorporate adequate activities, resources, and teaching methodology. Presently, there is no formal syllabus for teaching Arabic as a foreign language at IPSA or at other South African institutions. The selection of the materials is at the discretion of the instructor, and materials may differ from year to year. The *Arabiyyah Bayna Yadayk* [Arabic between your hands] series is commonly used by some instructors for teaching Arabic modules. However, those textbooks are more suitable for students at the elementary and intermediate levels, not for university students, who need to meet the requirements of National Qualifications Framework (NQF) levels 5, 6 and 7 in terms of competencies and skills.

The present study is therefore action-based research that attempts to design a learning prototype that can be used either fully online, or in a hybrid mode, especially in countries that, notwithstanding exceptional circumstances brought about by the COVID-19 pandemic, encounter intermittent problems such as natural disasters, protests, violence, and so on. This study not only aims to describe the designed listening and speaking e-course, but it also examines the perceptions of the students towards course resources and activities. Due to the exploratory nature of this study, research questions rather than hypotheses were investigated. The questions used to guide the study are:

1. What are the attitudes of the AFL learners towards the resources of the designed e-course?
2. What are the attitudes of the AFL learners towards the activities of the designed e-course?

The perceptions of other stakeholders are equally important, but are beyond the scope of this study.

3. Literature Review

Online learning, whether hybrid or totally remote, has attracted the attention of language learners and educators. This interest has resulted in a bulk of literature in certain areas of language pedagogy. The use of disruptive technologies in teaching foreign languages was, for instance, investigated in several studies. Some of these studies investigated the use of social media platforms (e.g., Facebook and WhatsApp), Wikis, YouTube-based materials, and other multimedia for teaching Arabic vocabulary and writing skills (Abdullah, 2015; Wargadinata et al., 2020; Zainuddin and Sahrir, 2016; Albantani and Madkur, 2017). Other studies dealt with the use of Web 2.0 tools for enhancing reading and writing skills (Shalihah et al., 2021), the role they play in the achievement of learners (Mohammed, Assam and Saidi, 2020), and the use of websites for the delivery of content (Ghani and Daud, 2018). The attitudes of students and teachers towards the use of social media platforms and Web 2.0 tools in the Arabic language classroom were also explored (Bahruddin and Febriani, 2020; Wargadinata et al., 2020; Abdullah, 2015).

The use of such tools mentioned above will not yield the desired results if they are not aligned with the learning outcomes of a course. While the use of technology in teaching a foreign language is undisputable, adequate attention has not been paid to the design of syllabi or learning prototypes that can enhance the language skills of learners. A few studies have dealt with the use of learning management systems in some foreign language courses which used a blended or hybrid mode of teaching. Moodle, for instance, has been used for the delivery of an online component for teaching English lexical and grammatical topics in a blended English language course for Spanish-speakers with a focus on writing skills (Rymanova, Baryshnikov and Grishaeva, 2015). Moodle was also used for the teaching of business English at a Czech University (Kučírková, Kučera and Vydrová, 2014). Similarly, Google Classroom was used to teach postgraduate courses on communicative English grammar (Haggag, 2019) and English business writing skills (Apriyanti et al., 2019). The perceptions of students at a

Bangladeshi university towards using Google Classroom for teaching English were also investigated (Islam, 2019). Another study reported on the use of LMS in teaching learners with existing knowledge of English at a Russian university with the aim of individualizing language learning (i.e., tailoring the course to fit the needs of individual learners). This study underscored the importance of adopting multiple learning paths that integrate various learning styles (Tumskiy, 2019). Another recent study investigated the use of Canvas LMS for the delivery of content in the form of e-books for Arabic language learning in an Indonesian context (Fauzi et al., 2020). While the above studies agree that there is a strong correlation between the use of learning management systems and student achievement, the findings are largely based on summative achievement tests that may or may not reflect the true abilities of learners.

Among the four language skills, speaking and listening received less attention in the existing literature than reading and writing. Some studies reported on the impact of blended learning activities on the augmentation of English listening and speaking skills in the Bangladeshi, Indonesian and Omani contexts (Rabbi, Zakaria and Tonmoy, 2017 ; Rahmawati, 2019; Pramila and Thomas 2019 ; Hussein Alsowayegh et al., 2019 ; Grgurovic 2011). Those studies employed various learning management platforms such as Google Classroom, the online Cambridge LMS, and Blackboard®.

Although the above studies emphasize the use of technology in foreign language teaching and learning, they focus on the general benefits of technology. They also largely focus on the perceptions of learners towards the mode in which learning content is delivered, their dedication and acceptance of technology, and the optimization of teaching hours. These studies do not, however, describe the learning prototypes used in content delivery, how technology has been integrated, or the impact of course design on student language skills. In addition, the studies are generally concerned with hybrid or blended learning, which implies that higher-order thinking activities are used in a traditional classroom. In most of the above studies, "technology integration seems to be an isolated goal to be achieved separately from pedagogical goals" (Ertmer and Ottenbreit-Leftwich, 2013, p.176). The haphazardness of many online designs and their failure to reach their full potential could be attributed to lack of emphasis on pedagogical underpinnings such as Bloom's taxonomy, and on technology-integration models such as SAMAR, TIM, ADDIE, ASSURE, and etcetera. Very few studies reported on online language instructional designs based on such integrative models (Yugandhar, 2016; Aljojo et al., 2019; Mohammed, Assam and Saidi, 2020).

Hence, this study differs from the previous ones in several aspects. Firstly, it is an extension of other empirical studies that attempted to integrate technology in the teaching of Arabic as a foreign language (Mohammed, 2018; Mohammed, Assam and Saidi, 2020; Mohammed, Al-Sowaidi and Banda, 2021). Unlike other studies, the present study aims to design course content for the teaching of speaking and listening skills which have been described as highly demanding, complicated and multi-faceted (Asakereh and Dehghannezhad, 2015; Walker, 2014). Listening skills in particular are often marginalized in the language syllabi and have commonly been "regarded as a passive skill, [...] an ability that would develop without assistance" (Osada 2004, p.53). To master these two skills, instructional designs need to equip learners with sufficient knowledge of vocabulary, grammar, culture, genre, speech acts, register, discourse, and phonology (Scrivener, 2005). This requires the design of highly motivating materials that can be used for the teaching of listening and speaking skills in a fully online or hybrid environment. Although LMSs play a vital role in the delivery of materials and the management of learning, relying on the features of a particular LMS may be insufficient for a productive teaching and learning experience. In other words, LMSs are designed to serve education in general, and may not include diverse tools for listening and speaking activities. Therefore, the learning prototype described in this study makes use of various web-based tools and e-learning standards such as SCORM. The use of such standards does not only assist in the design of learning activities, but also in the offline delivery of materials. This is the first known study that integrates technology into the teaching of Arabic speaking and listening skills based on modern pedagogical and technology-enhanced instructional approaches. Technology alone is not sufficient for ensuring an ideal online learning environment. Successful instructional design needs to strike a balance between pedagogy and technology (Garrison and Norman, 2008; Harasim, 2017; van Merriënboer and Paul, 2017; Picciano, 2017). This study, therefore, adopts a focused approach to the integration of technology, which is described in the following section.

4. Theoretical and Conceptual Framework

This study is based on an eclectic approach that integrates concepts from information technology and instructional design. In particular, it utilizes Bloom's taxonomy of learning objectives (Bloom, 1956) and the Technology Integration Matrix (TIM) (Technology Integration Matrix, 2009; Hornack, 2011; Welsh, Harmes, and Winkelman, 2011). Bloom's taxonomy is composed of six levels that can be used to structure the learning objectives, lessons, and assessments for any course. Those levels are shown in Figure 1 below.

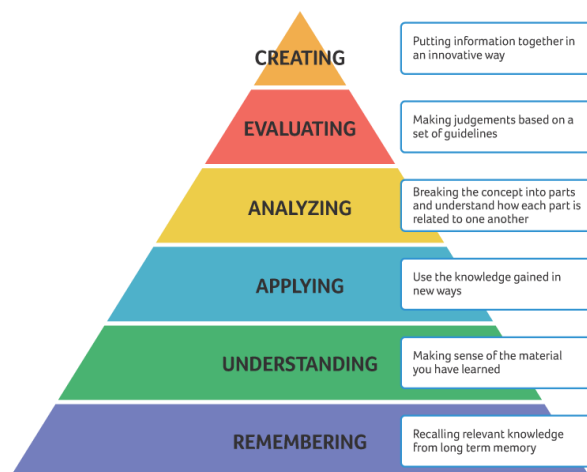


Figure 1: Bloom's taxonomy of learning objectives

Remembering means retrieving and recalling relevant knowledge or facts from long-term memory. An example of remembering activities could be a listening comprehension exercise. At the Understanding level, students should be able to summarize a news report or translate a sentence or text. Students can apply what they learn if they use the grammatical rules or vocabulary they cover in a lesson in their digital stories, conversations, or debates. Analyzing activities can be more challenging to the learners. They might categorize the argument of a debate into constituent parts, key ideas, or hyper-themes. At the Evaluating level, students should be able to evaluate a recording or oral presentation based on checklists and rubrics. Finally, Creating requires more evidence of active learning on the part of the learners. Digital storytelling is an example of a Creating activity.

The Technology Integration Matrix (TIM), which constitutes the second component of our theoretical framework, is based on the concept of meaningful learning. Meaningful learning environments have five characteristics, namely, Active, Collaborative, Constructive, Authentic, and Goal-Directed. TIM associates these five characteristics with five levels of technology integration: Entry, Adoption, Adaptation, Infusion, and Transformation. In other words, active learning increases on a continuum from entry to transformation. One of the underlying principles of TIM is associated with the ownership of learning. There is a gradual shift from a teacher-centered approach to learning, to student-centered learning at higher levels. That is, at an initial stage, technology is mostly used by the teachers, who are required to train the students in how to use it. When students become more advanced, they are empowered enough to select a technology and to use it to achieve certain learning outcomes, as shown in Figure 2.

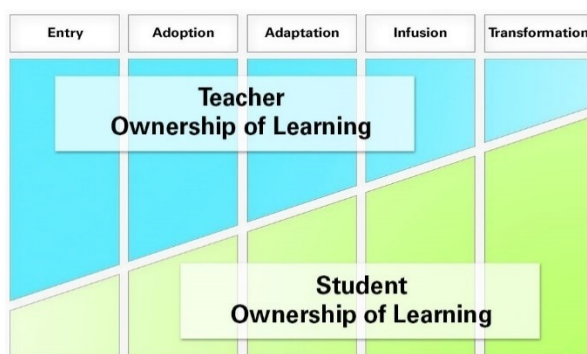


Figure 2: Ownership of learning in TIM (Winkelman, 2019)

Another significant underlying principle behind the TIM method is that higher levels of technology integration require higher-order thinking on the part of the students, as Figure 3 shows.



Figure 3: Bloom's lower-order and higher-order thinking and TIM (Winkelman, 2020)

Hence, Bloom's taxonomy and TIM should not be used independently. Technology can be integrated across all levels of Bloom's taxonomy. The Entry and Adoption levels provide the technological foundations for learners. To effectively build upon these levels, students must acquire knowledge and skills that enable them to use various technological tools in conventional ways. Students can use technology to perform lower-order thinking activities. On the other hand, activities in which students use technology to evaluate content, assess their peers, or perform analysis show that learners are capable of Adapting and Infusing technology. The use of technology to create activities and language resources is part of the transformational potential of TIM. At the Transformation stage, optimal use of technology is reached. Students may start to use technological tools innovatively. Hence, the integration of Bloom's taxonomy and TIM enables language teachers to design tasks with clearly defined learning outcomes. An array of interesting and motivating learning activities that were previously inconceivable, can be designed. The following section demonstrates how the two models are integrated in a fully online listening and speaking course.

