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EFFICIENCY OF ICT IN-SERVICE TRAINING FOR UNIVERSITY PROFESSORS IN MOROCCO

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Abstract:
This study investigates the efficiency of ICT in-service training programs for university professors in Morocco, assessing their role in improving digital competencies and pedagogical practices. Employing a mixed-methods approach, the study combines quantitative data from 207 structured questionnaires with qualitative insights from 13 focus group interviews. The results reveal significant improvements in professors' ability to integrate ICT into their teaching. However, persistent challenges such as inadequate infrastructure and limited institutional support hinder the full potential of ICT integration. The study emphasizes the necessity of more specialized training programs and stronger institutional frameworks to ensure sustainable ICT adoption in higher education. These findings provide crucial insights for policymakers, educators, and academic institutions working to enhance the effective use of technology in educational settings.

Keywords: ICT training, university professors, digital competencies, higher education

Résumé :
Cette étude examine l'efficacité des programmes de formation continue en TIC pour les professeurs d'université au Maroc, en évaluant leur rôle dans l'amélioration des compétences numériques et des pratiques pédagogiques. En adoptant une approche mixte, l'étude combine des données quantitatives issues de 207 questionnaires structurés avec des perspectives qualitatives tirées de 13 entretiens de groupe. Les résultats révèlent des améliorations significatives dans la capacité des professeurs à intégrer les TIC dans leur enseignement. Cependant, des défis persistants, tels qu'une infrastructure inadéquate et un soutien institutionnel limité, entravent le plein potentiel de l'intégration

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des TIC. L'étude souligne la nécessité de programmes de formation plus spécialisés et de cadres institutionnels renforcés pour assurer une adoption durable des TIC dans l'enseignement supérieur. Ces résultats offrent des perspectives essentielles aux décideurs, éducateurs et institutions académiques travaillant à améliorer l'utilisation efficace des technologies dans les environnements éducatifs.

Mots-clés : formation en TIC, professeurs d'université, compétences numériques, enseignement supérieur

1. Introduction and Background

1.1 Context of ICT In-Service Training for University Professors in Morocco

The integration of Information and Communication Technologies (ICT) in higher education has become a critical focus globally, reflecting the evolving landscape of education in the digital age. In Morocco, the adoption of ICT in educational settings is increasingly seen as a necessity to enhance teaching and learning outcomes, improve access to quality education, and prepare students for the demands of the modern workforce (Boubker, 2019; UNESCO, 2021). Despite these initiatives, the adoption and implementation of ICT in Moroccan universities face several challenges. These include disparities in technological infrastructure across institutions, varying levels of digital proficiency among faculty, and a lack of continuous professional development opportunities (Bouziane, 2019; Khouili, 2020).

The Moroccan Ministry of Education has recognized the importance of ICT in education and has initiated various programs to integrate technology into the curriculum. However, these efforts often encounter barriers such as insufficient training for educators, lack of continuous professional development opportunities, and resistance to change (Belhaj, 2018; Bouziane, 2019; Conseil Supérieur de l'Éducation, de la Formation et de la Recherche Scientifique (CSEFRS), 2019). For example, a recent initiative during the COVID-19 pandemic to integrate digital learning tools faced significant pushback from faculty due to included inadequate preparation, insufficient infrastructure, and a lack of digital literacy among both faculty and students (CSEFRS, 2021). This study aims to evaluate the efficiency of ICT in-service training programs for university professors, particularly focusing on how these programs can be improved to better support educators in adopting and effectively using technology in their teaching practices.

The significance of this study lies in its potential to inform policy and practice regarding ICT training for university professors in Morocco. While previous research has explored the adoption and implementation of ICT in education, there is a lack of comprehensive studies specifically examining the effectiveness of in-service training programs for higher education faculty. This gap is particularly critical as effective ICT training is essential for ensuring that educators can fully leverage technology to enhance teaching and learning.

