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THE ROLE OF E-PROFESSIONAL DEVELOPMENT PROGRAMS IN DEVELOPING DIGITAL TECHNOLOGY SKILLS AMONG PRIMARY GEOGRAPHY TEACHERS

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Abstract: This study explores how e-professional development programs can improve the technology skills of primary school geography teachers given the paced changes happening in education today and the growing importance of technology, in schools. The sample of the study consisted of 223 geography supervisors (educational supervisors), and geography curriculum coordinators, from the Ministry of Education located in Jordan who oversee teachers and offer technical assistance and professional advice. The data of the study were collected using a questionnaire after ensuring its validity and reliability. The results of the study showed that although primary school geography teachers have some abilities, in utilizing technologies there are noticeable deficiencies in more advanced digital skills. This suggests that existing training programs may not adequately cater to the requirements of these educators. Moreover, the research emphasizes shortcomings in teachers' proficiency in fields like digital research, design and handling tools which create obstacles, to using technology effectively in their classrooms and detrimentally affect students' educational experiences. The study suggests making changes to development programs by focusing on improving practical skills and hands on training opportunities, for educators. This will help teachers apply their knowledge in real classroom settings effectively. By enhancing the training materials comprehensively educators can better cater to their students' needs leading to improved standards and academic achievements. Moreover, the study recommends that professional development programs integrate personalized training tracks that cater to the various technological skills of teachers. Tailoring these programs to address specific areas of weakness in teachers' digital skills will ensure more proficient learning experiences. Furthermore, the research advocates for continuous support for teachers, through follow-up workshops and digital resources, to ensure that technology integration is sustained in the classroom. Emphasis should also be placed on fostering a collaborative community where teachers can share knowledge and strategies on using technology in teaching geography effectively. By implementing these suggestions, teachers will not only improve their technological proficiency but will also be better equipped to prepare students for the demands of a rapidly evolving digital world.

Keywords: Geography learning, E-Professional development, digital technology, professional training, geography teachers

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INTRODUCTION

With the explosive development of knowledge and rapid technological changes around the world, education must move alongside this growth, particularly in the area of teacher preparation (AlAli & Al-Barakat, 2024; Artemyev et al., 2025; Al-Ghamdi, 2017). Digital technology has turned into a core factor within the process of education, and this asks that geography teachers be equipped with advanced technological skills that should then be applied to effective use in the classroom (Civís Zaragoza et al., 2021). This situation highlights the importance of electronic professional development programs, which serve as a critical means for enhancing teachers' competencies in employing digital technology.

These programs not only improve teachers' ability to navigate and utilize modern technological tools but also empower them to adopt innovative teaching strategies that enhance educational quality and increase student engagement with the learning material (Davies, 2019; Joshi et al., 2023; Muammar et al., 2023). Electronic professional development programs play a vital role in developing digital technology skills among geography teachers, directly contributing to the enhancement of student learning quality in geographical concepts (Al-Barakat et al., 2023). As digital transformation becomes embedded in modern educational systems, geography teachers must adapt to these changes and continuously refine their skills in using

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technological tools. These programs effectively support this endeavor by providing teachers with the necessary training and resources (Chang & Kidman, 2024; Chin et al., 2025; Montero-Mesa et al., 2023; Taimalu & Luik, 2019). They aim not only to improve teachers' proficiency in handling technology but also to guide them in effectively integrating these tools within the geography curriculum, enriching students' understanding of scientific concepts and their practical applications (Al-Ghamdi, 2017; Schulman & Demantowsky, 2024). This becomes all the more urgent in the education in geography s, where many particular facets of geography require novel forms of teaching aids that would help students comprehend concepts and apply them to real-life situations. Some of the sources are Montero-Mesa et al. (2023) and Taimalu & Luik (2019).

It thus becomes so imperative that digital technology be used to explain and simplify such difficult concepts with virtual simulations, experiments using augmented reality, and interactive videos. Again, geography teachers are supported in how to effectively apply these tools into the classroom through electronic professional development programs that enhance the knowledge of students and make it more applicable to everyday life (Booher et al., 2024; Hannah & Rhubart, 2019; Davies, 2019; Muammar et al., 2023; Naveed et al., 2022). Joshi et al. (2023) cite the aspect of technological empowerment for teachers themselves to develop their digital competencies. Such empowerment will eventually enable them to convert traditional classrooms into vibrant, digital learning environments that are collaborative in approach and assure positive interaction among students to ultimately bring flexibilities and joy in the learning process.

Besides, digital skills development has wider implications in strengthening the pedagogical knowledge of geography teachers to guide students to adopt productive learning behaviors that significantly enhance communication. This comprehensive approach not only positively affects student learning outcomes but also equips students with a deeper understanding of using structural equation modelling to analyze the impact of teachers' technological skills on students' acquisition of essential soft skills, such as communication, representation, and modelling (Çam & Koç, 2024; Huang et al., 2022; Gulnur & Kamshat, 2025; Hanke & Schmalor, 2024; Knecht et al., 2020; Joshi et al., 2023; Park, 2021; Robinson, 2015). Moreover, according to AlAli & Al-Barakat (2024), systematic training has the role of enabling teachers to gain the required competencies and knowledge in the creative use of digital technology in classroom teaching. In fact, the learning of geography will not experience a vital change if the use of technological tools is not rooted in an appropriately framed educational context. Professional development programs, as such, become an integral part of teacher preparedness toward the infusion of technology in geography schooling. Professional development programs teach teachers to develop innovative learning lessons with activities, conduct scientific simulations on digital platforms, and communicate scientific ideas through interactive visual displays (Davies, 2019; Krajňáková et al., 2024; Labianca, 2021; Park, 2021; Robinson, 2015; Smit et al., 2023).

Given the mentioned factors, it can be stated that with the increasing influence of digital technology in the future of education, it is even more important for geography teachers to improve their technological skills. Professional development activities in the electronic medium are very effective in preparing teachers to incorporate technology in their teaching practice. It also helps the teachers to improve on their technical skills in addition to helping them to come up with more creative, exciting and efficient ways of delivering learning materials to the students. Therefore, as the world of education develops, these training initiatives remain vital to ensure that geography education stays current and relevant, while enhancing pupils' understanding of geography, geographical concepts, and their significance in today's world.

LITERATURE REVIEW

E-professional development of geography teachers is, therefore, the cornerstone in furthering digital education. It involves a continuous training program designed to adequately arm educators with the skills needed in the integration of technology into the educational process. These programs provide a variety of training opportunities, including self-paced online courses and virtual workshops, allowing teachers to enhance their abilities without the constraints of traditional training environments (Akram et al., 2021; Aslan & Zhu, 2017). This flexibility alleviates time and financial burdens, enabling educators to adapt to rapidly evolving technological advancements while maintaining their professional commitments (Chung et al., 2020).