5. The Designed Syllabus

The designed syllabus aims to develop the listening and speaking skills of Arabic learners through several interactive activities and resources. It consists of five chronological learning units that were taught in the first semester of the 2020 South African academic year (March 2020 - July 2020). Each chronological unit is composed of various theme-specific lessons with clear learning outcomes. It consists of three components: listening, speaking and conversational Arabic. The content can be updated, and topics be changed if necessary. Table 1 provides a list of the course modules and contents in its present/initial form.

Table 1: Modules and contents of the designed course

Unit	Listening Modules	Speaking Modules	Conversational Arabic
Unit 1	Pilgrims' visit to Medina	Sectarianism in Middle East countries	Fashion (YouTube-based lesson) Hajj and Umrah occasions
Unit 2	Children and violence	Crime in South Africa	Joha and the tent (YouTube-based lesson) Social occasions (Marriage)
Unit 3	Mawlid (celebration of the birthday of the Prophet Muhammad) and Christmas in Cape Town	Social justice & minority rights	Joha in the Zoo (YouTube-based lesson) Visiting the sick
Unit 4	Halal industry	Illegal hunting	Joha and Water (YouTube-based lesson) Celebrating a newborn
Unit 5	Wasatiyyah (Moderation; literally the "middle way" in Islam)	Redistribution of land in South Africa	Joha and examinations (YouTube-based lesson) University graduation

The entire course was presented in NEO LMS as the snapshot in Figure 4 shows.

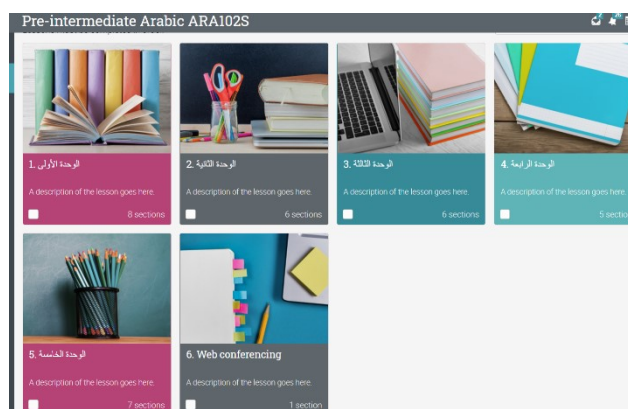


Figure 4: Course interface in NEO

The resources for the course included YouTube videos, socio-economic issues, religious texts, and dialogue simulations, among others. The activities in each unit were based on the learning outcomes for each lesson. They were aligned with Bloom's taxonomy and the TIM's five levels of technology integration. Table 2 gives an overview of the activities in one of the units

Table 2: Integration of TIM and Bloom's taxonomy in the syllabus

TIM	Bloom	Activity
Transformation	Creating	Debate, simulation, discussion, wikis, digital storytelling
Infusion	Evaluating	Evaluate a peer-spoken activity
Adaptation	Analyzing	Oral presentation, short dialogue
Adoption	Applying	Subtitling
Entry	Understanding	Summary of a video/ vocabulary work
Entry	Remembering	Listening comprehension

Navigating back and forth between the various units with their different components can be potentially cumbersome. Thus, a user-friendly course layout optimizes effective language teaching and learning on a digital platform. The landing page of the course includes all the units and lessons of the course and learners can move freely between units and lessons, as shown in Figure 5.



Figure 5: The landing page of the course

While the LMS can be highly beneficial in teaching some language skills, it may not be so for teaching speaking and listening. Thus, the use of education technology specifications such as LTI can be especially useful for the latter skills. LTI integration allows for the use of learning tools from different vendors to be used within a LMS. However, not all learning management systems are LTI-compliant, and the use of this feature is not always straightforward. In addition, free versions of LMSs may not provide LTI integration at all. Moreover, some tools are not compatible with Learning Tools Interoperability (LTI) specifications. Nevertheless, third party Web 2.0 tools can also be integrated into the LMS without the use of LTI education technology specifications either through direct links, embedded source code, SCORM, or HTML5 Package (H5P) format activities. The course in this study has utilized several of these tools to create effective integrated activities and to make them available to students in a single software. The use of these tools, with their robust features can guarantee a fully online course that permits high levels of interactivity and timely feedback. It is worth mentioning that the learning activities vary from one lesson to another. There is no single model, or a one-size-fits-all policy that can be used in every lesson. Although the syllabus is designed for AFL learners at a South African tertiary institution, the model can be applied in its entirety, or with idiosyncratic adjustments, to design fully online or blended courses at other institutions. In what follows, some of the activities and resources used in the three components of the syllabus are discussed.

5.1 Listening

Listening lessons start with a pre-listening activity which students typically complete during the first five minutes of a synchronous web-conferencing session, by posting their answers via the LMS discussion forum, or by giving an oral presentation through a Sanako Connect Lab. The listening lesson is then presented to the students. Students are required to listen to or watch a two-minute report or YouTube video and are encouraged to take notes. Figure 6 below gives a screenshot of a listening multimedia resource.



Figure 6: Listening multimedia resource in NEO

After watching or listening to the video, students are requested to perform various types of interactive or gamified exercises such as vocabulary quizzes, listening comprehension questions, multiple-choices and/or matching exercises, as shown in Figure 7 below.

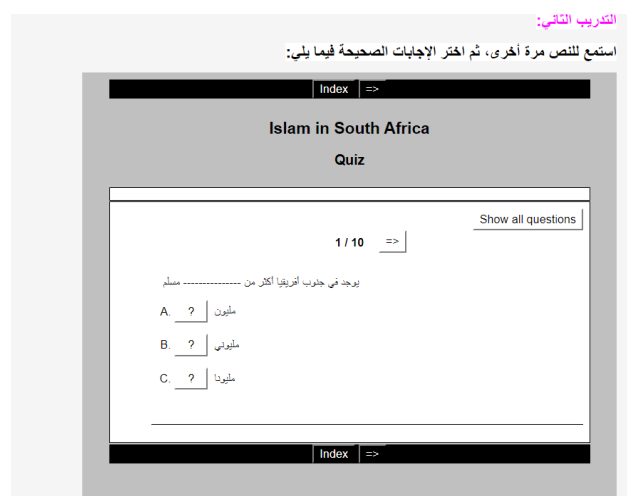


Figure 7: Listening comprehension activity embedded in NEO

Students are also required to compose sentences in which they use words or expressions they have learned in the lesson. They might also be assigned to listen to the report and provide a transcript and English subtitles for it. They may also be asked to record their own one-minute discussion about a lesson-related topic, as shown in Figure 8.



Figure 8: A Vocaroo recording activity embedded in NEO

5.2 Conversational Arabic

The Conversational Arabic component utilizes authentic conversational texts that deal with various topics such as water crises, fashion, technology, internet, examinations, and etcetera. Lessons typically start with a short conversational video. Then, students are required to summarize the video orally. Later, a full transcript of the video is made available. The students are then encouraged to watch the video again. They then role play the conversation. Finally, an H5P activity was created for each lesson. H5P activities usually include several in-video comprehension questions to test students' understanding, as shown in Figure 9.

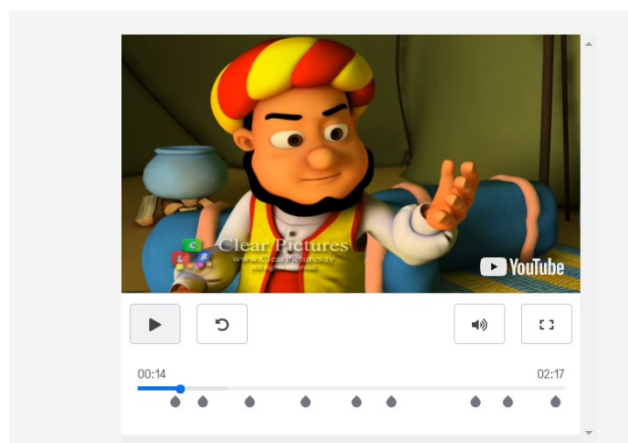


Figure 9: H5P interactive video quiz embedded in NEO

Each conversational Arabic lesson includes a dialogue simulation, which consists of various branching scenarios, as is clear in Figure 10.

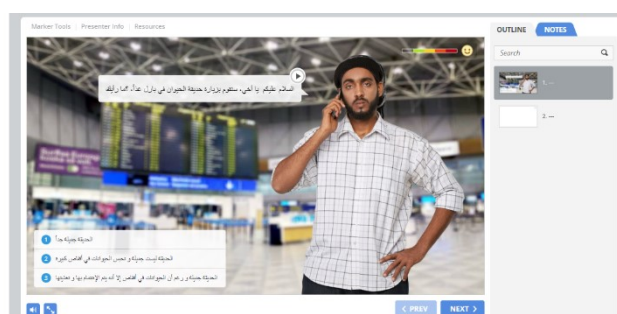


Figure 10: Dialogue simulation activity

A branching scenario is an interactive activity that enables learners to practice communication skills using multi-choice narratives. Simulation activities are ideal for the practice and enhancement of communication skills. The time limitations of teacher-led instruction can make it difficult to cover certain types of conversations, for

instance, a conversation at an airport. A dialogue simulation, on the other hand, can consist of several topic-related scenarios or dialogues, where learners can practice each one individually. Simulation can be created using authoring tools such as ActivePresenter, Ispring or branchtrack.

5.3 Speaking

The speaking component consists of many discussion topics, debates, and Wikis. Students are encouraged to talk about topics such as land distribution in South Africa, COVID-19, crime, polygamy, social services, and domestic violence, among others. For synchronous discussions, debates, role-plays and real-life dialogues, the course uses Sanako Connect. Students are divided into pairs or groups and are asked to engage in discussion as if they are in a physical class. Sanako Connect recreates the same experience of a physical language lab and is often referred to as a language lab in a browser. Teachers can share their screen, speak, or listen to one student or the entire class.

The syllabus also includes more advanced skills and activities such as consecutive and simultaneous interpreting. For this purpose, the course also uses Sanako Connect. Students can listen to a master track and insert their interpretation or voice into the video, as shown in Figure 11. This feature is particularly ideal for consecutive interpreting activities, a feature that video editing software often lack.

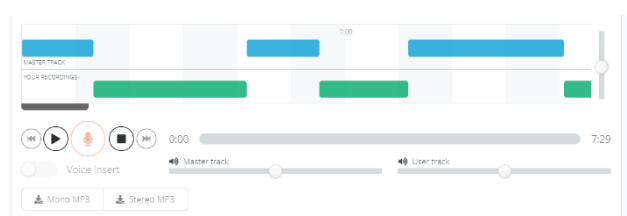


Figure 11: Consecutive interpreting in Sanako Connect

Sanako Connect facilitates all speaking, listening, and interpreting tasks that typically take place in a physical language lab. Speaking assignments such as debates, discussions, and Wikis were also created straight in NEO LMS, as is obvious in Figure 12.