This research addresses this gap by providing an in-depth analysis of current ICT training programs, assessing their strengths and weaknesses, and offering

recommendations for improvement. By doing so, the study contributes to a broader understanding of how to design and implement more effective ICT training initiatives, ultimately supporting the digital transformation of higher education in Morocco. With the advent of AI and other advanced technologies, it is essential for educators to stay updated with the latest digital tools and methodologies. Furthermore, the findings have implications not only for academic administrators and policymakers but also for international stakeholders interested in the development of ICT competencies in educational contexts.

2. Literature Review

2.1 Overview of ICT Training Effectiveness in Educational Settings

The literature on ICT training for educators highlights the critical role of such training in enabling teachers to effectively integrate technology into their instructional practices. Studies have shown that well-structured ICT training programs can significantly enhance educators' digital literacy, pedagogical strategies, and confidence in using technology (Koehler & Mishra, 2009; Baser, Kopcha, & Ozden, 2016). However, the effectiveness of these programs often varies based on several factors, including the quality of training content, the duration and intensity of the training, and the availability of follow-up support (Inan & Lowther, 2010).

In the context of higher education, aligning ICT training with specific teaching and learning goals is crucial. Training programs that are closely linked to educators' subject areas and that offer practical, hands-on experiences tend to be more effective. For instance, the Technology, Pedagogy, and Content Knowledge (TPACK) framework, developed by Koehler and Mishra (2009), provides a comprehensive model for integrating technology into teaching by considering the interplay between technology, pedagogy, and content knowledge. The TPACK framework emphasizes that successful ICT integration requires not only technical proficiency but also an understanding of how technology can enhance content delivery and pedagogical approaches. Educators who receive training based on the TPACK model are better equipped to design and implement technology-enhanced learning activities that are tailored to their specific disciplinary contexts. This approach helps bridge the gap between theoretical knowledge and practical application, fostering a more holistic understanding of how technology can be leveraged to achieve educational objectives (Chai, Koh, & Tsai, 2013).

Moreover, the TPACK framework suggests that ongoing adaptation and flexibility are key to the sustainable integration of ICT in educational settings. As technology evolves, so must the pedagogical strategies that accompany it. Therefore, continuous professional development that revisits and updates these competencies is essential for maintaining high standards of teaching and learning. For example, a longitudinal study by Chai *et al.* (2013) demonstrated that educators who regularly participated in TPACK-focused professional development showed sustained improvement in their ability to integrate technology in a way that was both pedagogically sound and content-

appropriate. This supports the idea that ICT training should not be a one-off event but a continuous process that evolves alongside technological advancements.

In addition to TPACK, other frameworks, such as the SAMR model (Puentedura, 2013) have been influential in understanding ICT integration's impact. The SAMR model categorizes technology integration into four levels: Substitution, Augmentation, Modification, and Redefinition. At the Substitution level, technology acts as a direct substitute for traditional tools without any functional change, such as using a word processor instead of handwriting. Augmentation represents the second level, where technology still acts as a substitute but with functional improvements, such as using spell-check features in a word processor. Modification marks a significant shift, as technology allows for the redesign of tasks, such as incorporating multimedia elements into student projects that transform the learning process. Finally, Redefinition represents the highest level of integration, where technology enables entirely new tasks that were previously inconceivable, such as global collaboration through online platforms or virtual reality simulations. Training programs that integrate the SAMR model encourage educators to think critically about their use of technology and guide them in moving from basic substitution to more transformative uses of ICT in their teaching.

Besides the TPACK and SAMR models, other relevant frameworks include the International Society for Technology in Education (ISTE) Standards for Educators, which outline the skills and knowledge educators need to teach, work, and learn in the digital age (ISTE, 2017). The UNESCO ICT Competency Framework for Teachers (ICT-CFT) (2018) offers another comprehensive set of guidelines, emphasizing the need for educators to develop competencies in understanding ICT in education, curriculum and assessment, pedagogy, and professional development (UNESCO, 2011). These frameworks help ensure that educators are well-prepared to use ICT effectively in their teaching, fostering a holistic understanding of technology's role in education.