E-professional development goes further than the mere acquisition of skills into an appreciation of higher-end technologies, such as LMS and interactive educational software. E-professional development is training that enables integration of modern information and communication technology tools into curricula, while supporting contemporary teaching approaches. The ultimate goal of such programs is to enhance educational quality through teachers being capable of using technology with an aim to increase students' engagement in enriched learning experiences and practices, encouraging self-directed learning and creative thinking (Montero-Mesa et al., 2023; Taimalu & Luik, 2019). Furthermore, e-professional development encourages a collaborative learning environment whereby teachers share experiences with their peers around the world through online communities. This further enhances diversity in experiences and encourages an integrated approach toward educational development. More importance is attached not just on theoretical input but also to practical application, emphasized through a variety of hands-on activities that give real-life experiences for the teacher in effectively using technology within the classrooms-as documented by Aslan & Zhu (2017), and Bahcivan et al. (2019).

Given modern trends in the design of geography curricula, which emphasize experimentation and exploratory learning, expertise with digital technologies becomes a necessary precondition for achieving specified learning goals in geography. Montero-Mesa et al. (2023); Taimalu & Luik (2019) provide several examples of virtual simulation technologies making possible students conducting inquiries in aspects of geography where access to traditional laboratories is impossible, like planetary geography , gravity, and chemical reaction. The e-professional development programs train geography teachers to integrate digital activities into their lessons, thereby supporting the achievement of geography curriculum goals, as documented by Çam & Koç (2024), Chung et al. (2020), Ghafar et al. (2023), Konstantakatos & Galani (2023), Montero-Mesa et al. (2023), Taimalu and Luik (2019).

E-professional development programs offer innovative educational platforms that enhance teachers' abilities to effectively use technological tools to support the teaching of geography in a more interactive and impactful manner. One of the key advantages of these programs is their role in fostering essential geographical skills among students, such as spatial reasoning, which enables them to understand how places are organized and how spatial relationships exist between natural and human phenomena (Chung et al., 2020; Ghafar et al., 2023; Konstantakatos & Galani, 2023; Montero-Mesa et al., 2023). These programs also support skills like map reading and analysis, which are fundamental for interpreting geographic information represented on maps and using it to understand various geographical patterns.

Additionally, these programs enable students to develop their abilities in working with geospatial data through advanced applications like Geographic Information Systems (GIS) (Ghafar et al., 2023; Konstantakatos & Galani, 2023; Montero-Mesa et al., 2023). Such tools are used to analyze and visualize data in fields like urban planning, environmental monitoring, and natural resource management. This approach enhances students' critical thinking, allowing them to comprehend contemporary geographical challenges and propose innovative solutions. Furthermore, tools like virtual globes (e.g., Google Earth) and interactive 3D mapping applications contribute to deepening students' understanding of geographical phenomena by enabling them to visualize locations and analyze their developments over time. These skills are particularly significant in light of global transformations that necessitate educational curricula capable of keeping pace with modern demands, such as the updates made to geography curricula in Jordan, which emphasize these skills to prepare students for future challenges (Chung et al., 2020; Ghafar et al., 2023; Konstantakatos & Galani, 2023; Montero-Mesa et al., 2023).

Virtual field trips and augmented reality (AR) simulations represent practical examples of how technology can be utilized to stimulate active learning. These activities the place, help which the in students turn to enhances explore the geographical students' concepts experience in the realistic subject manner and without well their having For interest to example, in physically students it go can as to visit the Amazon rainforest virtually or tour the Egyptian pyramids, which will help to make learning more interesting and engaging (Labianca, 2021; Park, 2021). Moreover, these programs enhance teachers' ability to deliver diverse and tailored educational content that meets the varying levels of students, ensuring equal learning opportunities for those in different areas, whether in major cities or rural regions. Notably, these efforts align with global educational reforms aimed at making education more inclusive and focused on meeting the demands of the 21st century (Konstantakatos & Galani, 2023; Labianca, 2021; Park, 2021; Robinson, 2015). In conclusion, e-professional development programs represent an effective means of supporting geography education, not only by empowering teachers to use technology efficiently but also by equipping students with essential life and professional skills. These skills enable them to contribute positively to their communities and address global challenges with confidence and competence.

Through these programs, teachers learn to use mobile devices and educational apps to strengthen these skills, leveraging digital measurement applications or simulation programs that allow students to predict outcomes before conducting experiments (Campbell et al., 2020; Montero-Mesa et al., 2023). Building on current trends in geography curriculum development that prioritize experimentation and exploration, e-professional development is vital for enhancing digital technology skills among geography teachers. For example, students can explore ocean depths or study tectonic movements using virtual reality technologies, broadening their learning experiences without leaving the classroom (Bahcivan et al., 2019).

Furthermore, these programs enable teachers to leverage technology to promote collaborative learning. In geography classes, students can utilize digital collaboration tools to share ideas and work on joint projects, thereby enhancing their communication and teamwork skills. This aligns with the goals of geography curricula, which aim to develop life skills alongside scientific knowledge (Denieffe, 2020; Méndez et al., 2022). Field studies carried out on various issues in developing digital technology skills in current learning environments signal the rise of interest in technology integration in education. For instance, Al-Barakat et al., (2023) talks about the impacts of collaborative versus individual online training programs on physics teachers. From his results, collaborative training appears to be more effective than individualistic training in developing digital technology skills among physics teachers. This pegs the imperatives further for ensuring collaboration among teachers in digital professional Development programs, hence nurturing professional learning communities which can move with the times of technological advancement.

Along the same line, Al-Ghamdi (2017) found that digital training works best in preparing teachers to design electronic tests. In the process, digital training outperformed traditional training in impact. These findings expose the need for incorporating digital training into professional development programs as ways to fix advanced technological skills into modern education. Aveed 2022, demonstrates that digital training significantly helps the teacher in effectively managing virtual classrooms and enhances cognitive and practical skills of educators in dealing with digital learning environments. Thus, it has proved the importance of integrating technology for the facilitation of interactive, flexible learning environments. The study by Al-Zahrani & Ali (2018) presented a model for developing technological competencies among Arabic language teachers through a specialized digital training program, showing notable improvements in teachers' abilities to utilize digital tools. This confirms the need for training programs tailored to different educational specializations to address the specific requirements of each field. Joshi et al. (2023) explored the effect of classroom practices in utilizing communication tools, collaboration skills, digital skills, and software on students' communication behaviors while teaching mathematics. Through an online survey among 466 mathematics teachers in Nepal, they found a very low level of digital skill transformation; therefore, the practices that enhance the use of communication tools and collaboration skills among teachers indeed affect the communication behaviors of students.