Assignment	Start	Due	Given	Max score	% of overall	To grade	Submitted
المعجم من الإيماءات الجمعة 17/08/2023		5 Nov 00:00	✓	10	7.7	4	4
Translation of the poem-Voice note الجمعة 17/08/2023		1 Nov	✓	10	7.7	15	5
أزاحة السبيل في كتب تالون الجمعة 17/08/2023		20 Oct	✓	100	7.7	7	7
إعادة توزيع الأراضي - مناقشة الجمعة 17/08/2023	11 Aug 00:00	29 Sep 00:00	✓	10	7.7	1	1
Reading: Land Distribution in South Africa الجمعة 17/08/2023	17 Aug	16 Sep	✓	10	7.7	16	7
نص من كتاب لاجئين وكثافة الجمعة 17/08/2023		3 Sep 00:00	✓	10	7.7	5	5
QUIZ 1 الجمعة 17/08/2023		2 Sep	✗	21	7.7		
Exercices - صورة البلد الجمعة 17/08/2023		31 Aug	✓	10	7.7	3	6
تقويم الله - تسجيل للترجمة والقرآن الجمعة 17/08/2023	23 Aug 01:00	31 Aug 22:00	✓	10	7.7		1
Discussion: Activities of the Arab world in Africa الجمعة 17/08/2023		14 Aug 11:00	✓	10	7.7		8

Figure 12: Assignments in NEO LMS

The system ensures the optimal use of these activities. Students can write, chat, and speak to each other. They can also submit written or recorded comments on their classmates' responses. Instructors facilitate and monitor the discussion or debate, and provide feedback on the students' participation.

Using features such as SCORM allows for the integration of PowerPoint presentations for each lesson along with recorded narratives and graded interactive quizzes. These quizzes can incorporate constructive feedback to enrich the effectiveness of instruction. In addition, a SCORM package can be compressed into a ZIP file, and thus can be downloaded for offline use.

6. Materials and Methods

This study is descriptive-analytical in its structure. It describes a listening and speaking syllabus that was presented remotely via a LMS system during the first COVID-19 lockdown in South Africa. It also employs a quantitative approach through a questionnaire composed of 30 five-point Likert items, to investigate the attitudes of AFL students at IPSA towards the syllabus.

6.1 Participants

The respondents of the present study were thirty-one AFL students at IPSA. The participants constitute all registered students in the Bachelor of Arts program in their second or third years of study.

6.2 Instrument and Procedures

To investigate the perceptions of the students towards the online Arabic speaking and listening course, a questionnaire was developed for this study. The following steps were considered in the development of the questionnaire:

1. Conduction of semi-structured interviews with fifteen AFL students from the IPSA student population. The students were asked some questions and were also given the opportunity to raise their own questions. The questions were then reviewed by two specialists in the field. Such interviews enabled us to “draw up an item pool” (Dörnyei, 2007, p17). A forty-four-item questionnaire was prepared in the beginning.
2. The questionnaire was reviewed by two professors of Applied Linguistics who suggested the deletion of eight items. An initial pilot study was then conducted with ten AFL students from the IPSA population. The rationale behind the pilot study was to ensure the comprehensibility and clarity of the questionnaire's items. A Principal Component Analysis (PCA) was also conducted before analyzing the questionnaire's reliability. Based on the experts' recommendations, the outcome of the pilot study, and the PCA, six items which were reported as poorly understood were omitted, along with eight other irrelevant items. The questionnaire in its final form was reduced to thirty items.
3. The thirty-item questionnaire was then administered to thirty-one AFL students, none of whom had participated in the pilot study. The reliability of the questionnaire was calculated using Cronbach's alpha consistency, which reveals the questionnaire demonstrated an acceptable internal consistency ($r = 0.87$).

For statistical analysis, the participants' attitudes towards the designed course were categorized into three levels: high, medium, and low, as follows:

- From 1.00 to 2.60 indicates a mean of low value.
- From 2.61 to 3.40 indicates a mean of medium value.
- From 3.41 to 5.00 indicates a high value mean.

The statistical significance was analyzed using various statistical models, including descriptive statistics and t-tests, as appropriate.

7. Results

To investigate the attitudes of the AFL students at IPSA towards the speaking and listening online course, the means, standard deviations, and percentages of each item across all the participants were calculated. For this purpose, GNU PSPP, a program for statistical analysis of sampled data, was used. Table 3 shows the students' responses to the resources in the syllabus.

Table 3: Students' perceptions of the resources in the course

No	Items	Percentages (%)					Mean	SD
		1	2	3	4	5		
1	The course introduced authentic texts produced by native speakers.			3.23	12.90	83.87	4.81	.48
2	The materials represent various text-types.	6.45	16.13	48.39	16.13	12.90	3.13	1.06
3	The course is student-focused to a great extent.	6.45	6.45	6.45	16.13	64.52	4.26	1.24
4	The course provides self-paced and personalized materials.	6.45	6.45	3.23	16.13	67.74	4.32	1.22

No	Items	Percentages (%)					Mean	SD
		1	2	3	4	5		
5	The topics selected in the course are graded in terms of content and difficulty.	9.68		9.68	16.13	64.52	4.26	1.26
6	Resources cater for various learning styles.	6.45		6.45	19.35	67.74	4.42	1.09
7	The teaching methodology is effective.	3.23	3.23	9.68	35.48	48.39	4.23	.99
8	I have learned new vocabulary in my speaking classes.	6.45		3.23	16.13	74.19	4.52	1.06
9	My pronunciation improved.	6.45		9.68	16.13	76.74	4.39	1.12
10	The speaking class has a positive effect on my accuracy while speaking.	3.23	3.23	9.68	12.90	70.97	4.45	1.03
11	The speaking class helps improve my fluency in speaking.	3.23		9.68	19.35	67.74	4.48	.93
12	The course enriched my knowledge of idiomatic expressions, collocations, and proverbs.	6.45	3.23	6.45	9.68	74.19	4.42	1.18
13	The course enhanced my Arabic grammar usage.	6.45	6.45	3.23	19.35	64.52	4.29	1.22
14	The course enhanced my acquisition of various speech acts in Arabic	6.45	3.23	3.23	12.90	74.19	4.45	1.15
15	The course enhanced my proficiency and communicative competence.	6.45	9.68	12.90	6.45	64.52	4.13	1.34
		9.46		9.67	81.45		4.30	1.09

As the data in Table 3 shows, the average for items in the relevant section of the questionnaire ranged from (3.13) to (4.81) with corresponding percentages from (76.65%) to (96.77%). This indicates a medium to high level of agreement on all items. The emerging statistics reveal that the participants of this study identified that the resources of the course are satisfactory.

As for the learning activities of the course, respondents were asked to rate their effectiveness on a five-point scale: 'not at all effective', 'somehow ineffective', 'neutral', 'quite effective', and 'extremely effective'. Table 4 shows the responses of the students to the activities of the online course.

Table 4: Students' perceptions towards the activities of the course

No.	Activities	Percentages (%)					Mean	SD
		1	2	3	4	5		
16	Zoom sessions and Zoom breakout rooms	6.45	9.68	9.68	9.68	64.52	4.16	1.32
17	Interactive videos			12.90	9.68	77.42	4.65	.71
18	Listening activities	6.45	9.68		9.68	74.19	4.35	1.28
19	Vocabulary quizzes	6.45	9.68	6.45	9.68	67.74	4.23	1.31
20	Discussion forums	6.45	12.90	45.16	16.13	19.35	3.29	1.13
21	Debating		3.23	9.68	12.90	74.19	4.58	.81
22	Wikis and chats	6.45	6.45	6.45	12.90	67.74	4.29	1.24
23	Game-based activities	6.45	6.45	6.45	6.45	74.19	4.35	1.25
24	Role-playing	3.23	6.45	12.90	6.45	70.97	4.35	1.14
25	Digital storytelling			9.68	9.68	80.65	4.71	.64
26	Oral recording	3.23	6.45	9.68	6.45	74.19	4.42	1.12
27	Peer assessment tasks	6.45	6.45	6.45	6.45	74.19	4.35	1.25
28	Sanako Connect speaking activities	6.45		6.45	19.35	67.74	4.42	1.09
29	Interpreting activities	3.23	3.23	6.45	19.35	67.74	4.45	.99
30	Simulation activities	6.45		9.68	9.68	74.19	4.45	1.12
	Average of Each Point	9.89%		10.57	79.56%		4.33	1.09

As the data in Table 4 shows, the average for items in the relevant section of the questionnaire ranged from (4.16) to (4.71) with corresponding percentages from (74.2%) to (93.398%). This indicates a high level of agreement on all items. The emerging statistics reveal that the participants in this study identified that the activities of the course were highly effective. In addition to the analysis of the attitudes of the respondents

towards various aspects of the syllabus, this study also analyzed their overall attitude towards the syllabus. For this purpose, a t-test for one sample was used. The results of the t-test are given in tables 5 and 6, respectively.

Table 5: One-sample statistics

One-Sample Statistics				
	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>S.E. Mean</i>
Sum	31	129,61	15,24	2,74

Table 6: One-sample test

One-Sample Test						
	Test Value = 120,000000					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Sum	3,51	30	,001	9,61	4,02	15,20

It is clear from the above tables that the t-test value is 3.51 with a significance level of 0.001. That is, the respondents' overall attitude towards the online course was positive and is statistically significant at $p < .05$.

8. Discussion

This section discusses the attitudes of the AFL students who completed the course towards the course's resources and activities, as understood from the findings of the questionnaire. The findings showed a high degree of satisfaction concerning the resources of the course. In the view of the respondents, the course introduced authentic TV broadcasts, conversations, and discussions produced by native speakers which are mostly related to a South African context. Some of the texts are presented by Arab native speakers and represent various genres or text-types. The course includes news reports, narratives, stories, dialogues about health as well as religious, economic, and social problems. The finding of this study is in line with others that show the significance of using authentic materials in teaching a foreign language (Oğuz and Bahar, 2008; Johnson, 2016; Rao, 2019).

The respondents also generally agreed that the resources of the course are student focused. The course puts the student at the center of the learning process. Students were given clear instructions on how to navigate the materials and what they were supposed to do before-, during, and after each lesson. The progress of the students was also tracked via the LMS. The role of the instructor was to facilitate, monitor, and assist the students during different stages of the course. The positive impact of learner-centered education on the achievement of the learners was also confirmed in several previous studies (Tullis and Benjamin, 2011; Wang, 2017; Arvanitis, 2019).

The syllabus also acknowledges individual differences among students, and the need to personalize learning (Dolog et al., 2004; Kukulska-Hulme, 2016) by allowing students to navigate the materials at their own pace. The topics were selected and presented very carefully in terms of information load and difficulty, with easier topics first and more challenging ones later. The findings from the questionnaire also showed that the course caters to various learning styles. The course strikes a balance among various modalities (Guichon and Cohen, 2016; Lebedeva, 2018). Texts, images, interactive videos, recordings, digital stories, and the like were presented in the course. Respondents also agreed that the teaching methodology was effective. The student-teacher interaction took place synchronously through web conferencing tools such as Zoom, Google Meet, and Microsoft Teams, and asynchronously through LMS. The alignment of materials and activities with clear learning outcomes (Amin and Mirza, 2020) made it easier for the students to cope with the requirements of the course. Interactive activities were carefully designed and included constructive feedback. The videos were subtitled, and recordings of lectures were made available to the students via LMS. All of these could have positively influenced the students towards a favorable view of the teaching methodology.

Moreover, the findings of the study showed that the syllabus generally enhanced the learners' skills and their communicative competence. Their usage of lexical items, idioms, and collocations in discussion forums and debates conducted online showed noticeable improvement in their lexico-grammatical competence. The respondents also agreed that their pronunciation, self-efficacy, and confidence improved. This was also clear in their participation in oral presentations and recordings. Although the recordings abound with pronunciation errors, this is typically understood as natural and a part of learning (Touchie, 1986). In the beginning, students

were reluctant to produce a one-minute recording, but weeks after the initiation of the course, their participation and confidence improved dramatically. The increased fluency and accuracy of students were both noticeable. This was also articulated by respondents who agreed that their speaking, listening, and communicative competence in general showed improvement.