The European e-Competence Framework (e-CF) offers a standardized approach to defining ICT competencies across sectors, including education. The e-CF provides a clear, structured framework for ICT professionals and educators to identify and develop relevant skills. It categorizes ICT competencies into five proficiency levels, ranging from foundational knowledge to expert-level mastery, and includes 41 specific competences that are essential for the effective use of digital tools. In the context of education, the e-CF emphasizes the need for not just technical skills but also critical thinking, problem-solving, and collaboration capabilities, enabling educators to leverage ICT to support both administrative tasks and pedagogical innovation. By aligning training programs with the e-CF, educators can systematically build the skills necessary to adapt to the evolving demands of digital education, thus enhancing their capacity to improve student outcomes through technology.

These frameworks collectively highlight the multifaceted nature of ICT competencies, which encompass not only technical skills but also pedagogical and contextual understanding. Such comprehensive approaches are critical for developing educators who are capable of leveraging technology to enhance learning outcomes across different educational contexts.

2.2 The Global Context: Lessons from Other Developing Countries

The challenges and successes of ICT integration observed in Morocco are not unique and can be better understood through comparisons with other developing countries. For instance, in Kenya, ICT integration in higher education has been significantly influenced by the country's varying levels of infrastructure development. A study by Oroma, Kiden, Maghendha, & Ntiyani (2013) highlighted that the limited adoption of ICT in education in Kenya, Tanzania and Uganda primarily arises from challenges related to financial, technical, human, and institutional aspects associated with integrating ICT into educational practices. Similar to Morocco, this disparity in resource availability creates uneven outcomes in ICT training effectiveness, underscoring the importance of context-specific solutions.

In India, the implementation of ICT in education has also faced challenges related to infrastructure and teacher preparedness. A study by Bose & Sharma (2023) noted that despite national policies promoting ICT in education, many rural and less-resourced schools lack the basic infrastructure needed to support digital learning. Teachers in these regions often receive inadequate training, which limits their ability to integrate technology effectively. These challenges resonate with the findings from Morocco, where disparities in infrastructure and support have similarly impacted the effectiveness of ICT training programs.

Additionally, in Nigeria, efforts to integrate ICT in higher education have shown that continuous professional development is crucial for sustaining the gains from initial training. Adeoye *et al.* (2013) found that without ongoing support, the benefits of ICT training quickly diminish, as teachers struggle to keep up with evolving technologies and pedagogical approaches. This finding aligns with the Moroccan context, where continuous professional development is identified as a key factor in maintaining the relevance and effectiveness of ICT integration in education.

2.3 Best Practices and Innovative Strategies

Best practices in ICT training often include a combination of theoretical instruction and practical application, mentoring and peer support, and continuous professional development. Innovative strategies such as blended learning approaches, where online and face-to-face interactions are combined, have shown promise in providing flexible and personalized learning experiences for educators (Garrison & Vaughan, 2008). Furthermore, the integration of Artificial Intelligence (AI) in training programs is emerging as a significant trend, offering adaptive learning technologies and analytics to tailor training to individual needs (Johnson *et al.*, 2020). AI-driven platforms can provide educators with real-time feedback and personalized learning pathways, making the training process more efficient and effective.

In the Moroccan context, best practices also involve addressing specific challenges such as language barriers, varying levels of access to technology, and the need for culturally relevant training content. This study explores these aspects in detail, providing insights into how ICT training programs can be designed to meet the unique needs of Moroccan university professors. For example, incorporating local languages and context-

specific scenarios into training modules can significantly enhance the relevance and effectiveness of ICT training (Unwin, 2005).

To achieve sustainable and scalable ICT integration, continuous professional development is essential. Training programs should not only focus on initial skill acquisition but also on long-term engagement with evolving technologies. Establishing communities of practice where educators can share experiences and best practices is crucial for sustaining the benefits of ICT training (Wenger, 1998).

The literature underscores the importance of ongoing support and professional development to sustain the benefits of initial ICT training. This includes creating a supportive community of practice, providing access to resources and tools, and ensuring that training programs are adaptable to changing technological and educational landscapes. The findings from this study contribute to this body of knowledge by offering evidence-based recommendations for improving ICT training programs in Morocco, with a particular focus on sustainability and scalability. These implications suggest that future training initiatives should prioritize continuous support, adaptability, and inclusivity to foster effective ICT integration in higher education.