Apart from that, Joshi et al. (2023) accentuated that professional development programs would contribute to developing digital technology skills and develop a digital learning strategy that would increase the use of digital communication skills and software for improving student learning. This view is further reiterated by Muammar et al. (2023), who observed that

digital tools have directly influenced teaching quality and positive learning outcomes, underlining the need for a wider integration of technology into educational curricula. Globally, Civís Zaragoza et al. (2021) pointed to the development of teacher competencies in the digital age as a major ongoing priority and targeted innovative training strategies for teachers that will enable them to maximize the full potential of current technologies. Baysan & Cetin (2021) reported a review of how education switched to remote mode in the wake of the COVID-19 pandemic, revealing that successful implementation depended much on the adaptability of teachers to digital tools and technical skills to manage the setbacks of e-learning effectively. Through these studies, it is clear that digital professional development is a key element in developing teachers' technological skills, which is crucial for improving the quality of education and adapting to the challenges of education in the digital age. Therefore, integrating technology into teachers' professional development programs is an essential step to enhance the educational process and improve students' academic performance.

Research problem

The changes in e-learning that have occurred in the last two years during the COVID-19 pandemic have presented a number of difficulties for primary school geography teachers in Jordan in terms of how to integrate the digital resources into their teaching effectively. Traditional educational systems are finding it difficult to meet the current technological demands thus creating a gap between the digital skills needed for today's classrooms. The research done by Joshi et al. (2023) and Muammar et al. (2023) has revealed that there is a critical need for teacher training programs to prepare future teachers for the 21st-century classroom. To achieve this, the Ministry of Education in Jordan in conjunction with the National Center for E-Learning has provided several programs that have tried to improve the technological knowledge of geography teachers through technology assisted measures and training courses. However, there is still a research gap concerning the effectiveness of the e-professional development programs targeting the development of digital skills for primary school geography teachers in Jordan. While studies have addressed general teacher training programs and instructional technology, they have not sufficiently focused on the particular digital skills needed by geography teachers.

This research gap highlights the necessity to improve the teachers' technological knowledge and competencies to enhance the quality of teaching and learning. Despite the several professional development programs that have been offered, there is little research that has focused on the effects of such programs on the digital skills of geography teachers in Jordan. The importance of this research is that it has the possibility of bridging the research gap and thus understanding how e-professional development programs meet the needs of geography teachers. The present study will try to establish how these programs help to improve the technological skills of the teachers and in turn the quality of teaching.

Also, the study will focus on the part played by these programs in meeting the problems that geography teachers face in meeting the technology needs and the dynamic nature of the education system. This study is significant as it provides useful information regarding how professional development programs can be designed in a way that they address the needs of geography teachers. Through assessing the efficacy of such programs, the study seeks to offer practical suggestions on how geography teachers' digital skills may be enhanced in the context of Jordan. Therefore, the research question guiding this study is: *What is the role of e-professional development programs in developing digital skills among geography teachers, as perceived by educational supervisors and curriculum coordinators in geography?*

METHODS AND PROCEDURES

1. Participants

The sample for this research includes 223 supervisors and coordinators of geography subjects, decided on the usage of a simple random sampling technique. This method guarantees that there may be no bias in participant choice, thereby improving the credibility of the consequences received. The sample consists of both geography subject supervisors and curriculum coordinators, making sure complete illustration of diverse academic and professional stories. Participants had been drawn from extraordinary academic levels, ranging from kindergarten to secondary schooling, which covers all age businesses and educational classes inside the northern regions of Jordan. Criteria for player selection included years of experience in instructional supervision, educational qualifications, and participation in expert improvement applications.

As for the demographic characteristics of the sample participants in terms of their gender, academic qualifications, and teaching experience, they were graphically represented in Figure 1.

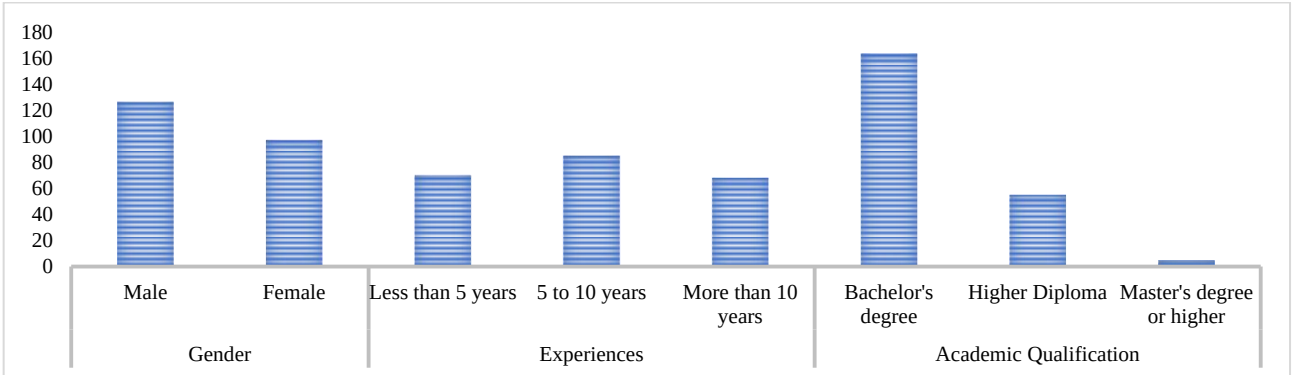

Figure 1. Distribution of study sample participants by gender, academic qualification, and teaching experience

More specifically, Table 1 clarifies the distribution of participants through gender includes 126 male respondents (56.5%) and ninety seven female respondents (43.5%). In phrases of tutorial qualifications, 163 respondents (73%) hold a bachelor's diploma, fifty five respondents (24.7%) preserve a grasp's diploma, and five respondents (2.30%) maintain a doctoral diploma. Regarding years of enjoy, 70 respondents (31.4%) have between 1 and five years, eighty five respondents (38.1%) have between 6 and 10 years, and 68 respondents (30.5%) have extra than 10 years of revel in. This distribution displays the range of backgrounds and academic wishes the various members, contributing to the evaluation of the impact of expert improvement packages on teachers' digital capabilities.

Table 1. Demographic Characteristics of the Study Sample

Variables	Categories	Frequency	Percentage (%)
Gender	Male	126	% 56.5
	Female	97	% 43.5
Experiences	Less than 5 years	70	% 31.4
	5 to 10 years	85	% 38/1
	More than 10 years	68	% 30.5
Academic Qualification	Bachelor's degree	163	% 73.00
	Higher Diploma	55	% 24.7
	Master's degree or higher	5	% 2.30

2. Instrument of the study: The research tool aims to investigate how electronic professional development courses can improve the technology skills of geography teachers. The survey was created by drawing from theoretical resources well as the researchers' own teaching experiences, in geography and digital technology. As a result the first draft of the survey contained 55 questions rated on a five point Likert scale. The scale had these choices available, for selection. The options, on the scale included "high" with a rating of (5) "High" rated as (4) "Moderate" scoring (3) "Low", with a score of (2) and "Very Low" marked as (1). The items were grouped into four domains as outlined below:

3. Domain One: Digital Usage: This domain covers 14 items centered around the abilities needed by geography educators to employ digital technology in their teaching practices. To evaluate teachers' skills in operating and overseeing devices well as handling tasks, like uploading and downloading files or using Office software and multimedia tools. It also assesses their proficiency in utilizing resources like email, social media and blogs - skills that're crucial for improving communication and efficiency, within digital learning settings.

