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EXPLORING DISTANCE TRAINING IN LIFE AND EARTH SCIENCES: TOOLS, PRACTICES, CHALLENGES, AND WAYS OF IMPROVEMENT

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Abstract- This study aims to assess the experience of distance training in the department of Life and Earth Sciences (LES) at the Regional Centre for Careers Education and Training, Marrakesh-Safi (RCCET-MS) in Morocco, to ensure pedagogical continuity, during the Covid-19 confinement period. The study used the analytical descriptive approach and involved trainers and teacher trainees of Life and Earth Sciences (N=116). To answer the study questions a questionnaire was developed and introduced to participants. Findings showed that a set of information and communication technology (ICT) tools and distance training models were implemented to ensure training for teacher trainees, despite the poor theoretical and practical training in ICT use in remote education. Faced challenges included weak interactivity and difficulty in assessing trainees' achievements during the virtual sessions. The researchers recommend that teachers should be trained in ICT use in distance education, and high-quality numerical tools should be developed and made available for training and education purposes.

Keywords: Pedagogical Continuity, Distance Training, Life and Earth Sciences Department, ICT, Covid-19 Confinement.

1. INTRODUCTION

A global closure of educational institutions, colleges, and universities has been recommended as a result of the Covid-19 pandemic's rapid spread. Up to 99% of school-age children globally were affected by learning space closures in low- and lower-middle-income countries. Many countries have turned to distance learning as a reaction to this epidemic to guarantee that learning continues for all age groups. From primary to higher education, Moroccan students will be taught remotely using national television networks, national education portals, social media, and interactive and online platforms, according to a decision made by the Ministry of National Education (MoNE) on March 16, 2020 [1].

In light of this, certain higher education institutions in Morocco have decided to stick with offering their courses exclusively remotely, while others have chosen to use a hybrid approach, and yet others have started offering in-person instruction [2]. To ensure proper pedagogical management of the training year 2019-2020 within the Regional Centers of Carriers in Education and Training (RCCET), the MoNE has established a schedule specifying all operations aimed at completing training programs and organizing required examinations during the COVID-19 pandemic. Based on various ministerial notes and decisions, a regional plan of distance training for the benefit of trainees at the RCCET-MS, was established.

Accordingly, to ensure pedagogical continuity for teachers' qualification, the department of LES at the RCCET in Marrakesh has endeavored to take a set of pedagogical measures to secure the time of "distance learning", for the benefit of 108 trainee teachers, during the period of confinement. Faced with the uncertainty of when the Covid-19 confinement will end, or when new waves of the virus may emerge, "distance learning" has become a mandatory alternative and has been an emergency change in the training process, raising many questions about the post-Covid-19 pandemic training scheme.

Will things return to normal? Is there an urgent need for a comprehensive evaluation and review of the training and education process? Should we prepare for any new emergency? Should we remote to distance training to adapt to the changing health situation due to the pandemic? Is the experience of distance learning, during the confinement period, an opportunity to reconsider the training process at the level of RCCETs in Morocco? To answer the issues mentioned above and predict the future of "distance learning", it was necessary to investigate the challenges and constraints that impeded this experience within the department of LES in the RCCET-MS. This can be achieved by investigating participants involved in the training program during this period. The raised questions include:

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- Which modules were taught remotely?
- What were different digital media that have been used?
- What instructional activities were conducted during the confinement period?
- What are the constraints and challenges encountered during distance training?

The prevailing policy strategies adopted by training institutions worldwide underscore the crucial role ICT can play in enhancing the quality of education in sciences and engineering. In fact, ICT and distance e-learning are implemented in science and engineering institutions in differing degrees. Moreover, several studies reported on the usage of ICT tools and distance e-learning in engineering education, and their impact on students [3]. However, there are very few reports that have examined the use of ICT and distance learning in training preservice teachers of sciences, before and during the Covid-19 pandemic [4].

In fact, Life and Earth Sciences is not taught as often in a distance-based setting, probably due to concerns about the effectiveness of distance learning, and issues specific to LES education. Therefore, the current study aimed to shed light on distance learning approaches among trainee teachers of LES, with the main focus on the status of ICT and distance training use before and during the Covid-19 lock-in. It also investigated the trainee's engagement, interaction, and performances, as well as constraints and challenges encountered during distance training implementation. The study findings may serve as a basis for the improvement of the distance training process within the pre-service teachers' training establishments.