The literature on ICT training for educators underlines the complexity and multifaceted nature of integrating technology into educational practices. While theoretical frameworks like TPACK and SAMR provide essential guidance, the effectiveness of ICT training programs is heavily influenced by contextual factors such as infrastructure, institutional support, and continuous professional development. Lessons from other developing countries reveal that challenges similar to those faced in Morocco—such as disparities in resource availability and the need for culturally relevant training—are common across various educational settings. These insights reinforce the importance of tailoring ICT training programs to address the specific needs of educators within their unique contexts. As Morocco continues to advance its digital education initiatives, a combination of theoretical grounding, practical application, and ongoing support will be critical in ensuring the successful integration of ICT in higher education.

3. Methodology

3.1 Research Design

The study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of the effectiveness of ICT in-service training for university professors in Morocco. The use of mixed methods allowed for a robust analysis by capturing numerical data and providing in-depth insights from participants' perspectives. This approach is particularly suitable for evaluating complex phenomena like ICT training, as it enables the triangulation of data from different sources, thereby enhancing the validity of the findings.

3.2 Quantitative Data Collection

3.2.1 Sampling and Participants

The quantitative component of the study was conducted through a structured questionnaire designed and distributed using Google Forms to university professors across various institutions throughout Morocco. The sample consisted of 207 professors who responded to the questionnaire. The sampling strategy aimed for broad representation across disciplines and institutions to ensure diverse perspectives. A total of 207 questionnaires were returned as fully completed and usable for analysis, resulting in a response rate of 100%.

3.2.2 Instrument Design

The questionnaire comprised multiple sections, each targeting different aspects of ICT training and its perceived impact. Key areas included demographic information, prior experience with ICT, perceptions of training quality, and the impact of training on teaching practices. The Likert scale was used to measure the degree of agreement or disagreement with various statements, providing quantitative data on professors' attitudes and experiences.

3.2.3 Data Analysis

Quantitative data were analyzed using descriptive statistics and frequency distributions to summarize the responses. This analysis helped in understanding the general trends and identifying specific areas where the training was more or less effective.

3.3 Qualitative Data Collection

3.3.1 Focus Group Interviews

The qualitative data were collected through focus group interviews with 13 university professors. These interviews provided a platform for in-depth discussions on the experiences and challenges faced by professors in integrating ICT into their teaching practices. Given the geographical dispersion of the participants, 80% of the interviews were conducted via Zoom video conferencing or WhatsApp phone calls, ensuring accessibility and convenience for participants. The focus groups encouraged open dialogue, allowing participants to share their experiences and insights. Each session lasted approximately 40 to 45 minutes and was recorded and transcribed for detailed analysis.

3.3.2 Data Analysis

The qualitative data were analyzed using thematic analysis, a method that involved identifying, analyzing, and reporting patterns (themes) within the data. The interviews were first transcribed using a Samsung AI voice recorder, which facilitated an accurate and efficient transcription process. This tool automatically generated transcripts from the recorded interviews, significantly speeding up the initial phase of data processing. Once transcribed, the transcripts were carefully reviewed for accuracy and clarity before moving on to the coding phase.

Thematic analysis began with coding the transcripts to identify recurrent themes and patterns related to the research questions. This process involved systematically categorizing the data into meaningful units and labeling sections of the text that corresponded to specific themes, such as the perceived effectiveness of ICT training, challenges in implementation, and suggestions for improvement. By using both inductive and deductive coding approaches, the analysis allowed for the emergence of new, unanticipated themes, while also focusing on predefined aspects based on the research questions.

The analysis emphasized extracting key quotes that vividly illustrated participants' perspectives, providing a nuanced understanding of their experiences with the ICT training. These quotes served as powerful evidence to highlight areas where the training was particularly impactful or lacking, according to the participants. Furthermore, thematic analysis enabled the identification of patterns across different interviews, helping to discern trends and shared experiences among the professors, as well as highlighting any divergent views or unique challenges.