3.1. Domain Two: Digital Research: In this domain of study are 10 items that gauge the skills of geography educators in finding and retrieving information on the internet using search engines and keywords efficiently. The evaluation also looks at how they can navigate through websites and research libraries and make use of technology to interact with different educational tools, like video calls and online activities. This domain plays a role in enhancing the standard of learning by strengthening teachers' capacity to locate suitable educational resources.

3.2. Domain Three: Digital Design: This domain involves 10 items centered on developing resources for geography education such as crafting digital teaching materials and producing engaging videos and presentations interactively. It also includes designing programs for learning and support materials that engage with content. Even though this domain plays a role in offering approaches to education the data suggests that there is room for improvement, in enhancing geography teachers' abilities in creating impactful digital learning content effectively.

3.3. Domain Four: Digital Management: In this domain of study are 12 items centered on overseeing education in the field of geography. It includes abilities such, as handling sites and collections encouraging conversations, within digital learning communities and scheduling activities and duties using digital resources. This domain also highlights management of platforms and interactive games creating project centered learning methods to boost imaginative thinking and evaluating digital learning information to track student advancement. Furthermore, encouraging the arrangement of workshops to educate educators and learners on the utilization of digital resources while also cultivating online learning communities to improve engagement and cooperation. Lastly advocating for learning by combining teaching approaches with digital innovations.

4. Validity and reliability: In order to validate the instrument effectively and reliably for its intended purpose and audience, in the field of geography education and digital technologies a group of 13 university professors were consulted to review the questionnaire provided. Their valuable input and insights prompted revisions to be made such as clarifying any confusing items rectifying grammatical mistakes and eliminating questions that were deemed unnecessary or unsuitable by a majority consensus of at least 30 %, among the experts involved. Consequently a total of 9 items were removed from the original questionnaire version. This iterative process culminated in the revised version consisting of 46 crafted items.

After making these adjustments and modifications as suggested by the reviewers feedback we proceeded to carry out a study involving a group of 20 observers who were not part of the original research sample. The purpose was to evaluate the reliability and accuracy of the tool by examining various factors such, as Composite Reliability (CR) and McDonalds Omega to gauge the soundness of the constructs. Analysis process clarifies the Omega values, for McDonalds fell between 0.82 and 0.85 with CR values ranging from 0.80 to 0.86. These values exceeded the recommended threshold of 0.70, indicating strong internal consistency. The Average Variance Extracted (AVE) values ranged from 0.68 to 0.78, surpassing the minimum

requirement of 50%, confirming that the tool's latent variables are well-aligned. This criterion is satisfied because the loading factor values are higher than the required minimum. These results validate the scales' validity and reliability (AlAli, 2020).

5. Data Collection and analysis

Upon creating the survey and verifying its accuracy and consistency through methods the researchers secured formal consent, from the Ministry of Education in Jordan to gather information regarding geography supervisors at every level of education starting from early childhood education to high school. This authorization was crucial in guaranteeing the thorough implementation of the research encompassing geography supervisors, across levels. A random group of 123 supervisors was chosen for the study. The researchers put together a roster of supervisors' names and selected participants at random to make sure there was a mix of supervisors, from educational areas. The questionnaires last iteration was circulated digitally in the semester of the year 2023 2024 with detailed and thorough guidelines to help participants grasp the queries and give precise responses effectively. After gathering the surveys and organizing them with numbering, for record keeping the information underwent analysis through the use of Statistical Package for the Social Sciences (SPSS). Descriptive statistics were applied to uncover and interpret frequencies, percentages, averages and standard deviations. This examination enabled the researchers to draw conclusions based on the participants' feedback laying groundwork, for investigating the study's main query.

FINDINGS OF THE STUDY

This study aims to uncover the role of e-professional development programs in developing digital skills among geography teachers, as perceived by educational supervisors in geography education. To achieve this, means and standard deviations were calculated for the role of professional development programs in enhancing digital technology skills among geography teachers, specifically in the dimensions of digital usage. The results of the data analysis for each dimension were presented separately, as follows:

1. First Dimension - Digital Usage

This dimension includes 14 items related to the role of professional development programs in enhancing digital usage skills among geography teachers. These items were graphically represented in Figure 2 and Table 2.

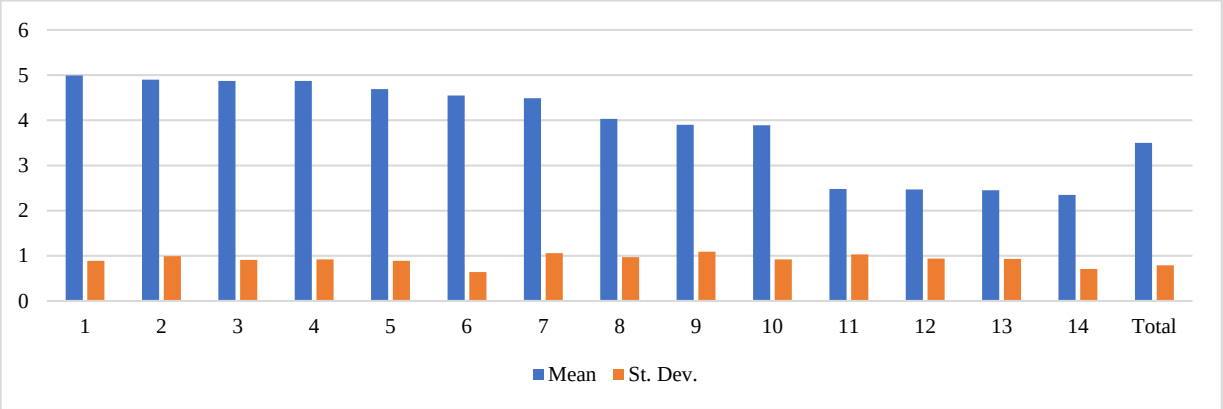

Figure 2. The role of e-professional development programs in enhancing digital usage skills

Table 2. Data analysis related to participants' responses of the role of E-professional development programs in enhancing digital usage skills