When respondents were asked to rate the speaking and listening activities presented in their online course, they reported positive attitudes towards the activities. Respondents liked the Zoom sessions and especially the breakout room activities. Zoom sessions can be very boring (Toney, Light and Urbaczewski, 2021) if not supplemented by breakout room activities such as role-playing or discussion, or comprehension exercises.

Students also agreed that interactive videos were very effective. In these mostly interactive H5P activities, students were asked to watch a video and answer questions that were inserted into the video to assess their comprehension. Respondents also found the listening activities effective. Most of these activities were prepared as SCORM packages and included answers and constructive feedback. Vocabulary quizzes were prepared for each lesson and were gamified using a Web 2.0 tool called Quizlet before they were embedded in the LMS system. Students rated them as extremely effective. Discussion forums, debates, wikis, and role-play were also integrated into different lessons throughout the course using the functionalities of the LMS and Sanako Connect. Students also rated these as highly effective. The gamification of the content was developed using several game-based activities that were created using Smart Notebook, Wordwall, and Kahoot and were also rated by the students as effective. These findings have been corroborated by previous studies which acknowledge the role of gamification in achievement and motivation of students (Flores, 2015; Udjaja, 2018; Dehghanzadeh et al., 2019).

The findings also emphasized the benefits of project-based learning, such as digital storytelling in which students practice their language skills using images, videos, texts, scripts, and recordings (Robin, 2008; Liu, Tai and Liu, 2018). The findings also revealed that there were commonalities among the students' responses concerning the effectiveness of peer assessment tasks (Spiller, 2012; Fathi, Mohammad Yousefi and Sedighraves, 2017).

Furthermore, students reported positive attitudes towards speaking activities, which were conducted via Sanako Connect. This digital web-based lab enabled them to be involved in real-time discussions and conversations that at the time this study was conducted were not possible without this technology. Interpreting activities, both simultaneous and consecutive, were also integrated into the course and the respondents found them extremely effective. Of special interest are the consecutive interpreting activities, during which students listen to a portion of a recording and insert their translation/interpretation, and then they continue to translate the entire video.

Simulation was also utilized in the course to teach dialogues and conversations. Students were introduced to conversations that are generally not implemented in a physical class setting due to time limitations (Coleman and Yamazaki, 2018).

9. Conclusion

Speaking and listening are highly demanding and multi-faceted language skills, especially for non-native learners. The transition to remote learning due to COVID-19 created added burdens on both teachers and learners. However, while the pedagogical literature abounds in explanations for designing materials for building reading skills, grammar, and vocabulary, it largely lacks the same depth for designing learning prototypes that can enhance listening and speaking skills. There is an obvious need for the use of well-established e-learning ecologies such as LTI and SCORM-compliant learning management systems, which can enable syllabus designers and teachers to provide more effective materials for the language classroom. Special attention needs to be given to skills that require more intensive effort and advanced skills on the part of the learners, including speaking and listening.

This study explored the design of a fully online course for teaching Arabic speaking and listening skills in a South African context during the COVID-19 pandemic, as well as the effectiveness of the course for improving students' language skills and linguistic competence. The study provided a detailed description of the resources and activities of the course and its delivery. It revealed that the students were satisfied with the content of the course, including its authentic topics, resources, and activities. This study also demonstrated that the course caters for a variety of student linguistic and psychological needs and considers individual differences and

learning styles. The students reported that they were impressed with the multimodality of the course. In addition to the textbook, the course employed the use of supplemental texts, and audio and video materials. It also introduced a considerable number of dialogue simulations, debates, and discussions. The study findings identified that the course syllabus enhanced learners' linguistic competence, accuracy, and fluency. The course content also enhanced their motivation, self-efficacy and self-regulated learning. For ease of accessibility, the course was entirely delivered on NEO LMS. The technology-enhanced activities and resources were not only based on the features of the LMS, but also utilized various tools and standards such as Web 2.0 tools, SCORM packages and LTI features. Although the study used NEO LMS as a platform for the delivery of the course, the technology-enhanced approach adopted in this study can be applied in other LMS platforms or sites such as Google or WordPress. Language teachers can use the model presented in this study in its entirety or with modifications to revamp their language courses, while taking into consideration students' satisfaction levels and needs. This course format has the potential to serve as a basis for teachers to design online, blended, and face-to-face courses that are likely to suit in the "new normal" in a post-COVID-19 environment.

This study focused on the design of a remote speaking and listening syllabus for teaching Arabic as a foreign language. Future research may expand these results by designing syllabi for the same skills in other languages, or by designing learning prototypes for other language skills. Moreover, this research study investigated a syllabus, which was designed and taught by the researcher. It also investigated the perceptions of the learners towards the designed syllabus based on a small size sample, although the sample included the entire population of AFL learners at the site of research. Therefore, the findings of the study cannot be generalized for a larger population. The syllabus presented in this study needs to be implemented with other groups of students and taught by more instructors. The attitudes of both students and teachers need to be investigated both qualitatively and quantitatively. In addition, the impact of the syllabus may be investigated in other language contexts and institutions. Finally, future research work could analyze the possible differences in impact among students according to many variables such as gender, language level, computer literacy, e-learning ecologies, and e-learning specifications.

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Providing Online Learning Situations for In-Service Mathematics Teachers' External Transposition Knowledge During COVID-19 Pandemic: Case of Indonesia

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Abstract: Updating mastery of mathematics scholarly knowledge is vital for mathematics teachers' professional development in Indonesia. External transposition refers to the transposition of mathematics scholarly knowledge to the school curriculum. During the COVID-19 pandemic, online learning becomes the primary strategy for strengthening the external transposition knowledge of mathematics teachers in Indonesia. This study aims to describe the process of providing online learning situations in lifting the in-service mathematics teachers' external transposition knowledge during the COVID-19 pandemic. The online learning involved 57 in-service high school mathematics teachers in Indonesia as participants. The scholarly knowledge to be delivered was the visualization of matrix multiplication. This qualitative study is a didactical design research that includes a prospective learning situation analysis, a meta-technopedadidactic analysis, and a retrospective analysis. In the prospective learning situation, the solutions for re-situating face-to-face learning to online learning were disclosed. Moodle was used as the Learning Management System, and GeoGebra Classroom was used as the Task Response System. A meta-technopedadidactic is an educator's ability to comprehensively analyze pedagogic interaction, didactic interaction, and didactic pedagogy anticipation in using technology in a learning situation. The finding in the meta-technopedadidactic analysis showed the role of technology as a visualization tool in online learning, evidence of participants' external didactic transposition, constraints, and collaboration in learning. Finally, the retrospective analysis suggested some future improvements for better online learning situations. This study contributes to the comprehensive organization of e-learning courses in Indonesia for mathematics teachers' professional development based on pedagogic interaction, didactic interaction, and didactic pedagogy anticipation in the use of technology. Despite some of the study's limitations, the findings have the potential to be an advantage for the long-term sustainability of e-learning as a new norm for teachers' professional development programs, rather than just a foreshadowing of the pandemic.

Keywords: online learning situation, teachers' professional development, external didactic transposition, didactical design research, Moodle, GeoGebra Classroom

1. Introduction

Due to the COVID-19 pandemic, education in Indonesia is shifting to online learning to enforce health protocols, a scenario that almost every country faces. Several survey studies reveal the difficulties faced by Indonesian educators in reacting to the abrupt shift in the school system during the pandemic (Fauzi, et al., 2021; Garad, Al-Ansi, and Qamari, 2021). Additionally, many authors survey in-service mathematics teachers in Indonesia and show their perspectives on the challenges of adopting online learning in their mathematics classrooms during the pandemic (Mailizar, et al., 2020; Azhari and Fajri, 2021). However, little information about the practice of in-service mathematics teachers' professional development (PD) in Indonesia during the COVID-19 pandemic.

Before the pandemic, Indonesia already has a long-run agenda of innovative mathematics teachers' PD programs (Kusumah and Nurhasanah, 2017; Sumaryanta, et al., 2018). As an archipelago nation with a large population of mathematics teachers, online learning has become an alternate strategy in Indonesia that complements face-to-face in-service mathematics teachers' PD (Marfuah, 2017; Sumaryanta, et al., 2018). Due to the COVID-19 pandemic, online learning become inevitable as the primary strategy for mathematics teachers' PD in Indonesia.

The outcome of the national assessment, which was conducted in batches from 2015 to 2018, is one of the pillars of in-service mathematics teachers' PD strategies in Indonesia. This outcome shows the urgency of a follow-up program for strengthening teachers in mastering professional competencies and pedagogical competencies (Sumaryanta, et al., 2018). Professional competencies cover mastering mathematics knowledge

and technology. While pedagogy competencies cover mastering curriculum knowledge, learning theory, developing learning instruction, and managing the classroom. According to Sumaryanta, et al. (2018), as a follow-up program, mathematics teachers' PD in Indonesia is organized based on courses that differentiate mastering mathematics knowledge and pedagogy competencies to be delivered.

Aside from enhancing mathematics and pedagogical competencies, we identify another issue that requires attention in Indonesian mathematics teachers' PD, which is how the PD program in Indonesia can aid teachers in connecting the mathematics they learned in higher education and the mathematics required by the curriculum. The discontinuity between the mathematics that teachers learn during pre-service and the mathematics that is teachers' responsibility in the school curriculum is a gap that must be followed up on mathematics teachers' PD (Dreher, et al., 2018; Kilpatrick, 2019). The in-service mathematics teachers have complicated responsibilities (Herbst and Chazan, 2020), so their mastery of mathematics scholarly knowledge may shift due to their focus on the duties. As teachers concentrate on their in-service duties at school, at the same time, the development of technology and mathematics knowledge is advancing rapidly from what teachers have learned in their pre-service education. So, it is natural to require teachers to upgrade their competencies.

Switching between institutions can create gaps in mathematical knowledge, as evidenced by Basitere and Ivala (2015). The discontinuity can be explained by the Theory of Didactic Transposition (Chevallard, 2019; Chevallard and Bosch, 2020). According to the theory, mathematical knowledge adapts in the institution that produces it. Those institutions are mathematicians, curriculum experts, teachers, and students. The theory implies that teachers' knowledge should cover: scholarly knowledge, curriculum knowledge, taught knowledge, students' learned knowledge, and the transposition between the first four. There are two main transposition stages: external and internal didactic transposition (Bosch, et al., 2021). External transposition refers to the transposition of scholarly knowledge to the school curriculum. Correspondingly, internal transposition refers to the transposition of taught knowledge by teachers to students' learned knowledge. Thus, the transposition knowledge connects the blocks of knowledge that the mathematics teaching profession requires. Hence, the importance of transposition knowledge for mathematics teachers is not about acquiring advanced mathematics but more about analyzing the dynamics of mathematical knowledge multi-dimensionally and coherently, culminating in how students learn mathematics. Furthermore, transposition knowledge values teacher's autonomy as a profession that has a central role in bridging mathematics knowledge and curriculum knowledge, not just accepting it as the policy of external stakeholders.