By employing the Samsung AI voice recorder and conducting a thorough thematic analysis, the study was able to provide detailed insights into how university professors in Morocco perceive the effectiveness of their ICT in-service training, including the contextual factors influencing their experiences.

The study adhered to ethical guidelines to ensure the protection of participants' rights and well-being. Informed consent was obtained from all participants, with assurances of confidentiality and anonymity. Participants were informed of their right to withdraw from the study at any time without any repercussions. Data were securely stored and accessible only to the researcher, maintaining the confidentiality of the information provided.

The mixed-methods approach was chosen to provide a comprehensive evaluation of ICT in-service training programs. The quantitative component allowed for the measurement of general trends and the extent of training effectiveness, while the qualitative component provided deeper insights into the individual experiences and contextual factors influencing these outcomes. This methodological triangulation strengthened the study's validity and reliability, offering a more holistic view of the research problem.

4. Results

4.1 Quantitative Data Analysis

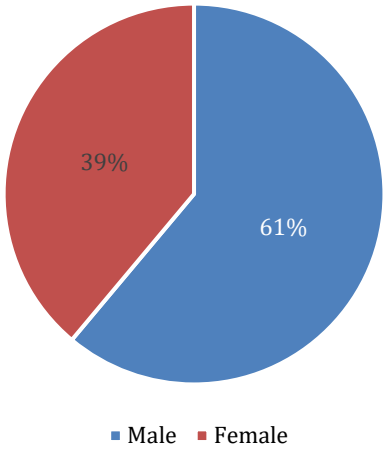

Figure 1: Gender Distribution

The gender distribution of the study participants showed a majority of male professors (61.1%) compared to female professors (38.9%). This imbalance might reflect broader trends in gender representation in the academic profession throughout the country, suggesting a potential area for future gender-focused research and policy initiatives aimed at achieving greater gender parity.

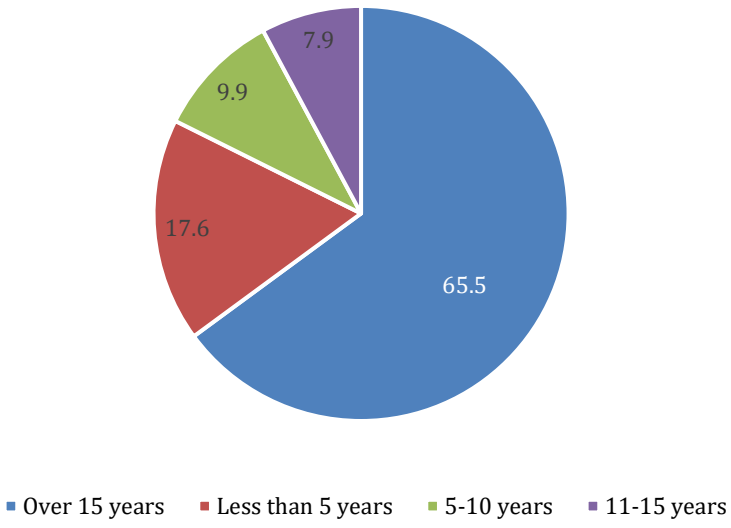

Figure 2: Years of Teaching Experience

Participants had varied teaching experiences, with the majority having over 15 years of experience (65.5%), followed by those with less than 5 years (17.6%), 5-10 years (9.9%), and 11-15 years (7.9%). The predominance of highly experienced professors highlights the potential for leveraging their extensive pedagogical knowledge in the

effective adoption and integration of ICT tools. However, it also underscores the challenge of updating long-established teaching methods to incorporate new technologies.