No.	Items	Mean[1]	St. Dev.	Rating
1	Effectively turns on and off the computer and its peripherals.	4.99	0.89	High
2	Uses digital screen technologies.	4.90	0.99	High
3	Installs and uninstalls various programs on the computer.	4.87	0.91	High
4	Copies, pastes, and shares research links.	4.87	0.92	High
5	Sends and receives emails effectively.	4.69	0.89	High
6	Downloads and uploads files to and from the internet.	4.55	0.64	High
7	Uses social media platforms like Facebook, Twitter, and Instagram.	4.49	1.06	High
8	Creates, organizes, compresses, and decompresses files.	4.03	0.97	High
9	Utilizes Office programs such as Word, Excel, and PowerPoint.	3.90	1.09	High
10	Exports digital data to specified recipients.	3.89	0.92	High
11	Manages and uses blogs and wikis effectively.	2.48	1.03	Moderate
12	Interacts with digital learning systems such as Google Classroom and Moodle.	2.47	0.94	Moderate
13	Uses multimedia programs such as audio, image, and video editing software.	2.45	0.93	Moderate
14	Uses chat rooms for interaction and lesson organization.	2.35	0.71	Moderate
Total		3.50	0.79	Moderate

[1] To facilitate the interpretation of results, the following grading scale was adopted: High rating: if the mean is between 3.67 and 5.00; Medium rating: if the mean is between 2.34 and 3.66; Low rating: if the mean is below 2.33

Table 2 reveals that the average scores of the participants reached 3.50, indicating that the level of digital skills among geography teachers can be classified as "average." This finding highlights a moderate need for enhancing professional

development programs, as the current skill level does not fully align with modern requirements for integrating technology into education. Within this context, the table shows that certain essential skills received notable appreciation. For instance, the ability to operate and shut down a computer attained the highest average score of 4.99, reflecting the teachers' exceptional proficiency in this area. Similarly, the skill of using digital screen technologies garnered a high average of 4.90, suggesting that teachers are well-equipped to utilize this technology effectively, facilitating the delivery of educational content in innovative ways. Moreover, the ability to send and receive emails scored an average of 4.69, demonstrating the teachers' efficiency in employing modern communication tools, which underscores their strong capacity to engage with information technology.

Additionally, teachers exhibited a strong competency in installing and uninstalling software and sharing links, achieving a high average score of 4.87. This illustrates their capability in navigating essential digital tasks. Furthermore, there was notable development in the skills related to downloading and uploading files, which showed a high average score of 4.55, indicating that teachers can manage digital files effectively, thereby enhancing their access to educational resources.

However, an examination of the items with lower scores -specifically those rated 2.47 and below-reveals critical areas for improvement. For instance, the skill of managing digital learning systems, such as Google Classroom and Moodle, received an average score of 2.47, highlighting a significant gap in competency that necessitates targeted training in this area. Similarly, the average score for using multimedia software was 2.45, underscoring an urgent need to enhance teachers' abilities in utilizing these advanced digital tools. Lastly, the skill of using chat rooms recorded an average score of 2.35, indicating a deficiency in leveraging these tools for effective interaction and lesson organization.

2. Second Dimension - Digital Research

This dimension consists of 10 items that address the impact of professional development programs on enhancing digital research skills among geography teachers, presented in descending order, as shown in Figure 3 and Table 3.

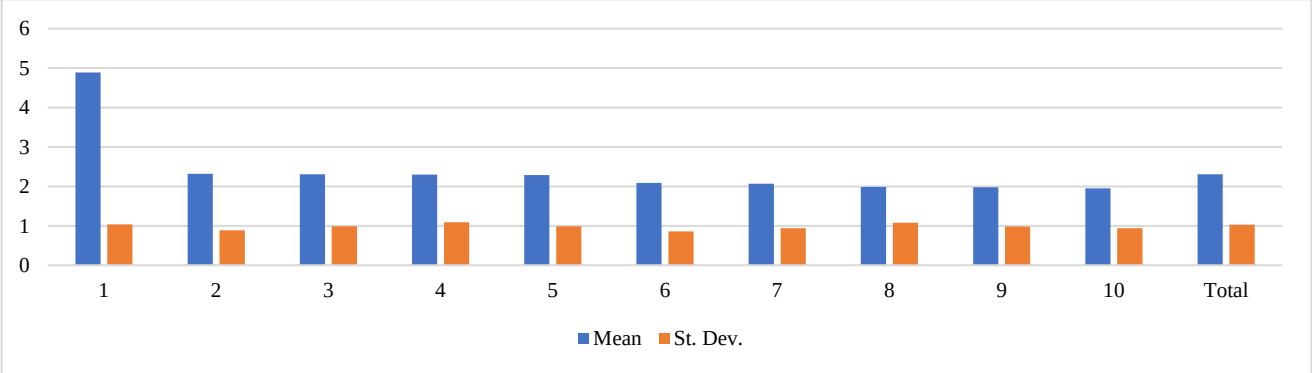

Figure 3. The Role of Professional Development Programs in Enhancing Digital Research Skills

Table 3. Data analysis related to participants' responses of the role of professional development programs in enhancing digital research skills

No.	Items	Mean	St. Dev.	Rating
1	Finds note-taking tools and shares them with students.	4.89	1.04	High
2	Uses text messaging tools to communicate with students.	2.32	0.89	Low
3	3. Conducts effective searches on search engines like Google and Yahoo.	2.31	0.99	Low
4	Browses websites of research libraries specializing in social studies.	2.30	1.09	Low
5	Searches for suitable electronic activities and infographics for teaching social studies.	2.29	0.99	Low
6	Searches for diverse educational resources such as video conferences to integrate them into lessons.	2.09	0.86	Low
7	Participates in relevant educational forums related to social studies.	2.07	0.94	Low
8	Tracks new releases and software in the field of teaching.	1.99	1.08	Low
9	Identifies appropriate keywords to access required information in the research scope.	1.98	0.98	Low
10	Identifies websites dedicated to teaching social studies.	1.95	0.94	Low
Total		2.31	1.03	Low

Table 3 presents a comprehensive analysis of the impact of electronic professional development programs on enhancing digital research skills among geography teachers. The results reveal a concerning decline in teachers' effectiveness in this domain, with an overall average score of 2.31 and a standard deviation of 1.03. This indicates significant variability in the application of digital research skills across the teaching population. Although the first item, which pertains to the use of note-taking tools and their sharing with students, received the highest rating of 4.89, this still suggests that the integration of these digital tools is limited. This finding underscores an urgent need for additional training focused on more effectively incorporating these tools into teaching practices. In contrast, the average score for other items remains notably low; for instance, the use of texting tools for communication scored only 2.32. This highlights a weakness in teachers' utilization of digital technology to enhance educational communication, a critical area that necessitates strengthening within training programs.