Given the significance of transposition knowledge for mathematics teachers and the COVID-19 pandemic situation, this study proposed online learning as a solution to lift mathematics teachers' transposition knowledge in Indonesia. The strength of online learning lies in its flexibility, connectivity, and convenience in studying (Kynigos and Kalogeria, 2012; Lamanaskas and Makarskaitė-Petkevičienė, 2021). One of the key ideas to get through the COVID-19 crisis is that the education system should provide digital open educational access that supports the teaching profession (UNESCO, 2020). Hence, this study aims to describe the process of providing online learning situations in lifting the in-service mathematics teachers' external transposition knowledge. We limited our discussion on constructing external transposition knowledge of matrix multiplication. The following are the guiding research questions: how was the process of designing the online learning situation in facilitating in-service mathematics teachers in lifting their external transposition knowledge of matrix multiplication; how was the implementation; and what should be improved for future implementation? To address those research questions, the following section will provide a literature review on the online learning environment from the perspective of a didactic system.

2. Didactical System in Online Learning Environment

Providing mathematics learning situation is about vision on a multidimensional didactic system consisting of teachers' roles, students' needs, specific mathematics content, and learning environment (*milieu*) (Schoenfeld, 2012, p. 588). Milieu contains all objects or materials in the didactic system that students interact with to acquire knowledge. Additionally, a milieu can include devices and digital resources that students interact with (Joubert, 2017). The didactic system includes the interaction between teachers and students (pedagogy interaction/PI), the interaction between mathematics content and students (didactic interaction/DI), and the anticipation of didactic and pedagogy that teachers prepare to teach specific mathematics content (Didactic Pedagogy Anticipation/DPA) (Kansanen, 2003; Suryadi, 2013). A meta-pedadidactic is the educator's ability to comprehensively analyze pedagogy interaction, didactic interaction, and didactic pedagogy anticipation in a learning situation (Suryadi, 2013).

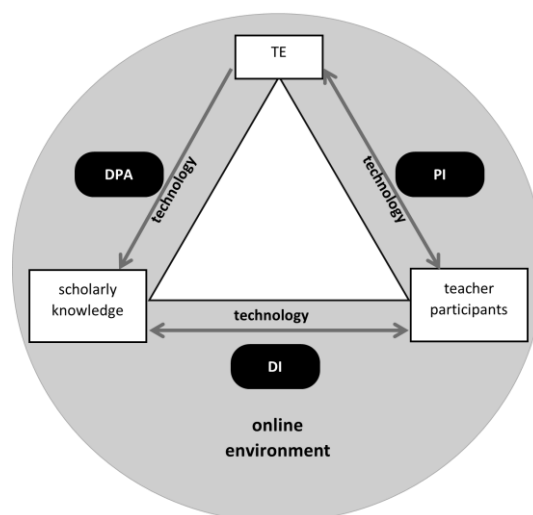


Figure 1: The use of technology in the didactic system

The rapid development of technology expands to the issue of technology integration into didactic mathematics systems (Ruthven, 2012; Cao, et al., 2021). The situation in online learning is undoubtedly different from the situation in face-to-face learning because of the difference in the milieu. Hence, a meta-pedadidactic should be adapted into a meta-technopedadidactic, an educators' ability to comprehensively analyze pedagogic interaction, didactic interaction, and didactic pedagogy anticipation in the use of technology in a learning situation. In this study, the didactic system components are teacher educator (TE), scholarly knowledge about matrix multiplication, and teacher participants, using technology to mediate the DI, PI, and DPA (Figure 1).

The interaction between didactic system components to obtain mathematical knowledge underlies the formation of a learning situation. In the didactic system, Brousseau (2002) defines the learning situation as a series of situations of action, formulation, validation, and institutionalization. Brousseau and Warfield (2020) also write that the learning situation consists of 1) Situation of Devolution, 2) Mathematical Situation, and 3) Situation of Institutionalization. In a Situation of Devolution, the educator explains course objectives, rules and introduces the mathematics problem. Then in a Mathematical Situation, learners perform mathematical activities (our case is matrix multiplication activity), actively make predictions, conduct self-exploration, interact with the milieu, make decisions about mathematical concepts, communicate, and self-validate their decisions. In a Situation of Institutionalization, the participants believe the knowledge is an introspective action on their experience as a learner. Here the educator has a role in preserving participants' knowledge from unexpected deflection and completing knowledge links that have not been covered in previous mathematics situations.

Strengthening teachers' knowledge through online PD courses has become an interest of policymakers, researchers, and educators in various countries (Gómez-Blancarte, et al., 2019; Joubert, Callaghan, and Engelbrecht, 2020; Martínez, et al., 2020; Pölzl-Stefanec, 2021). This research is critical because understanding the learning situation is about more than just the learner's learning outcomes; it is also about understanding the conditions and constraints of the learning system that promote or hinder learning and how the system can be improved for the long-term sustainability of mathematics teachers' PD in Indonesia. Furthermore, substantial consideration should be highlighted to online learning technologies as evidence of implementing new norms in mathematics teachers' PD.

3. Methods

3.1 Didactical Design Research for an online environment

This qualitative research is didactical design research (DDR). Since 2010, Indonesia has led the development and dissemination of DDR (Rudi, Suryadi, and Rosjanuardi, 2020). DDR's philosophy is to provide active learning situations to construct learners' ways of thinking and ways of understanding mathematics knowledge. The core of DDR is how educators explore the reality in the context of the mathematics classroom underlying the change and reflection of learning (Turmudi, et al., 2014; Suryadi, 2019). Here, DDR implements a hermeneutic phenomenology (Ricoeur, 2016) that combines the narrative of experience and the interpretation of experience in the use of technology (Reijers and Coeckelbergh, 2020). This research paradigm is interpretive and transformative (Guba and Lincoln, 2005; Creswell and Creswell, 2018; Suryadi, 2019), where the authors

designed, developed, implemented, analyzed the realities and reflected on learning. DDR is a series of processes in designing learning situations in a didactic system, including analysis of prospective learning situations, analysis of meta-pedagogical, and retrospective analysis (Fuadiah, Suryadi, and Turmudi, 2019; Rudi, Suryadi, and Rosjanuardi, 2020). This study demonstrates how DDR is transforming due to the COVID-19 pandemic. To our knowledge, this is the first DDR study in Indonesia that discusses learning situations in a fully online mathematics classroom with in-service teachers as learners. As a result, the DDR series in this study consists of the analysis of the prospective learning situation, analysis of meta-technopedagogical, and retrospective analysis.

- Analysis of the prospective learning situation

First, the authors analyzed scholarly knowledge using the didactic transposition perspective to develop the reference epistemology knowledge (Chevallard and Bosch, 2020). The authors also analyzed the pedagogical interactions that will be employed to develop the online learning situation. Second, the results of the scholarly knowledge analysis and pedagogy analysis were then presented as a learning situation design. This design included technological analysis to support each phase of the learning situation and the anticipation. Focus Group Discussion (FGD) was then conducted, inviting all of the authors, three mathematics teacher educators (*widyaiswara*), and two experienced teachers for validating our design externally. The results of the FGD became our object of revision.

- Analysis of meta-technopedagogical

The design was implemented in the course, and the authors comprehensively analyzed the aspects of technology, pedagogy, and didactic. The analysis focused on how the providing learning situation can facilitate participants' transposition knowledge of matrix multiplication.

- Retrospective analysis

The retrospective analysis was conducted based on the gap between the analysis of meta-technopedagogical and the prospective learning situation analysis. The authors also reflected on how the system can be improved for future mathematics teachers' PD directions. The retrospective analysis also serves as internal validation by researchers (Creswell and Creswell, 2018).

Thus, we employed this series of prospective learning situation analysis, meta-technopedagogical analysis, and retrospective analysis to address each of the three research questions we set earlier.

3.2 Course setting and Participants

The course was online asynchronous learning held at <http://p4tkmatematika.kemdikbud.go.id/ett/>. Despite the common opinion that underestimated the potential of asynchronous learning in an online environment, asynchronous learning has benefits that teachers were more flexible in managing their time for learning (Koutsabasis, et al., 2011; Kynigos and Kalogeria, 2012), especially during the COVID-19 pandemic. Asynchronous learning contributes positively to learners' learning achievement (Corfman and Beck, 2019; Galikyan and Admiraal, 2019).

All the authors contributed to all stages of the research, and the first author acted as the TE. The participants were 57 mathematics teachers from Indonesian high schools. Participants voluntarily registered through open recruitment, valuing teachers' autonomy and flexibility to engage in mathematics teachers' PD (UNESCO, 2020). Several considerations were used to select applicants: 1) geographical proportions, 2) evidence of statements about the ease of Internet access in their area, 3) evidence of statements about their willingness to participate fully asynchronously, 4) evidence of principal support, and 5) at least has a bachelor's degree in mathematics or mathematics education. As for the first, geographical proportions were taken into account to ensure equity of access to professional development and future dissemination throughout all regions in Indonesia. The second consideration came about as a result of the fact that online asynchronous learning is highly reliant on Internet access. In fact, not all regions in Indonesia have access to a reliable Internet network (Azhari and Fajri, 2021). Meanwhile, the third and fourth criteria were required as evidence of the applicant's commitment to the program and showed support from the principal. Finally, the fifth condition established that participants possess a prior understanding of linear algebra.

More than 60 teacher applicants matched the necessary criteria. However, during the process, some of the chosen participants displayed no online activity and could not be reached in any way. As a result, there were only 57 participants.

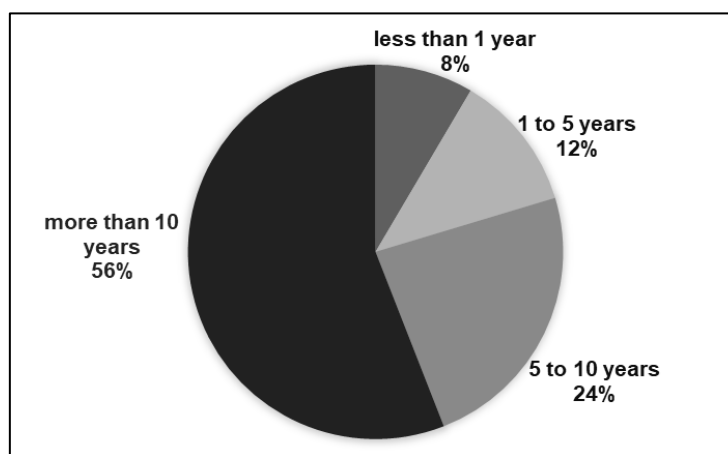


Figure 2: The years of in-service experience of the selected participants

Furthermore, the data on the years of in-service experience of the selected participants are presented in Figure 2. This information is essential to understand how long they have left mathematics scholarly knowledge in their pre-service education. As illustrated in Figure 2, more than half of the selected participants have more than ten years of teaching experience. The authors also interviewed several teachers, asking what they know about why matrix multiplication has a different procedure than matrix addition or scalar multiplication by matrix. These preliminary interviews revealed that most of them never paid attention to the rationale of matrix multiplication that they taught in high school. Yani, a high school teacher in Bantul, Indonesia, said, "I only know the matrix multiplication formula as written in the students' textbook. I just thought it is an international convention that matrix multiplication rules are different from matrix addition or scalar-matrix multiplication..."

Furthermore, the natural setting of participants' technology mastery should also be informed. This study used GeoGebra Classroom as one of the technology in the mathematics situations (which will be discussed later in the analysis of technology sub-section). As a result, information on the GeoGebra skills of the participants is necessary. The chosen participants were asked to answer one multiple choice question on a Google Form regarding how they rated their level of mastering GeoGebra. Figure 3 demonstrates that there were no participants who had never used GeoGebra. Moreover, based on their self-rated, the mastery level of GeoGebra varied and was dominated by participants with moderate GeoGebra skills levels. However, some participants were advanced or even slightly mastered GeoGebra.