2. MATERIALS AND METHODS

2.1. Research Design

The methodology adopted consisted of evaluating the experience of distance learning within the department of LES at the RCCET-MS, Morocco, during the period of confinement related to the Covid-19 pandemic. This could make possible the assessment and appreciation of gains, of this local experience, during the period from March to July 2020. The exploration of its evolution and determining factors may help to anticipate the challenges and issues that the current educational training system has to face. Thus, it may contribute to the establishment of an appropriate pedagogical approach that would include "distance learning" in the educational policy of Morocco, with the integration of different forms of training (face-to-face, self-training, and remote training).

2.2. Study Participants and Training Modules

The study involved teachers, with 7 to more than 20 years of experience as a teacher, and trainee teachers of LES (N=116) belonging to the RCCET-MS, Morocco. The taught modules during the study period (2019-2020) consisted of Learning Management, Learning Assessment, Basic Biology Reinforcement, Basic Geology Reinforcement, Didactic Production, Analysis of Classroom Practices, School Life, and School legislation and professional ethics.

2.3. Data Collection Tool

An electronic questionnaire was developed. The questionnaire's sections were divided into multiple-choice and short-answer categories, with the latter concentrating on the respondents' views, preferences, and experiences with distance learning methods. The objectives of the study were explained to the participants, along with detailed instructions for completing the questionnaire and a guarantee of anonymity. Consent was sought from the study participants.

The investigated teachers were allowed to mark more than one choice in responding to the questions on the survey. To ensure the validity of the data collection tool, opinions and comments were taken from specialized educational experts, regarding the clarity of items and the relevance and adequacy of paragraphs. All of the experts' comments were taken into consideration and all required changes were made. The questionnaire, in its final form, sent to the targeted teachers as a Google Forms link, was composed of 18 questions covering the following paragraphs:

- The training of trainers in the use of modern technology
- The degree of preparedness of the trainers for remote training
- The devices, means, and platforms used
- The digital supports used and their quality
- The activities carried out remotely
- The constraints and challenges encountered during the distance training process.

3. RESULTS AND DISCUSSION

3.1. Training in ICT before Confinement (Covid-19)

Based on Figure 1, a high percentage (87.5%) of the participants had received training in ICT before confinement duration (Covid-19). In this context, 57.5% of them reported that the duration of the training attended was between one and three days. This finding may be related to several measures established and implemented by the Ministry of National Education targeting approximately 266000 teachers anterior to the Covid-19 pandemic (1990-2019) [5]. Furthermore, numerous programs have captured the attention of education sector leaders, including NAFIDA, INJAZ, and GENIE. These aimed to train pedagogical staff and generalize the integration of ICT in the educational system to improve the quality of education and training in Morocco, bringing it into line with international standards [6]. However, the Higher Council for Education, Training and Scientific Research [7] reported that most of the teachers at the secondary school level have a moderate mastery of ICT. Moreover, according to the same report, more than 85% of teachers raised the need for training in using ICT in education. It has also been reported that lower ICT proficiency among teachers is strongly linked to their misperception of the impact of distance learning on learners. Thus, training is considered a challenge for education officials to ensure better distance education services.

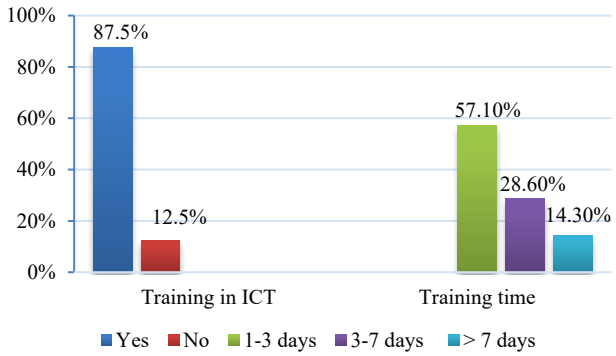

Figure 1. Proportion of participants trained to ICT use in Education and their distribution by the length of time they were trained to use ICT before the Covid-19 confinement period