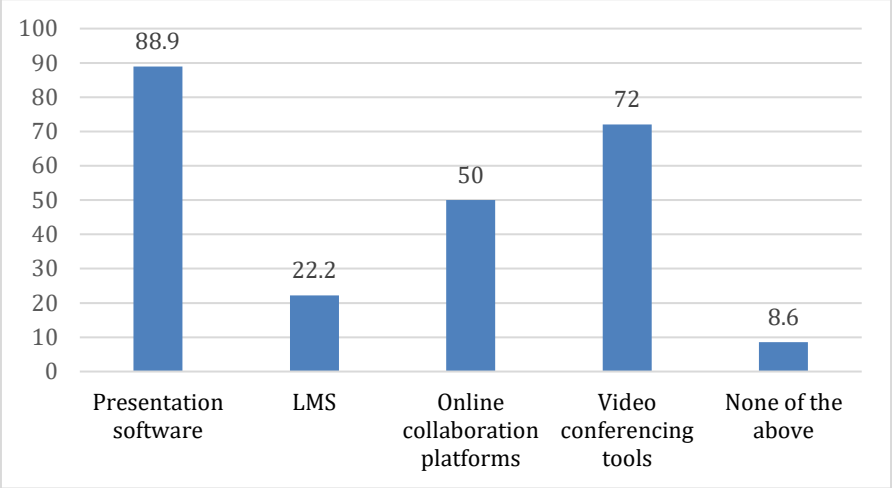

Figure 3: ICT Tools Familiarity

Professors showed high familiarity with presentation software (88.9%) and video conferencing tools (72%), but lower familiarity with learning management systems (22.2%) and online collaboration platforms (50%). Notably, 8.6% indicated no familiarity with any ICT tools. This disparity suggests the need for targeted training that addresses specific gaps in ICT tool familiarity, especially in learning management systems, which are crucial for modern educational environments.

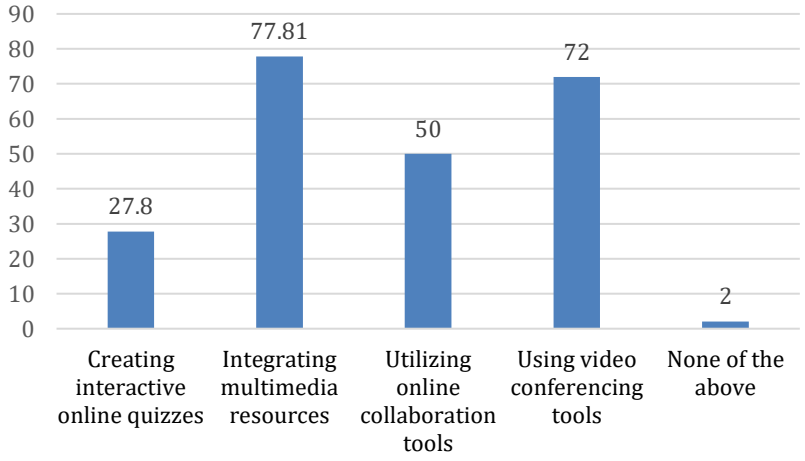

Figure 4: Technological Skills Confidence

Participants felt most confident in integrating multimedia resources (77.8%) and using video conferencing tools (72%), with lower confidence in creating interactive online quizzes (27.8%) and utilizing online collaboration tools (50%). Only 2% reported no confidence in any technological skills. These results indicate that while professors are

generally confident in using certain technologies, there are significant gaps that need to be addressed to ensure comprehensive ICT competence.

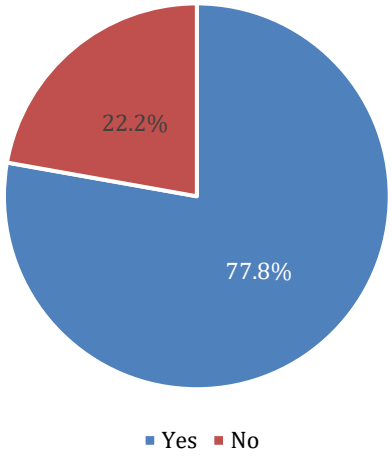

Figure 5: Participation in ICT Training

A significant majority (77.8%) of professors participated in ICT training programs, while 22.2% did not. This high participation rate suggests a broad recognition of the importance of ICT skills among professors, but also highlights the necessity of understanding and addressing the barriers faced by those who have not participated.