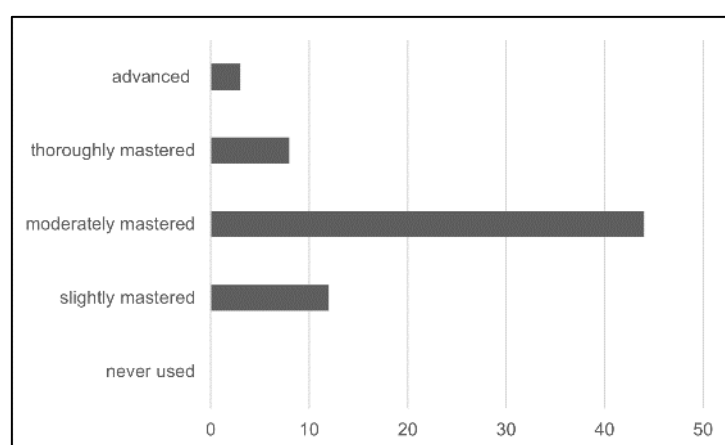


Figure 3: Participants' self-rated mastery of GeoGebra

3.3 Data collection and data analysis

The data was collected through a literature review on scholarly knowledge about matrix multiplication, participants' task responses, participants' responses on the forum, FGD, and phone interviews. For the confidentiality of participants' data, a numbering system prefaced with "P" was used to replace the participant's name. In capturing participant posts on the forum, participants' full names were blurred.

Data analysis was carried out qualitatively (Miles, Huberman, and Saldana, 2014). First, the authors carefully observed the online learning situation and marked the evidence related to the research objectives. Second, the authors discussed internally to reach a consensus on which pieces of evidence should be used, which should be eliminated, and how it should be categorized. Finally, the finding is displayed and concluded. The authors acknowledge the limitations of this study that personal subjectivity and reflection strongly influence the analysis. Hence the authors used various data to triangulate the findings and minimize bias (Denzin, 2017).

4. Results and Discussion

In this section, the results of the analysis of the prospective learning situation, analysis of meta-technopedadidactic, and retrospective analysis will be presented. Analysis of the prospective learning situation is used to answer the first research question: How was the process of designing the online learning situation facilitate in-service mathematics teachers in lifting their external transposition knowledge of matrix multiplication. Meanwhile, analysis of meta-technopedadidactic is used to solve the second research question: how was the implementation of online learning situations facilitate in-service mathematics teachers in lifting their external transposition knowledge of matrix multiplication. Finally, the retrospective analysis means to answer the last research question: what should be improved for future implementation.

4.1 Analysis of the prospective learning situation

Here, the analysis of scholarly knowledge as didactic, analysis of pedagogy, and analysis of technology will be discussed. The discussion will be continued with the development of a prospective learning situation. The results of the FGD will then be presented as an external validation of the learning situation's design.

4.1.1 Analysis of scholarly knowledge of matrix multiplication

The concept of the matrix is one of the essential pieces of scholarly knowledge in mathematics. Matrix multiplication is a compulsory topic in Indonesia's high school curriculum (age 16–18 years old) (Ministry of Education and Culture, 2018). However, the definition of matrix multiplication in the high school curriculum is a ready-to-use concept that is abstract and procedural (Allyson Hallman-Thrasher, Erin T. Litchfield, and Kevin E. Dael, 2016; Barahmand, 2020). Matrix multiplication at the Indonesian high school level curriculum leads to the solution of a system of linear equations. On the other hand, matrix multiplication is defined in scholarly knowledge in the 18th century by Arthur Cayley (Barahmand, 2020) and then occurs in linear algebra, which can be visualized geometrically (Cook, Zazkis, and Estrup, 2018).

The analysis of scholarly knowledge was based on the study of Cook, Zazkis, and Estrup (2018) that discuss the rationale of matrix multiplication in linear algebra. Scholarly knowledge continues to develop dynamically along with technological developments so that there are more and more studies supporting the emerging technology to support the visualization of teaching matrix concepts at the tertiary level, as shown by (Aytekin and Kiyamaz, 2019). At this point, the learning situation tends to facilitate teachers constructing an understanding of matrix multiplication using visualization and then providing a discussion about the transposition.

4.1.2 Analysis of pedagogy

Constructive learning is the pedagogical approach used in this study. The learning process begins with a triggering question, which is followed by scaffolding tasks that help learners through the action, formulation, validation, and institutionalization processes, allowing them to develop their knowledge (Brousseau, 2002). Because in-service teachers are adult learners, andragogy should be taken into account when shaping pedagogical interactions. Adult learning andragogy is concerned with respecting principles such as the learner's curiosity for information, autonomy in learning, prior experiences, preparedness, orientation, and motivation (Knowles et al., 2015).

4.1.3 Analysis of technology

Technological requirements in the design are centered on technology to support didactic interaction, pedagogy interaction, and didactic pedagogy anticipation. In particular, the technology is needed to facilitate participants in constructing knowledge of matrix multiplication visualizations in an online environment. Technology in mathematics learning plays two prominent roles: technology to provide a feedback environment and technology to do mathematics tasks (Joubert, 2017). Therefore the design combined Moodle as a Learning Management System (LMS) and GeoGebra Classroom as a Task Response System (TRS).

The decision was based on the following. One of the factors in the failure of online learning during the COVID-19 pandemic in Indonesia is the teachers' readiness to use technology (Mulyanti, Purnama, and Pawinanto,

2020; Azhari and Fajri, 2021). So, the choice of popular technology is fundamental in reducing TE and participants' anxiety (Price and Kadi-Hanifi, 2011). Moodle is a popular LMS technology used in mathematics teachers' PD in Indonesia. Indonesia is one of the top ten nations worldwide regarding the number of Moodle accounts (Moodle, 2021). The main features were needed are forums and pages, which are well integrated into Moodle and are adaptable (Zainuddin, Idrus, and Jamal, 2016). Moreover, numerous studies have established that Moodle-mediated learning contributed positively to the mathematics learning process (Mlotshwa, Tunjera, and Chigona, 2020; Astriawati and Pratama, 2021).

GeoGebra Classroom is a GeoGebra-based virtual classroom. GeoGebra is a popular tool in mathematics education that combines Computer Algebra System (CAS) and Dynamic Geometry Software (DGS) (Hohenwarter and Fuchs, 2005; Marfuah, 2017). GeoGebra features a special plugin to combine with Moodle (Ferdianová, 2017). GeoGebra is also widely known to positively impact mathematics learning (Adelabu, Makgato, and Ramaligela, 2019; Martinovic and Manizade, 2020; Juandi, et al., 2021). However, GeoGebra Classroom as a new TRS developed by GeoGebra (Zöschbauer and Hohenwarter, 2020) still opens opportunities for further exploration. It allows a teacher to notice all learners' manipulation when they engage in a GeoGebra activity even though the teacher and students are not in the same room. GeoGebra Classroom allows the TE to observe participant interactions with GeoGebra, read each participant's response, and monitor participants' progress online. Additionally, participants are not required to create an account or join the GeoGebra website; instead, they just input the class code given by the TE.

4.1.4 Prospective learning situation

Table 1 is the learning trajectory in GeoGebra Classroom from our prospective analysis. The analysis is based on the fact that in-service teachers have already learned abstract knowledge of linear algebra in their pre-service education. The visualization is more to bridge the teacher's transposition knowledge, not narrow down the teachers' generalizations and reasoning.

Table 1: Learning trajectory in GeoGebra Classroom

Chapter	Technology
1. A matrix is a vector in vector space	
a. Recalling vector space definition	video, text, task 1
b. Vector in n-dimensional Euclid space	text
c. Focus on 2- and 3-dimensional Euclid space	task 2, task 3, task 4, task 5
2. Visualization of additional vectors	
a. Visualization in $\mathbb{R}^2$	task 6, task 7
b. Visualization in $\mathbb{R}^3$	task 8
3. Visualization of scalar-vector multiplication	task 9
4. Linear combination	text, task 10
5. Linear transformation	text, task 11
6. Matrix-vector multiplication	
a. Visualization in 2-Dimensional	task 12, task 13, task 14
b. Visualization in 3-Dimensional	task 15, task 16

Due to the COVID-19 pandemic, shifting from a face-to-face didactic system to an online environment is inevitable. The anticipation was re-situating the learning situation in an asynchronous environment. Table 2 shows the sequence of the situation of devolution, mathematics situations, and the situation of institutionalization to change the milieu from a face-to-face classroom to an online environment. Figure 4 shows the capture of our GeoGebra Classroom.

Table 2: Prospective learning situation

Situation	Activity Description	Technology Environment
Situation of Devolution	Course Introduction - One of the introductory fragments in Moodle Page: <i>"An activity of using GeoGebra Classroom will be presented to understand the visualization of matrix multiplication. If you were familiar with using GeoGebra in terms of your duties as a teacher, then here, GeoGebra will be used to demonstrate as you are a mathematician. Please click on the following link and enter the code provided by TE. You are free to discuss anything related to this visualization in the provided forum."</i>	Moodle Page

Situation	Activity Description	Technology Environment
Mathematics Situation	Visualization of Matrix Multiplication $Ax = b$ - Participants' self-exploring the GeoGebra Task (see Table 1)	Moodle link to GeoGebra Classroom
Situation of Institutionalization	Discussion - Participants were free to discuss with milieu to formulate and validate their task in the GeoGebra Classroom. Discussion - TE checked the participants' responses in GeoGebra Classroom and compared to the predicted references knowledge - TE intervenes in the discussion to bridge the institutionalization of participants	Moodle Forum

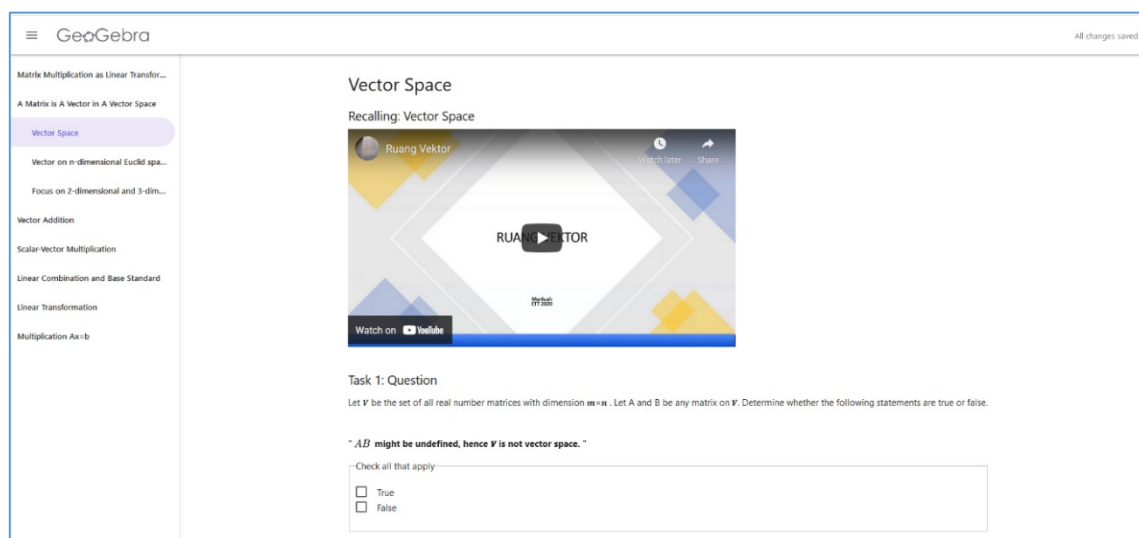


Figure 4: A capture of activity in GeoGebra Classroom (after translation)