3.2. Training in Distance Education and Distance Learning Status before Covid-19 Confinement Period

The results' analysis revealed that a significant percentage, 87.5% of the investigated group, had never received training in the field of distance education (Figure 2), despite the discourse on distance education in a set of official documents of the supervisory ministry (National Charter of Education and Training, Strategic Vision 2015-2030 and others). However, most of the training programs offered before were mainly focused on integrating ICT into education, while distance training practices and programs were scarce/not addressed. Moreover, the implementation of the new strategic vision for education and training 2015-2030, has stressed the requirement to generalize ICT in education with the encouragement of innovative educational practices, and ensuring equal access to training for beneficiaries. Teacher trainers have also attended other activities, such as seminars, symposiums, and workshops, around ICT use in education and training [8].

However, very few programs via distance training have been conducted, through setting up online platforms where they can register to have access to the main training modules taught in the RCCET-MS. Based on the study results (Figure 2), all the participants (100%) reported that they had never experienced distance training during their professional practices before the Covid-19 pandemic confinement. The main practice was limited to using ICT to share teaching materials and course summaries in a digital format with trainee teachers, via a number of several digital channels (e-mail, Facebook, WhatsApp, ...).

However, with the adoption of the new strategy for teachers' recruitment (2016-2017) [9], the Moroccan Ministry of National Education has developed a self-training program at a distance designed for teacher trainees. It aimed to develop the trainees' knowledge and professional skills, to fully meet the qualifications and abilities required to carry out the teaching tasks /missions, according to the pedagogical and didactic approaches prescribed by the Ministry of Education, and curricula requirements. For this purpose, teacher trainers within the RCCET had the responsibility for preparing necessary training materials, supervising and accompaniment the target trainees, with the organization of intermittent face-to-face training sessions.

The pre-service teachers' training was carried out in three different and complementary ways: field- training, distance training, and face-to-face training. Considering the professional profile of the trainees, they have benefited from "distance training" through several modules to help them develop the basic skills required for teaching professional practices. This training mode has been provided through courses (MOOC) accessible on the Ministry's distance training portal.

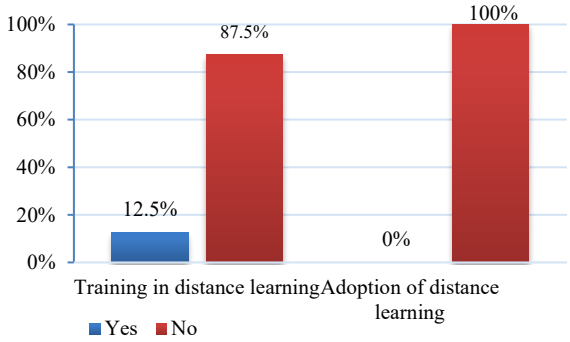

Figure 2. Proportion of participants trained on distance training practices, and participants' use of distance training before the Covid-19 confinement period

3.3. Types of Distance Training Adopted by Trainers in Confinement

According to the study results (Figure 3), 37.5% of the trainers used the synchronous mode as the only distance training method, while 62.5% stated using both (synchronous and asynchronous modes). However, none of the participants used the asynchronous mode only. Synchronous distance training takes place in the physical presence of both the teacher and the trainee teachers, offering the possibility of interaction in real-time between both parts, as well as among trainees. In contrast, asynchronous training occurs via online channels without interaction between the teachers and trainee teachers in real-time through video conferencing, live chat, and virtual classrooms, the lives.

Asynchronous distance training refers to the idea that teacher trainees receive training at different times and places. During the distance training period, trainers provide learning materials for reading, presentations, assignments, and assessment activities. In this case, teacher trainees have the opportunity to access these materials and complete the required tasks within a flexible time frame. In addition, the asynchronous distance training mode includes sharing of self-directed courses, dissemination of content through video, and exchange via discussion forums or social media platforms. The researchers emphasize that the use of ICTs should be compatible with the pedagogical approach followed by the teachers, with the most striking effects being observed among teachers who used ICTs in their professional practices for a long period.