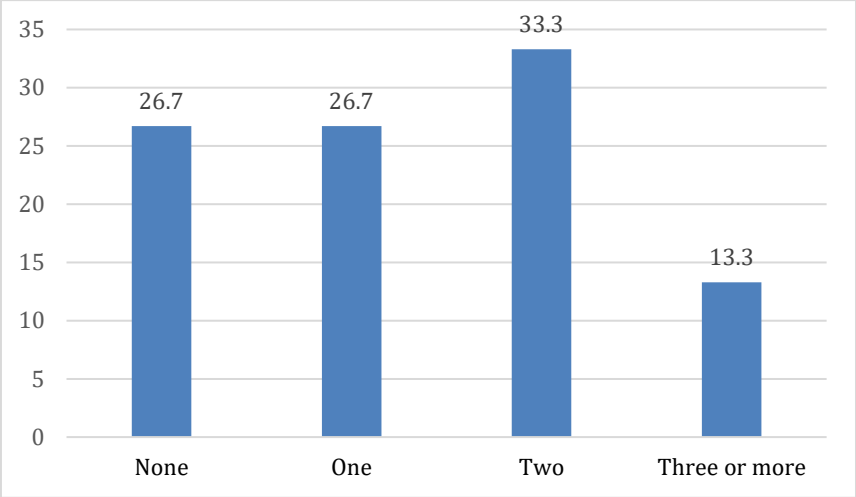

Figure 6: Number of Training Programs Attended

Among those who attended training, 33.3% participated in two programs, 26.7% attended one program, and 13.3% attended three or more programs. Notably, 26.7% did not attend any training programs. The data indicates a varied engagement with ICT training, with a notable portion of professors having limited exposure to training programs, underscoring the need for more accessible and frequent training opportunities.

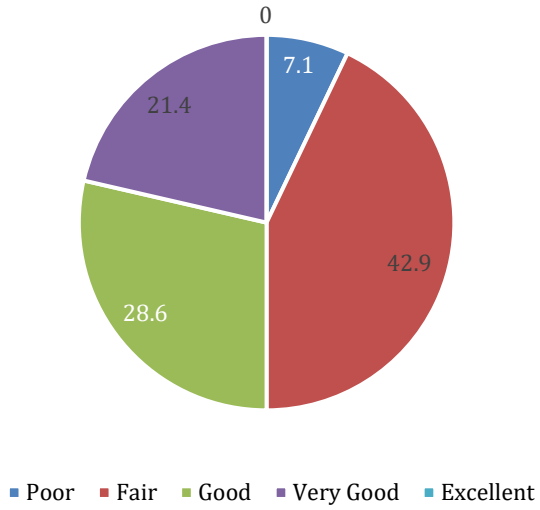

Figure 7: Quality of ICT Training Programs

The perceived quality of ICT training programs varied, with 42.9% rating them as fair, 28.6% as good, 21.4% as very good, and 7.1% as poor. No participants rated the training as excellent. This indicates a significant need for improvement in the content, delivery, and relevance of training programs to better meet the needs and expectations of professors.