Of the sixteen GeoGebra tasks provided, the discussion is limited to tasks 12-14 because the responses to tasks 12-14 best described how participants construct their transposition knowledge. Task 12 asks participants to respond by moving the red point to change the matrix A in order to observe the visualization of matrix multiplication (Figure 5). Task 13 is a question that directs participants to visualize multiplying specifically $\begin{bmatrix} 0 & 3 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ using an applet in Task 12. Task 14 is an essay question to explore participants' ideas about matrix multiplication visualization related to the matrix multiplication process in a high school way. The question of Task 14 is:

*"Are the visualization results following the usual matrix multiplication calculations rules that you teach?
Please elaborate your answer".*

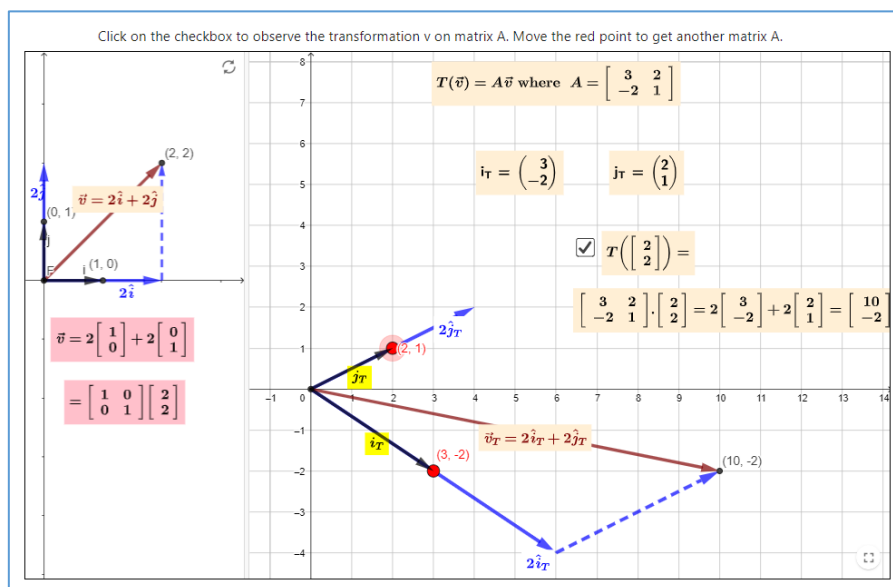


Figure 5: Task 12 in GeoGebra Classroom (after translation)

4.1.5 FGD results

Table 3 shows the FGD results. FGD emphasizes a research process to ensure rigor and validity (Hennink, 2014). The FGD was dominated by discussions about trajectory in the GeoGebra Classroom. Some detailed points in the instructional required improvement. Overall, the FGD participants agreed that the prospective learning situation could be implemented.

Table 1: FGD Result

Validator	Suggestion	Revision
Teachers Educator	The time duration of the video should not be too long.	The video length was revised to less than 3 minutes.
	Teachers may have forgotten the linear transformation matrix. More GeoGebra exploratory activities should follow the explanation of the linear transformation matrix.	More GeoGebra activities of the linear transformation matrix were added.
Teachers	Sliders for visualization in Task 15 should only be integers because the main idea is to understand the visualization, not to do complex calculations.	The increment of the slider in Task 15 was changed from decimal to an integer

4.2 Analysis of meta-technopedadidactic

The second research question is answered by analyzing participants' responses in the GeoGebra task and Moodle. Participants' posts in an online asynchronous discussion can represent the level of knowledge institutionalization and the level of involvement in their learning process (Galikyan and Admiraal, 2019). The findings are categorized into the following.

4.2.1 The role of technology as a visualization tool

Task 14: "Are the visualization results following the usual matrix multiplication calculations rules that you teach? Please elaborate your answer".

Task 14: Question

Apakah hasil visualisasi sesuai dengan perhitungan perkalian matriks menggunakan cara yang biasa Saudara gunakan? Jelaskan jawaban Saudara.

sama, tetapi algoritmanya beda. DI SMA $Ax=B$ pakai aturan baris kali kolom. Dengan visualisasi saya menemukan bisa juga pakai kombinasi linear dari kolom-kolom A. Dan bagi saya, visualisasi ini lebih mudah dipahami cara menghitung perkalian matriks. Hanya saja harus mengingat kembali aljabar linear, yang anak SMA belum dapat.

Figure 6: P1's answer to Task 14

P1: "The result is the same, but the algorithm is different. As for high school students, they use matrix multiplication by multiplying rows by columns. Meanwhile, using visualization, I found that matrix multiplication can also be a linear combination of the columns in A. Moreover, for me, this visualization is easier to understand. It is just that I have to recall linear algebra. Furthermore, high school students have not studied linear algebra yet."

By conducting interviews, we were able to triangulate the answers of P1 as below.

"I have been an in-service teacher for 15 years. When I studied linear algebra, I did not know GeoGebra, let alone GeoGebra Classroom. Visualization using GeoGebra reminded me of the connection between matrices and vectors. Maybe I just forgot this connection. I teach both topics (matrix and vector) in high school. However, I have always thought that matrices are algebra and vectors are geometry. Using GeoGebra makes me clearly understand the rationale of matrix multiplication that I teach. It adds to my personal knowledge."

P1's responses in Figure 6 showed that visualization helps learners concretize mathematical objects and make generalizations (Harel, 2017). This result reflects those of Arcavi (2003), who also find that visualization helps learners re-engage conceptual foundations that formal solutions can easily cover. Visualization combined with other teaching strategies has been effective in helping students understand matrix concepts (Harel, 2019). This finding also shows that GeoGebra Classroom's role in online asynchronous situations provides didactical interaction between learners and mathematics content. Furthermore, the GeoGebra Classroom facilitates self-constructive learning in the provided learning situations. The use of technology to support visualization in learning is also proven by Stevenson et al. (2015), can create meaningful and learner-centered learning.

4.2.2 Evidence of participants' external transpositions

The question of Task 14 was repeated in the Moodle Forum to reinforce the discussion. The TE's question in Moodle Forum was,

"Explain your perspective about matrix multiplication visualization related to matrix multiplication that you taught according to the curriculum?"

The authors conclude three categories of evidence of learners' external transposition knowledge. First, there was an acknowledgment of the limitedness of using visualization in matrix multiplication (Figure 7). Second, there was a difference of opinion about whether this visualization could be delivered to high school students (Figure 8). And third, attention to the multiplication of $Ax = 0$ for $x \neq 0$ (Figure 9).

In Figure 7, Astri's institutionalization came to the conclusion that visualization is limited to the matrix of 2×2 or 3×3 dimensions. Astri's opinion is in line with Harel (2019) that visualization can limit the students' ability at the tertiary level to generalize matrix concepts. Here external transposition knowledge brought Astri to a broader understanding of how the curriculum selects and presents scholarly knowledge (Chevallard, 2019).

RE: KB5: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
 by **ASTRI** · Tuesday, 14 July 2020, 6:08 PM

saya sudah mencoba memvisualisasi geometri hasil transformasi vektor v berdasar matriks A pada Geogebra book yang ibu buat. Hasilnya sama dengan cara perkalian matriks yang telah di ajarkan kepada siswa. Menurut saya kelemahan pendekatan Geometris ini tidak bisa diterapkan untuk matrik yang berordo selain 2×2 dan 3×3 misalnya matriks berordo 2×3 dan 1×3 yang dapat dikalikan dengan matrik vektor begitupun dengan matriks berordo 1×2 dan 3×2

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(the authors' translation)

"Using the GeoGebra book you created, I've tried to geometrically visualize the transformation of Av . The result is the same as the matrix multiplication that I teach to students. In my opinion, the weakness of using the geometric approach is that it cannot be applied to matrices with dimensions other than 2×2 and 3×3 . For example, multiplying a matrix of 2×3 , 1×3 , or 1×2 by a vector."

Figure 7: Astri's statement about the limitation of visualization

In Figure 8, Sari and Rahi differ in opinion about how visualization can be introduced to high school students. Sari argued that the prerequisite for understanding the visualization of matrix multiplication lies in students'

recognition of object position in 2-dimensional and 3-dimensional space. So, according to Sari, as long as students master these prerequisites, visualization can be delivered. Meanwhile, Rahi argued that students should have learned vector concepts to understand visualization. However, in the Indonesian high school curriculum, the vector topic is non-compulsory. Hence, the visualization approach cannot be delivered to all students. Rahi also emphasized the formidable challenge of introducing the concept of linear algebra to high school students.

RE: KBs: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
by Sari | Tuesday, 14 July 2020, 11:49 AM

Menurut saya bu... urutan materi dan prasyarat untuk memahami visualisasi perkalian matriks adalah anak mengenal posisi titik bidang datar dan bidang ruang, pada sumbu xy dan x... sejauh visualisasi membantu siswa untuk menentukan komponen matriks bu

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RE: KBs: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
by RAHI | Wednesday, 15 July 2020, 8:22 AM

siswa hendaknya sudah mendapatkan materi vektor dengan benar. vektor didapatkan siswa pada matematika peminatan kls x dan matriks matematika wajib kls xi. visualisasi perkalian matriks ini bisa diajarkan kesiswa hanya jika materi vektor sudah didapatkannya. itupun menurut saya berat kecuali penjelasan konsep aljabar linear diskip langsung ke pendekatan vektor geometris

(the authors' translation)

Sari: "I think the prerequisites in understanding visualization of matrix multiplication lies in understanding object position on 2- or 3-dimensional space. As long as students master these prerequisites, visualization can be delivered."

Rahi: "Students should have learned vector concepts to understand visualization. But, the vector topic is non-compulsory (in the Indonesian high school curriculum). So, the visualization approach cannot be delivered to all students. I think introducing linear algebra to high school students is quite a challenge unless the concept of linear algebra is omitted and the geometry visualization explanation is given first."

Figure 8: Difference of opinion of Sari and Rahi

As triangulation, Sari's opinion arose because of the experience as a mathematics teacher in a science specialization high school, in which all students have studied vector topics. Meanwhile, Rahi's opinion reveals obstacles in the structure of the Indonesian curriculum so that it is impossible to teach matrix multiplication using visualization. Rahi was aware of the didactical obstacle of matrix topic at the high school level. A didactical obstacle is a learning barrier that emerges from the curriculum structure (Brousseau, 2002). Further research is needed to determine how this awareness can inspire teachers to anticipate students' learning obstacles.

Figure 9 shows another evidence of external knowledge transposition. The TE intervened in the situation by asking in the forum:

"Have you observed the visualization of $Ax = 0$? Tell me your finding."

Here TE played a role in linking teachers' scholarly knowledge to the curriculum. In the situation of institutionalization here, TE used Moodle and GeoGebra Classroom simultaneously to intervene to complete knowledge links that have not been covered in previous mathematics situations.

RE: KB5: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
 by TUM - Wednesday, 15 July 2020, 9:02 PM

saya mencoba-coba di GeoGebra Classroom bagaimana supaya $Ax=0$. Ternyata untuk dua dimensi, $Ax=0$ kalau vektor i dan j adalah vektor yang berlawanan. Sekarang saya dengan cepat membuat contoh $Ax=0$ yang A dan x keduanya tidak 0 pada siswa saya, karena siswa sering tidak hati-hati dengan perkalian matriks $Ax=0$.