The utilization of synchronous online learning to prepare preservice teachers for online teaching remains an underexplored area in current research. It has been noted that synchronous online training was the predominant

method used to deliver educational content during the Covid-19 pandemic [10]. A prior investigation assessing the effectiveness of an online synchronous platform employed for teacher training revealed that synchronous e-learning technology serves as a valuable learning aid in enhancing preservice teachers' competence in subject matter and ICT skills. However, it was observed that several factors influence preservice teachers' ability to learn and utilize e-learning effectively, such as ease of use, a supportive learning environment, self-efficacy in e-learning, and proficiency [11].

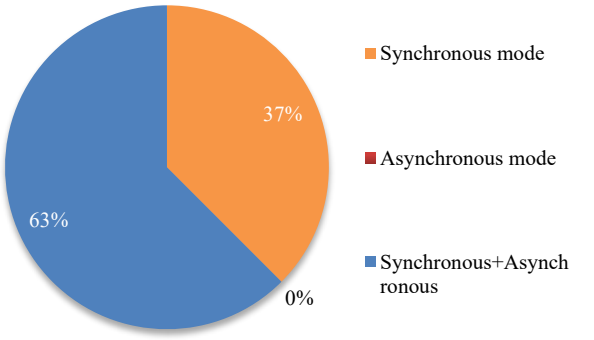

Figure 3. Distance training types (synchronous/asynchronous) participants used during the confinement period

The synchronous learning could be a good fit for fostering instant social interaction and accelerating information transfers, which could foster a sense of community and dispel myths [12]. It does, however, necessitate that trainers and trainees schedule shared times, and it is vulnerable to accessibility issues and technological difficulties relating to the power of Wi-Fi. Asynchronous instruction, on the other hand, offers greater temporal flexibility. This makes the content more accessible to a larger range of pupils and gives trainees more time to study and interact with it. Conversely, students who studied primarily in synchronous environments reported higher levels of peer-centered activities, such feedback, than students who studied primarily in asynchronous environments. Teachers, on the other hand, felt that there were less distinctions between synchronous and asynchronous teaching techniques, particularly when it came to feedback activities. Additionally, compared to trainees in asynchronous settings, students in primarily synchronous settings expressed higher overall pleasure and better support for their basic psychological needs and competence [13].

3.4. Attendance, Participation Rate, and Performance of Trainee Teachers in Distance Training Activities and Sessions During the Covid-19 Confinement Period

Attendance is considered as the most accurate known predictor of academic performance and has long been linked to success in distance training programs [14]. In compliance with the pedagogical rules adopted, to attend to distance training synchronous sessions, trainees are called to be connected to the Internet at a specific time following a schedule (day and time) established by the LES department. The study results indicated that attendance to distance training (synchronous) sessions was considered as average by 75% of the participants, while 25% stated to be high (Figure 4).

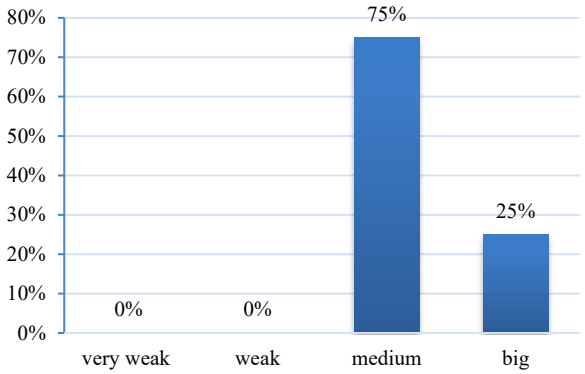

Figure 4. Attendance level of trainee's teachers in distance training activities and sessions during the Covid-19 confinement period

A variety of reasons may be responsible for teacher trainees'absenteeism from synchronous training courses, which can affect the trainees' understanding and performance. These may include, class schedules, training curriculum, content non-relevant, audio-visual equipment of the classes, lack of proper technology ...etc. The current study findings revealed discrepancies in the participation rates of the trainee teachers during distance education courses and activities (Figure 5). Although the preservice teachers can communicate directly with the trainer during synchronous sessions, for 75% of the investigated group, the participation rate of trainees did not exceed 50%, while 12.5% stated that the rate varied between 50% and 75%, versus 12.5% reporting that it was above 75%.