Furthermore, the results indicate that teachers face challenges in effectively utilizing digital research tools, particularly search engines such as Google and Yahoo, which received a low rating of 2.31. This deficiency points to a lack of fundamental research skills, which may hinder teachers' ability to stay updated with current educational resources. Additional items related to visiting specialized sites, such as electronic research libraries (2.30) and searching for electronic

educational activities (2.29), further illustrate a gap in teachers' engagement with specialized electronic resources. This limitation restricts their ability to leverage digital content that could enrich their educational practices, highlighting the necessity for enhanced practical training focused on effectively utilizing these tools and resources.

Moreover, items concerning participation in educational forums (2.07) and the use of appropriate keywords (1.98) reflect teachers' struggles to engage with digital educational communities and employ advanced search strategies. These findings confirm that teachers require intensive training to interact more effectively with digital resources and to develop robust research skills, including the formulation of advanced search strategies.

3. Third Dimension - Digital Design

This dimension includes 12 items related to the role of professional development programs in enhancing digital design skills among geography teachers, presented in descending order, as illustrated in Figure 4 and Table 4.

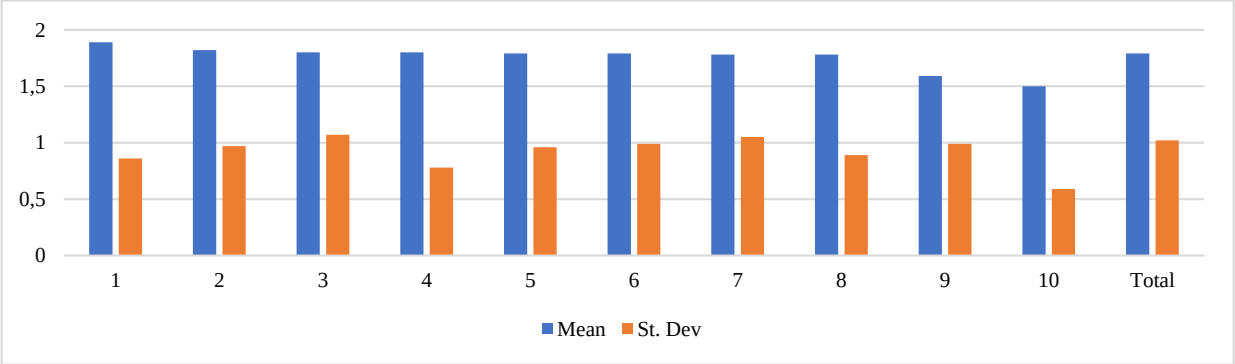

Figure 4. The Role of Professional Development Programs in Enhancing Digital Design Skills

Table 4. Data Analysis Related to Participants' responses of the role of professional development programs in enhancing digital design skills

No.	Items	Mean	St. Dev	Rating
1	Designs educational infographics and digital posters.	1.89	0.86	low
2	Designs a digital lesson plan in geography education.	1.82	0.97	low
3	Creates digital blogs to provide interactive dialogue space with students.	1.80	1.07	low
4	Designs interactive educational videos for social studies.	1.80	0.78	low
5	Develops impactful presentations using Office programs.	1.79	0.96	low
6	Develops various digital activities for students in social studies.	1.79	0.99	low
7	Designs enrichment and remedial digital programs for social studies.	1.78	1.05	low
8	Designs interactive digital textbooks from multiple sources to support educational content.	1.78	0.89	low
9	Creates interactive audio and visual files for social studies.	1.59	099	low
10	Designs diverse assessment tools such as tests and tasks to evaluate students.	1.50	0.59	low
Total		**1.79**	**1.02**	**low**

Table 4 analyzes participants' responses regarding the role of professional development programs in enhancing digital design skills among geography teachers. The overall average score across all items is 1.79, indicating a low level of competence in the digital skills acquired. This average serves as a warning about the limited impact of these programs, highlighting the urgent need for a comprehensive review of the training methodologies employed.

Examining the means for individual items reveals that "designing digital lesson plans in geography education" received an average score of 1.82. This suggests that teachers lack confidence in their ability to create interactive lesson plans, underscoring the critical need for more effective tools and strategies to leverage technology in their teaching practices.

Additionally, items related to "designing digital blogs" and "creating interactive educational videos" both recorded averages of 1.80. This demonstrates that teachers struggle to utilize these tools effectively to enhance student engagement. Given the integral role these media play in modern education, the absence of necessary skills to use them appropriately presents a significant obstacle to improving the learning experience. The table further reveals that other items, such as "designing impactful presentations using Office programs" and "developing diverse digital activities," received averages of 1.79 and 1.78, respectively. These results indicate that teachers lack the requisite skills to produce engaging digital content, which could negatively affect student participation in the educational process. Finally, the item with the lowest average, "designing assessment tools such as tests and assignments," recorded a score of 1.50. This reflects a clear gap in teachers' competence in the area of digital assessment. The low rating highlights their inability to design assessment tools that align with modern digital education standards, potentially undermining the accuracy of measuring learning effectiveness.

4. Fourth Dimension - Digital Management

This dimension encompasses 12 items that pertain to the influence of professional development programs on improving digital management skills among geography teachers, presented in descending order. Figure 5 and Table 5 illustrates this data. Table 5 analyzes the impact of professional development programs on the digital management skills of geography teachers, revealing significant deficiencies. All twelve assessed items recorded low average scores, indicating that current training programs inadequately equip teachers with essential skills. The overall average score recorded was 1.73, with a

standard deviation of 1.07, reflecting a consensus on insufficient digital competencies among participants. This dissatisfaction may hinder teachers' ability to integrate technology effectively into their practices.

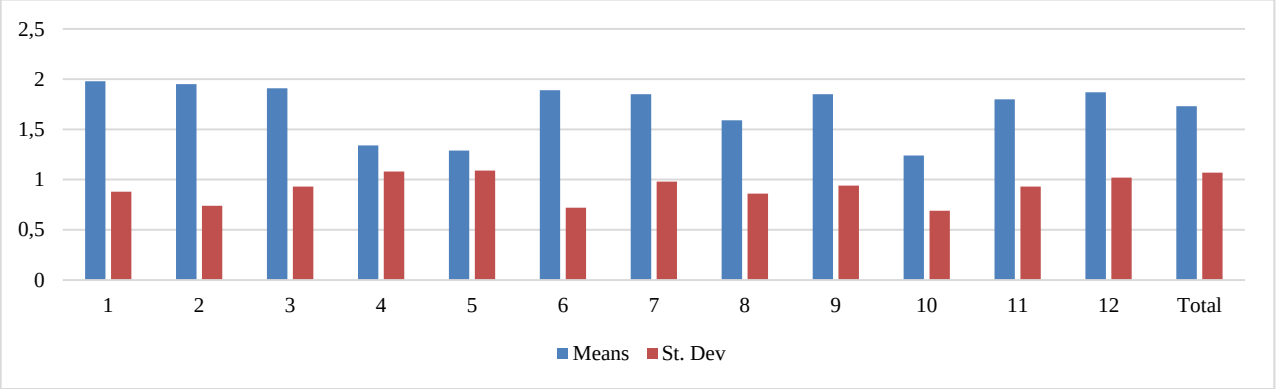

Figure 5. The Role of Professional Development Programs in Enhancing Digital Management Skills