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RE: KB5: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
 by Mei - Wednesday, 15 July 2020, 11:37 PM

Terimakasih Pak menambah pengetahuan saya

Permalink Show parent Edit Split Delete Reply

RE: KB5: DISKUSI TENTANG VISUALISASI PERKALIAN MATRIKS
 by Mal - Thursday, 16 July 2020, 2:16 AM

$Ax=0$ matriks A dan x keduanya bisa tidak nol ya Bu. dengan visualisasi jd sangat jelas. tapi saya hampir tidak pernah memberi soal $Ax=0$ ke siswa. menghitung perkalian matriks saja biasanya anak-anak masih kesulitan. terimakasih Pak

(the authors' translation)

Tum: "I explored the GeoGebra Classroom to visualize the multiplication of $Ax = 0$. I found that, for 2-dimensional space, $Ax = 0$ with $x \neq 0$ would be satisfied if the columns in matrix A were two vectors (with the same length) but in opposite directions. Now I can make example $Ax = 0$ for my students with more variety. My students are often not careful when encountering questions $Ax = 0$."

Mei: "Thank you for improving my understanding."

Mal: "I never asked my students about $Ax = 0$. They still have difficulty calculating the results of matrix multiplication in general (let alone determining $Ax = 0$)".

Figure 9: Discussion about $Ax = 0$

Mal's statement is consistent with Cook's (2018) that teachers frequently overlook the importance of reinforcing students' understanding of the zero-product property. High school students already have a lot of mathematics knowledge in their mathematics experience. However, the matrix is the first mathematical object in their cognitive structure where multiplication is not commutative, and the zero-product property is different from the multiplication of real numbers. The discussion above also shows that the providing learning situation facilitated learners to build their external transposition knowledge about $Ax = 0$. These results also support the idea of Wasserman (2018) that institutionalizing advanced mathematical knowledge can help teachers build ways of thinking about mathematics practice in schools. Moreover, it also raises the reflection of teachers' internal transposition in the classroom. As Kynigos and Kalogeria (2012) state, online learning provides a communication medium for teachers to express mathematical ideas and share their pedagogical experiences.

4.2.3 Technology as constraints but also collaboration tool in the learning situations

Technology was also the main constraint that hindered the participants' institutionalization. The finding shows that some participants had difficulty doing Task 13 and expressed it in the Moodle discussion forum. Here is one fragment of Moodle forum discussion.

P2: "Please guide me on how to answer this question (P2 captured Task 13). I do not know how to visualize."

P3: "me too...."

P5: "Go to Task 12 first. Then,

1. Move i to $[0,2]$ using redpoint;
2. Move j to $[3,-1]$ using redpoint;
3. Please look at what happens when you make changes, focussing on the matrix multiplication form displayed as text. "

P2: "Thanks."

P4: "Thanks for the explanation. Now I have a little idea too."

After observing P2, P3, and P4's responses in GeoGebra Classroom, they managed to complete all tasks as predicted. This finding shows that the anticipation of providing a discussion forum on online asynchronous situations plays a vital role in pedagogy interaction and didactic interaction (Galikyan and Admiraal, 2019). Participant P2 could not start the Mathematical Situation because they were not clear about the given rules in the Situation of Devolution. Nevertheless, they took the initiative to ask milieu for help in the discussion forum (and it turned out that P3 and P4 experienced the same situation). Here, the technology served as a collaboration tool between learners as they interact in solving a problem.

4.3 Retrospective analysis

Another finding was that twelve participants (around 21%) jumped Tasks 12, 13, and 14 in the GeoGebra Classroom. Consequently, there was no evidence of their institutionalization process. The authors observed the discussion forum and triangulated it with phone interviews. Participants who did not complete all the tasks were questioned about their reasons and difficulties. The reasons for incompleteness tasks were categorized as 1) time management, 2) being hesitant to ask questions in the forum, and 3) only focused on Moodle activity completion. This finding is not surprising as many authors mention the disadvantages of asynchronous online learning: participants tend to neglect tasks completion (Galikyan and Admiraal, 2019; Lamanauskas and Makarskaitė-Petkevičienė, 2021). Despite the fact that the participants were previously set to voluntary registration, acknowledging not anticipating this finding should be delivered as the main retrospective of the learning situations.

As a retrospective analysis, the authors noted some anticipations for future improvement. First, the authors see the need to strengthen participants' understanding of the GeoGebra environment to minimize technology issues. Providing introductory workshops can be a great way to shape participants' technological readiness (Pölzl-Stefanec, 2021). Second, the TE should encourage participants to be more active in discussing asynchronously in Moodle, considering the critical role of discussion forums in all learning situations. "Students need to be made aware of potential knowledge construction benefits of discussion forums in order not to view contributions to online discussions as something extra" (Galikyan and Admiraal, 2019, p. 7). Finally, the authors see the need to provide real-time communication in facilitating pedagogy interaction and didactic interaction, such as social media. A learning management system supported by interactive communication technology through social media encourages learners to actively participate in the learning process (Chaka, Nkhobo, and Lephala, 2020). Further research must devise practical strategies for increasing learner engagement in online learning without limiting teachers' autonomy as adult learners.

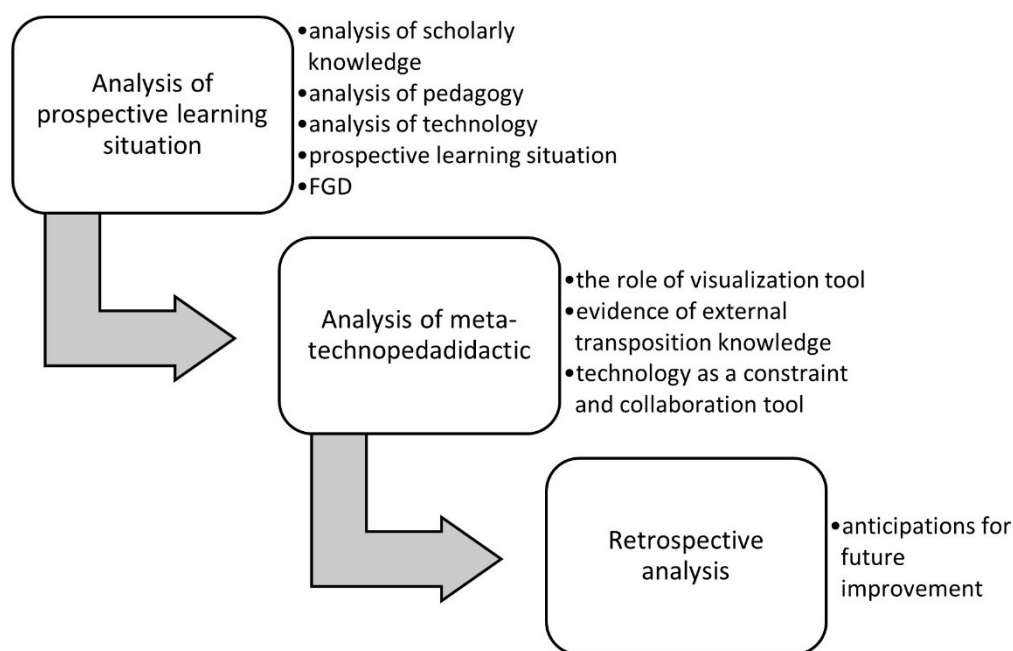


Figure 10: The findings in this study

5. Conclusion

This study describes the process of providing online learning situations in facilitating the in-service mathematics teachers lifting their external transposition knowledge of matrices multiplication during the COVID-19 pandemic. As shown in Figure 10, the process began with an analysis of prospective learning situations, followed by an analysis of meta-technopedadidactic, then a retrospective analysis. In the analysis of prospective learning situations, we developed our reference epistemology knowledge and pedagogical analysis. We then designed a learning trajectory and anticipation involving technology. The design of the learning situation combined Moodle as a feedback environment and GeoGebra Classroom as a task responses system. Focus Group Discussion was conducted to ensure the validity of the prospective learning situation. The meta-technopedadidactic analysis displayed the role of visualization using technology in didactic and pedagogy interaction. It also revealed

evidence of how learning situations can promote or hinder learning. Finally, the retrospective analysis suggested some improvements for future learning. Although the learning situation in this study is specifically related to the socio-cultural of educational institutions in Indonesia, the findings have the potential to be an asset for the long-term sustainability of e-learning for teachers' professional development programs, particularly those aimed at improving specific subject-matter knowledge, in mathematics or beyond. Further research is needed on how mathematics teachers' professional development provides e-learning to lift the internal transposition knowledge of the teachers.

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Editorial for EJEL Volume 20 Issue 1

Dear readers,

This edition of EJEL is a second and a final instalment of the special issue comprising articles responding to the call for papers from December 2020, on Covid-19 and the future of e-learning. The papers in this edition add to the diversity of views across different subject areas (technology, languages and mathematics) and different regions (China, Romania, Spain, South Africa and Indonesia).

Dan Li from Hunan Railway Professional Technology College (China) presents the results of a survey study on the benefits and challenges of online classes during the pandemic, from the students' perspective. These are confirming some of the findings from other similar studies from the previous issue on this topic (for example, technology obstacles) but also add some new findings, such as the benefits of developing digital learning communities. The shift to online learning seems to have induced a shift of power in the student/teacher relationship too, with students expecting to be more involved in future online learning design and setting higher expectations for teachers' online presence.

Benefits and challenges of online learning during the pandemic have also been considered by Lidia Alexa and her colleagues from Gheorghe Asachi Technical University of Iași (Romania). The outcomes of their (complementary) mixed method study suggest that students' digital competencies do not necessarily lead to the full exploitation of the benefits of online learning. They found that the role of teachers has expanded beyond learning and teaching to also providing mentorship and guidance in the times of crisis, suggesting wider institutional implications.

The paper by Nassima Kerras et al. from the Universities Pompeu Fabra and Granada (Spain) presents the challenges of online learning during the pandemic from the perspective of students learning Arabic language. In comparison with technical subjects studied in the previous two papers, the results of their survey indicate some specific difficulties of using technology to mediate the learning of pronunciation. The authors emphasise the need for empathy and creativity in class for increasing students' motivation for online learning.

Online learning of Arabic language is also the focus of the paper by Tawffeeq Mohammed from the University of the Western Cape (South Africa). In addition to evaluating students' learning experience using a purposely designed survey the study provides details of the course design founded on a Technology Integration Matrix with Bloom's taxonomy (Winkelman). The findings emphasise the benefits of digital storytelling and interactive online tools such as Sanako Connect for the effectiveness of students' learning.

Marfuah Marfuah and her collaborators from four different universities in Indonesia employ didactic design research in the analysis of pedagogical and didactic interactions in online learning of in-service mathematics teachers'. Their analysis reveals the crucial role of discussion forums for students' learning but also the need to explain the benefits of discussion for learning to the students who sometimes see it as an 'optional extra'.

The articles in this issue confirm that there is a great level of agreement on students' perspectives on online learning across different subject areas and different regions. To conclude this multi-instalment (19.1, 19.4 & 20.1) special issue on Covid-19 impact on e-learning, we can say with some confidence that the eagerly anticipated end of the pandemic would not imply the end of online learning. On the contrary, online learning is 'here to stay' despite the exposed issues and challenges. The experience gained during the pandemic will help in combining online with face-to-face instruction into meaningful and transformative learning activities that make up the blended learning model.

Journal Editors,

Marija Cubric and Heinrich Söbke