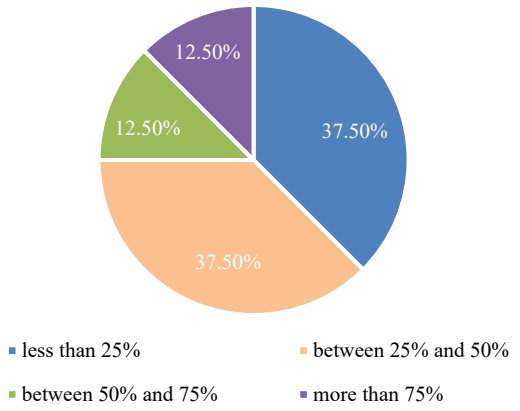

Figure 5. Percentage of participation of trainee's teachers in distance training activities and sessions during COVID-19 confinement period

In contrast, communication between trainees and trainers becomes limited during asynchronous sessions. Indeed, the answers to the trainee teachers' questions cannot be provided instantly in asynchronous sessions, they sometimes have to wait to get an answer by e-mail or via the comments of the virtual classroom. Sometimes this lack of interaction, both with the trainer and/or colleagues, leads the trainee to feel alone, resulting in weak motivation

and lower involvement in activities carried out in scheduled distance training sessions. In fact, this type of training is centered on the trainee teacher, requiring a great deal of autonomy and engagement to successfully complete all the activities of the distance training course. Additional reports revealed that the percentage of students actively engaged in virtual classrooms relative to the total number of students enrolled in virtual classes ranged from 30% to 64% [15]. According to the same authors, online education is a suitable way to decrease lecture hall absenteeism and boost student participation from both the professor's and the student's point of view, in addition to enhancing the variables linked to attendance in courses.

As presented in Figure 6, the study results revealed that the performance of the teacher trainees, in terms of completing the required training activities, was considered as average for 50% of participants, fair (25%), and high (25%). It was anticipated that ICT would result in more effective learning through the use of computers in the classroom. Nonetheless, there are a few research on how ICT affects academic performance. A previous meta-analysis resulted in optimistic conclusions suggesting that ICT use had positive impacts on students' academic achievement [16]. This is in line with case studies reporting a relationship between engineering trainees learning styles and their performance [17].

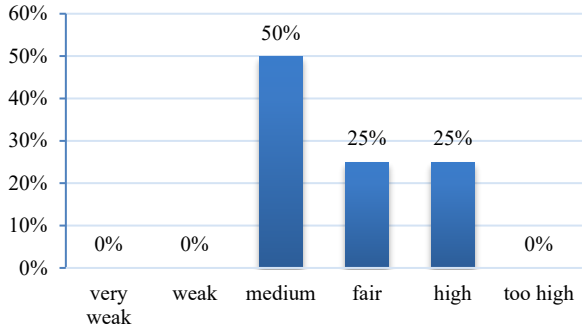

Figure 6. Performance level of trainee's teachers in distance training activities and sessions during the Covid-19 confinement period

3.5. Digital Media used for Distance Training During the Confinement Period

The study findings showed a diversification of the media types adopted to ensure continuity of training during the confinement period during 2019-2020 (Figure 7). A set of different office applications were combined, such as (Word), (PPT), and (PDF), which are widely used by trainers (100%), followed by audio and video type of media (87.5%), while 12.5% of the participants opted for recording audio-visual lessons during the confinement period.

Nowadays it is widely recognized that achieving the international educational goals set requires huge investments in terms of structuring training institutions and qualifying teachers. This major challenge cannot be met by offering traditional face-to-face training but requires adapting the training programs and making them accessible and available to trainers and preservice teachers, with the great support of ICT use [18].

The rates of use of the different digital media by the study group are presented in Figure 7. Interactive and semi-interactive materials accounted for more than half (50%) of the materials prepared and used by the trainers of the LES department during the period face-to-face courses were suspended. Interactive media has been found to have the advantage of increasing student engagement and to having the capacity to offer active, immersive learning that involves social interaction with peers [19]. Non-interactive materials accounted for only 25% of the materials used. Reports indicated that students had positive attitudes towards the use of interactive technology as compared to non-interactive ones, as the latter did not allow them to give feedback to each other or discuss the scheduled topics [20].