Table 5. Data analysis regarding participants' responses on the role of professional development programs in enhancing digital management skills

No.	Items	Means	St. Dev	Rating
1	Manages digital educational sites for geography.	1.98	0.88	Low
2	Organizes and manages digital portfolios for geography.	1.95	0.74	Low
3	Effectively manages discussions among digital learning groups.	1.91	0.93	Low
4	Uses digital tools to manage time and tasks in teaching geography.	1.34	1.08	Low
5	Effectively and efficiently manages digital learning platforms.	1.29	1.09	Low
6	Manages interactive digital educational games for teaching geography.	1.89	0.72	Low
7	Develops project-based learning strategies to enhance creative thinking using technology.	1.85	0.98	Low
8	Analyzes digital learning data to monitor student progress and make informed educational decisions.	1.59	0.86	Low
9	Organizes digital workshops to train teachers and students on effective use of digital tools.	1.85	0.94	Low
10	Creates digital learning communities to enhance interaction between students and teachers.	1.24	0.69	Low
11	Employs blended learning by integrating traditional learning methods with digital technologies.	1.80	0.93	Low
12	Stimulates creativity through the use of technology tools, such as digital design software.	1.87	1.02	Low
Total		**1.73**	**1.07**	**Low**

Among the assessed items, "managing digital educational sites" recorded the highest average score of 1.98, still within the "low" category, suggesting limited effective strategies for utilizing these platforms. "Organizing digital portfolios" recorded an average score of 1.95, and "managing discussions" recorded 1.91, highlighting challenges in facilitating digital interactions. The item "time and task management" recorded an average score of 1.34, indicating a troubling inadequacy in using digital tools for organization. "Managing interactive educational games" and "project-based learning strategies" recorded average scores of 1.89 and 1.85, respectively, showing a lack of innovative methods to enhance engagement.

"Learning data analysis" recorded an average score of 1.59, indicating limited capability to use data for informed decision-making. "Organizing digital workshops" scored 1.85, suggesting a need for more opportunities to share digital knowledge. Conversely, "creating digital learning communities" recorded the lowest average score of 1.24, reflecting inadequate efforts to build collaborative environments. Lastly, "blended learning" and "stimulating creativity" recorded average scores of 1.80 and 1.87, emphasizing the need for balanced integration of traditional and technological methods to foster creativity.

DISCUSSION

1. Discussion of the Results of Domain One

The findings, from the assessment show that geography teachers have varying levels of skills ranging from average to high competence levels which serve as a strong groundwork for their abilities in this area. Nevertheless these skills may not be adequate to address the complexities in education. The statistics indicate that fundamental abilities like operating computers and utilizing screens rank high on average indicating that teachers are proficient in integrating technology into their day, to day activities. However just having those skills is not enough, in today education scene. We need to incorporate creative methods that go beyond the tactics too. Teachers need to be adept, at using tech tools to provide notch educational material that meets the students' requirements. There are skill gaps, in managing educational systems that emphasize the importance of reviewing professional development programs. With the growing dependence on platforms such as Google Classroom and Moodle it is essential for teachers to gain an understanding of these tools. From what I have seen a lot of teachers feel hesitant to use these platforms because of training and resources. This gap highlights the requirement, for tailored workshops and training sessions that enable teachers to navigate these systems effectively.

Moreover the findings highlight the importance of improving proficiency in utilizing multimedia applications. These resources play a role, in promoting engagement between students and educational material. If educators lack the ability to leverage these tools it hinders their capacity to captivate and inspire learners. The incorporation of multimedia into teaching not enhances the journey but also aids in fostering a lively and participatory academic setting. Continuous assistance, in this domain is imperative to empower teachers in employing resources.

The restricted utilization of online chat platforms highlights the difficulties, in encouraging engagement between educators and learners. The incorporation of communication channels is essential for cultivating an setting. As, per the writers viewpoints enabling the use of tools encourages engagement enabling students to share their thoughts and queries promptly and smoothly. This discovery is, in line with patterns (Denieffe, 2020) well as the works of Méndez et al., 2022 and Monterro Mesa et al., 2023 that highlight the significance of improving these abilities as a key focus in professional growth initiatives to foster solid connections, between educators and learners. According to the information provided above the findings, in this area do not align with research (AlAli et al., 2024; Alali & Al-Barakat, 2022; Aslan & Zhu, 2017; Bahçivan et al., 2019; Birgin et al., 2020) which stress that the creation of development initiatives should be a key priority. These efforts should focus on training and continuous assistance. Such programs need to be tailored to address the needs of educators in the realm empowering them to enhance their digital competencies in line, with contemporary standards. Enhancing teachers' skills will have an effect, on the quality of education and students' achievements in the years to come.

2. Discussion of the Results of Domain Two

The findings regarding research abilities suggest that online professional development courses have not successfully improved the research skills of geography educators; this underlines the obstacles, in utilizing digital tools effectively in this context. In my opinion as a researcher I think this inadequacy in proficiency is influenced by factors such, as the inadequate design of these programs the lack of hands on training and the failure to incorporate contemporary technologies into educational curricula. The connection, between how skilled teachers with using technology and how well their students perform is not a theory, it is backed up by previous studies that highlight the significance of integrating digital tools into education practices. Research by Muammar et al. (2023) suggests that teachers need specific training to enhance their ability to utilize resources effectively. If teachers only receive training without hands on practice it becomes challenging for them to apply these skills in classroom settings. The results are consistent, with the research conducted by Al Shamrani (2019) which validated that educators who receive assistance in utilizing technology are more adept at incorporating these resources into their teaching methods. This assistance could involve attending workshops engaging in initiatives and being part of communities. All of which play a role, in improving teachers technological competence.

The limited involvement, in platforms and use of digital tools may also stem from a lack of understanding on how to actively participate in these online spaces. Many prior research works (Alali & Al-Barakat, 2023; AlAli & Aboud, 2024; Al Ghamdi, 2017; Al Zahrani & Ali, 2018) indicate that engaging with digital communities can greatly improve teachers skills in utilizing technology and promote the sharing of insights and thoughts. To sum up the discussion, on how to improve geography teachers' digital research skills effectively requires a strategy that focuses on hands on training and continuous assistance. By revamping development initiatives to include these aspects educators can enhance their readiness in using resources efficiently resultantly boosting their skills and enhancing students' academic achievements.