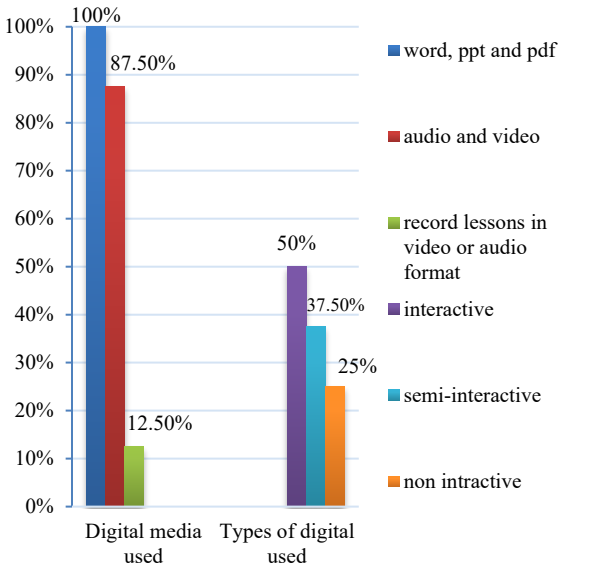

Figure 7. Rate of use of some digital media and their utilization (interactive, semi-interactive and non-interactive) by the study participants in distance training activities and sessions during Covid-19 confinement period

In general, modern technology allows for direct and regular communication, with the provision of information by taking advantage of the transmission of images and sounds at the same time. This made it possible to generate communication, facilitating continuous interaction during the different stages of distance training. Consequently, using different digital technological supports offers many options for modules' content delivery, and provides trainee teachers with many stimuli that address their different senses. So, they can interact in the same training situation through different types of information (image, audio, written text).

In this regard, it has been reported that the extent to which student trainees retain intended information, significantly increased with active participation in the training process. This is especially relevant if the presentation method adopted by the trainer requires the trainee teacher to use all his senses, and being fully engaged in the training process [21].

3.6. Types of Activities Carried out During Distance Training

To ensure the distance training during the period of confinement imposed by the Ministry of Education, the trainers of the department of LES have carried out various activities (Figure 8). These include course presentations (87%), sharing of documents (100%), workshops (75%), and evaluation tasks (62.5%).

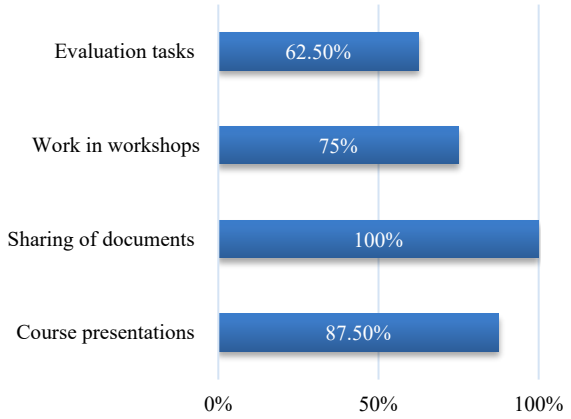

Figure 8. Types of activities teacher trainees carried out during distance training sessions, over the Covid-19 confinement period

The development and implementation of the aforementioned activities complied with the guidelines and training guides approved and prescribed by the Ministry of National Education. However, a few participants used official digital resources designed and provided by the Ministry [22]. Trainers also worked to carry out required assessments of trainees' professional knowledge and skills adopted in face-to-face training, taking into consideration the context of distance training.

3.7. Platforms and Tools Teacher Trainers used for Distance Training, over the Covid-19 Confinement Period

The evolution of platforms becomes imperative with the advancement of ICTs. Utilizing platforms has become obligatory during periods of confinement, exemplified by the Covid-19 pandemic. Consequently, numerous universities have crafted platforms enabling students to access various digital resources and engage with instructors [23]. Within the LES department at the RCCET-MS, "distance training" took place using several platforms and digital tools to communicate and coach the trainee teachers, and assess their cognitive and academic achievements. The results obtained (Figure 9) showed the diversity of techniques and means adopted by the teachers in order to ensure the continuation of the training, we mention, among others, the electronic platforms such as (Google Meet), (Google Classroom) and (Padlet). In addition to using email communication and relying on audio and video recordings. Social media has been a widely adopted medium in distance training during this exceptional circumstance.

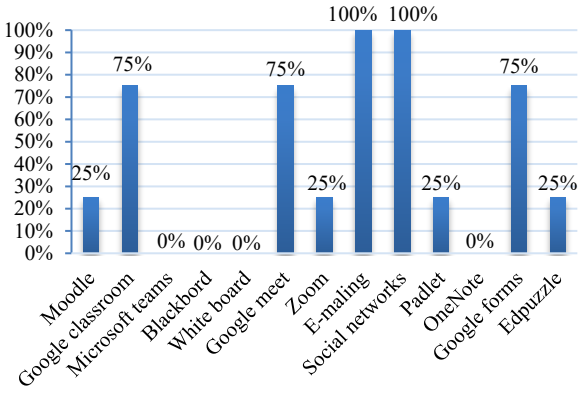

Figure 9. Platforms and tools teacher trainers used for distance training, over the Covid-19 confinement period

3.8. The Degree of Difficulty or Ease of the Methods and Platforms Adopted in Distance Training

The degree of difficulty or ease varies depending on the platform and tool used (Figure 10). The trainers declare that social networks and email are the easiest tools to use, while they stated that Moodle is the most difficult platform to handle.

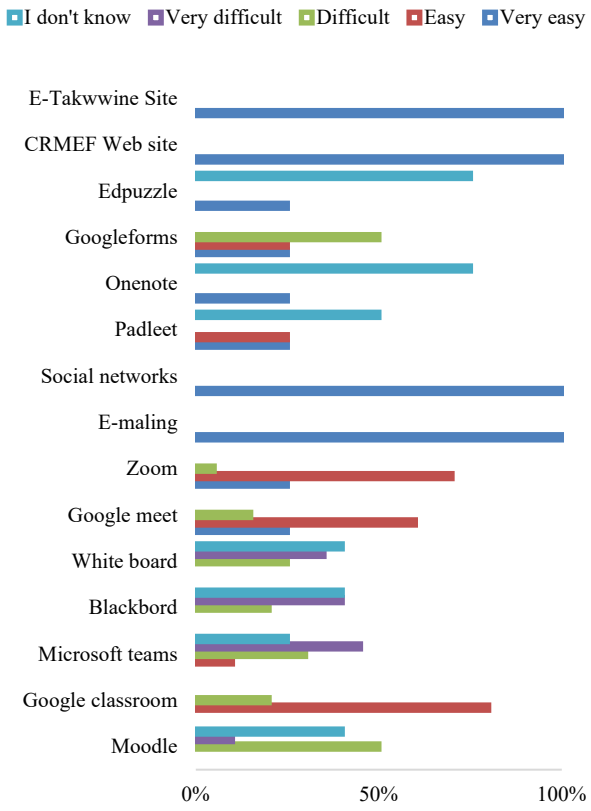

Figure 10. The difficulty or ease level of platforms and tools the participants used for distance training during Covid-19 confinement period

In general reasons for using an ICT method among others and the way in which is integrated into the distance training process are based on the trainer's pedagogical vision, preferences, experience, and competence in the field of ICT use, as well as on trainees' needs. Nonetheless, it is important to recognize that a variety of factors,

including individual traits, disciplinary affiliation, institutional setting, social and cultural milieu, and the understanding of the opportunities and limitations associated with a particular issue or task scenario, all have an impact on educational methods [24]. While it is expected that training outcomes be influenced by teaching practices, perceived and actual training outcomes influence the teacher's subsequent educational decisions. Therefore, in order to match the anticipated or actual influence of educational practices on the intended trainees, influencing elements may need to be changed or updated. [18].

Continuous training in the field of "distance education" should be provided for trainers and teacher trainees, whether in the classroom or at a distance, particularly in the preparation and development of digital resources and their use in classroom or distance training practices. UNESCO's principles on ICT use in education suggested that it would not be possible to meet the needs of professional training without virtual classrooms, and virtual laboratories [18]. This also requires the adaptation of curricula, reference materials, and training modules around the integration of ICT, in addition to the development or acquisition of digital training content, with quality-assured pedagogical software.