3. Discussion of the Results of Domain Three

The results of the study, on geography teachers digital design abilities indicate a deficiency in skills proficiency as shown by a low average rating that underscores the minimal effectiveness of existing training initiatives for educators in this field. This result can be linked to factors. Predominantly arises from the absence of hands on practical training, in these programs which results in teachers feeling ill equipped to utilize the acquired skills effectively within their teaching environments. Moreover the way the educational material is structured in programs might not fully tackle the difficulties teachers encounter which could restrict how beneficial the training is. Various research studies (Al Barakat et al., 2023; Al Hassan et al., 2022; Fraihat et al., 2022; Khasawneh et al., 2022) have shown that professional development initiatives focusing on learning have led to enhancements, in teachers' tech skills. For instance studies by Al Shamrani (2019) and Baysan & Cetin (2021) highlighted that incorporating hands on projects into training programs improved teachers' abilities emphasizing the pressing need for strategies, in programs. The focus, on learning is also reflected in the research findings concerning the challenge of creating assessment tools that align with the requirements of online education. A notable aspect highlighted by studies (Al Hassan et al., 2012; Khasawneh et al., 2023) indicates that educators frequently face difficulties due to a lack of expertise and materials to develop these tools underscoring the importance of assistance, in this domain.

Furthermore the decrease, in ratings for aspects pertaining to creating blogs and educational videos shows reluctance among educators to incorporate these resources even though they have the ability to improve student engagement. Al Ghamdis study from 2021 shows that teachers who underwent instruction on these resources were better equipped to include them in their teaching methods leading to a boost, in student involvement. It is clear from these findings that professional development programs need to be all-encompassing. They should contain hands-on training, focusing on what teachers really need help with. The key is to use methods that boost design skills and ensure teachers have the tools they need to continue growing. By improving the design of professional development programs, we can help teachers use technology more successfully, which will benefit students and help achieve learning goals.

4. Discussion of the results of domain four

The findings, from the category reveal a lack of digital management expertise among geography educators underscoring the pressing demand for enhanced professional development initiatives in this field. According to the authors' recommendations the majority of teachers are deficient in the skills needed to handle digital resources, which can be largely ascribed to inadequate opportunities, for hands on instruction. Research conducted by Çam & Koç (2024) demonstrates that practical training boosts teachers' capacity to integrate technology into instruction positively impacting the educational

experience. Henceforth the lack of hands on experience, in existing programs might be a factor contributing to the identified deficiencies, in skills. In addition, to that discovery about how educators handle games and project oriented learning techniques suggests that teachers are not fully taking advantage of these tools as they could be doing based on research, by various scholars (Al-Barakat & Al-Hassan, 2009; Al-Halalat et al., 2024; Chung et al., 2020; Denieffe, 2020; Méndez et al., 2022; Montero Mesa et al., 2023; Taimalu & Luik, 2019; Tondeur et al., 2017).

These studies indicate that integrating games can notably enhance student involvement and stimulate thinking. The lack of incorporating these approaches in education highlights the necessity, for providing teachers with training, on effectively utilizing these digital tools. Moreover the findings suggest that educators face challenges, in utilizing information to enhance outcomes. This is consistent, with research (Birgin et al., 2020; Buonsenso et al., 2021; Campbell et al., 2020; Çam & Koç, 2024; Detyna & Kadiri, 2019; Denieffe, 2020; Méndez et al., 2022; Montero Mesa et al., 2023) that underscores the significance of analyzing data to make informed choices.

Quality development initiatives should strive to improve educators' skills in this realm since proficient data analysis plays a role, in advancing the learning process. Additionally the findings indicate a shortage of efforts to create spaces by forming online learning communities. A research conducted by Al Hassanet et al. (2024) indicate that virtual educational communities promote teamwork and engagement, among educators and learners resulting in achievements. The lack of communities underscores the importance of enhancing teachers' interpersonal and communication abilities which're crucial for establishing more successful learning settings.

CONCLUSIONS

The research findings indicate that although teachers have skills in utilizing technologies effectively; there are notable deficiencies, in advanced digital competencies, like overseeing educational systems and analyzing data accurately. These gaps imply that existing teacher training programs may not fully cater to their requirements and call for a thorough review to align with the evolving landscape of education. Teachers often lack the skills, in design and tool management due to insufficient practical training provided to them. This absence of support and involvement hinders their capacity to seamlessly incorporate technology in classrooms resulting in an impact, on both teaching quality and students' learning encounters.

In order to tackle these challenges effectively and adapt to the changing landscape of education today in a manner a significant transformation of professional development initiatives is crucial. These programs should prioritize the acquisition of skills that align with educational standards. By integrating learning experiences and practical training sessions educators can better translate their knowledge into real world scenarios. It is imperative that these programs offer content to empower teachers with the resources needed to cater to students' needs and enhance the overall quality of education. To improve these programs further and make them more inclusive and engaging for teachers and trainers alike is essential. It's vital to focus on maintaining communication channels and providing support while also promoting active involvement, in digital learning communities to boost teachers' tech skills.

The research group analyzed 223 geography supervisors and curriculum coordinators, from Northern Jordan in the study; however, this might restrict how broadly the results can be applied to fields as well. The answers provided could be affected by the supervisors' interactions with teachers, which could result in views, on challenges related to professional growth.

In studies it would be beneficial to involve educators from fields to gain a more comprehensive insight into the effectiveness of training programs, for professionals Teaching supervisors and teachers can shed light on how supervisor support influences teachers' digital competencies Investigating new teaching approaches like project based learning, through experimental studies may boost teacher productivity and student involvement

Finally; to better understand the impact of economic obstacles, in utilizing technology for education purposes and to develop impactful solutions, for these challenges requires thorough evaluations first and foremost.

Limitations and Future Research Directions

This study was limited to a sample of 223 supervisors and coordinators of geography curriculum from northern Jordan, which may affect the generalizability of the results to other regions. The sample may not fully represent the challenges faced by teachers in other areas of Jordan. Therefore, future studies should increase the sample to contain varied regions in order to ensure broader representation of the trends and challenges related to enhancing digital skills. Furthermore, the study primarily relied on a questionnaire as the data collection instrument, which may not provide a comprehensive understanding of the complex challenges teachers encounter. To address this, future research could integrate a variety of instruments, such as classroom observations and semi-structured interviews, to collect more detailed and well-rounded data.

Regarding future research directions, it is crucial to broaden the scope of studies to include diverse learning environments and regions, as this would offer deeper insights into the challenges teachers face. Furthermore, exploring the influence of supervisory support on the development of teachers' digital skills is crucial. Research should also assess the effectiveness of innovative teaching methods, such as project-based learning, which may enhance teacher-student interaction. Finally, it is important to examine the economic barriers to adopting educational technology and develop dynamic solvongs to meet these challenges, ensuring the sustainable digital transformation of learning environments.

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