3.9. Constraints and Challenges to Distance Training

The "distance training" style of training has ensured pedagogical continuity for the benefit of preservice teachers at the LES department, during the confinement period, through the involvement of the department's trainers. However, the trainers have encountered several constraints and challenges during distance training implementation (Figure 11). In 100% of cases, constraints were related to the ignorance of approaches adopted in distance training, while in 87.5% of statements it was attributed to the lack of technical means among the trainee teachers, 75% for low Internet speed, versus 62.5% for technical problems related to the electronic devices used during distance training.

The low motivation of the trainee teachers towards this new mode of professional training was reported in 62.5% of cases, while the frequency of 37.5% was recorded for lack of mastery and proper use of modern technology being a constraint for ICT use. Furthermore, by its nature, LES training involves laboratory activities. Providing laboratory work is challenging in distance-based training [25]. The virtual laboratories offer user-friendly interfaces and demand less time [26]. They are essential components of distance education. Moreover, virtual labs can significantly contribute to grasping abstract concepts [23].

Other factors that challenged the trainers in this experience included the limited engagement of trainees in the process, and the assessment procedures of trainees' achievements being deeply impacted. During Covid-19, conducting assessments remotely has presented training institutions with unprecedented obstacles [25]. Academic dishonesty, infrastructure, covering learning outcomes, and students' commitment to submitting assessments were the primary issues found in the remote assessment [27].

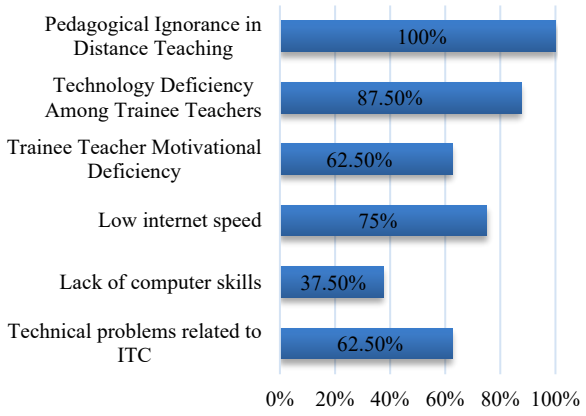

Figure 11. Constraints and challenges to distance training practice in the confinement period

Based on all the aforementioned, the technological infrastructure needed to implement distance education is a real constraint. It cannot be assumed that the connection is available to all trainee teachers, as many remote or rural areas do not have access to the Internet. In addition, a lack of prior preparedness of trainers in the use of modern technological tools and applications in the field of education to accomplish all educational tasks via the Internet [28].

4. CONCLUSION AND RECOMMENDATIONS

Based on the study results it has been found that distance training experience in LES during the Covid-19 confinement period demonstrated its benefits in ensuring the training continuity. A variety of ICT tools and digital media have been used. Both synchronous and asynchronous modes have been employed, with the synchronous type being predominant. Various activities have been carried out including, among others, course presentations, workshops, and evaluation tasks. However, the experience faced several challenges and constraints. These are mainly due to the lack of ICT means, technical problems related to the electronic devices used during distance training, and the lack of virtual laboratories. Other reported challenges were low motivation, limited attendance, and weak interactivity of trainee teachers.

Also, conducting assessments remotely was considered a challenging task for both trainers and preservice teachers. Despite these constraints and challenges, distance training using ICT can be considered as a complementary and/or alternative form of training. It may also be integrated as a compulsory component within blended training programs. This can contribute to better training and qualifying of preservice teachers, through the provision of knowledge, and development of competencies, needed in real teaching practices.

The integration of the distance training model in the qualification of preservice teachers can play a crucial role in reforming traditional education systems, by improving the quality of training outcomes, developing technical skills, and supporting teacher training programs in the training centers. For this purpose, it is recommended to:

- Enable trainee teachers to acquire new skills and abilities to effectively engage with the digital system in teaching and training; with the provision of required technologies.
- Develop an online learning platform that provides an interactive and engaging experience for trainee teachers.
- Create studios within the training centers, for the recording and production of high-quality audio-visual digital educational resources.
- Implement a system of continuous assessment with constructive feedback to help preservice teachers track their progress.
- Set up virtual laboratories allowing to perform LES experiments despite working remotely.

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