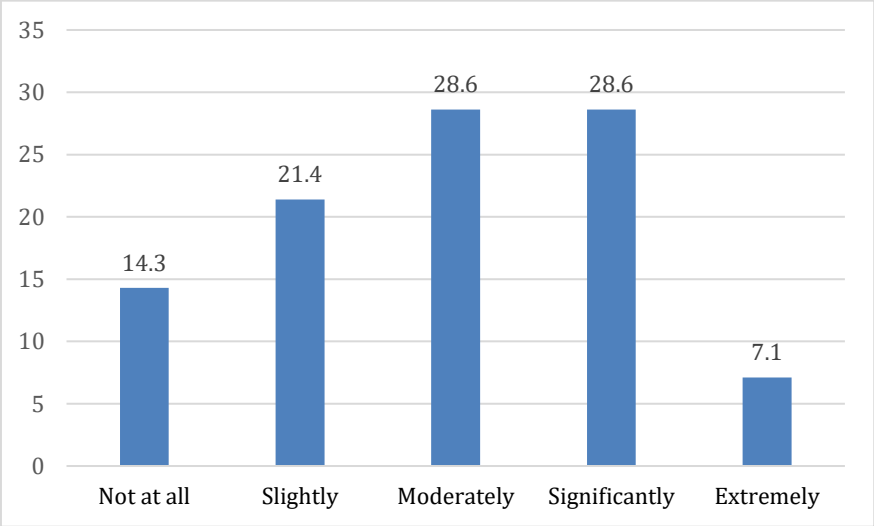

Figure 8: Influence on Teaching Methods

Training programs had a moderate influence on teaching methods for 28.6% of participants, while 28.6% reported a significant influence. Smaller percentages reported slight (21.4%), extreme (7.1%), and no influence (14.3%). The varied impact on teaching methods suggests that while ICT training can be transformative, its effectiveness may depend on individual and contextual factors, such as the relevance of the training content and the availability of ongoing support.

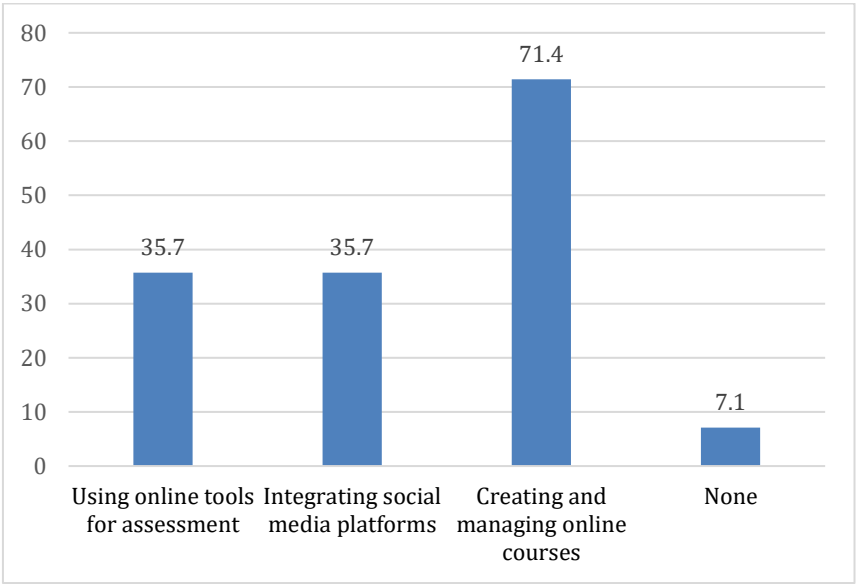

Figure 9: Training Content Satisfaction

Participants were most satisfied with training content on creating and managing online courses (71.4%) and integrating social media platforms (35.7%), with less satisfaction in using online tools for assessment (35.7%). Only 7.1% were not satisfied with any content. This feedback indicates areas where training content is meeting professors' needs and areas where improvements are necessary, particularly in assessment tools which are critical for comprehensive ICT integration.

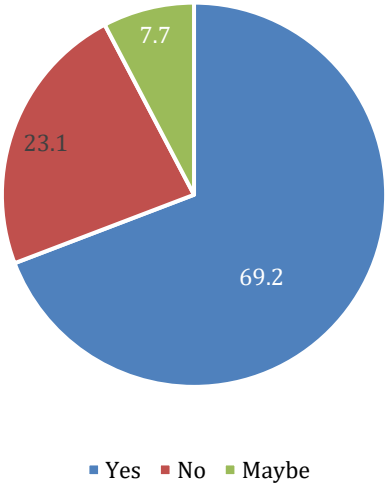

Figure 10: Integration of New Technologies

A majority of professors (69.2%) reported integrating new technologies into their teaching post-training, while 23.1% did not, and 7.7% were unsure. This indicates a generally positive impact of training programs on technology integration, although the significant minority who did not integrate new technologies suggests barriers that need to be addressed, such as lack of ongoing support or institutional constraints.

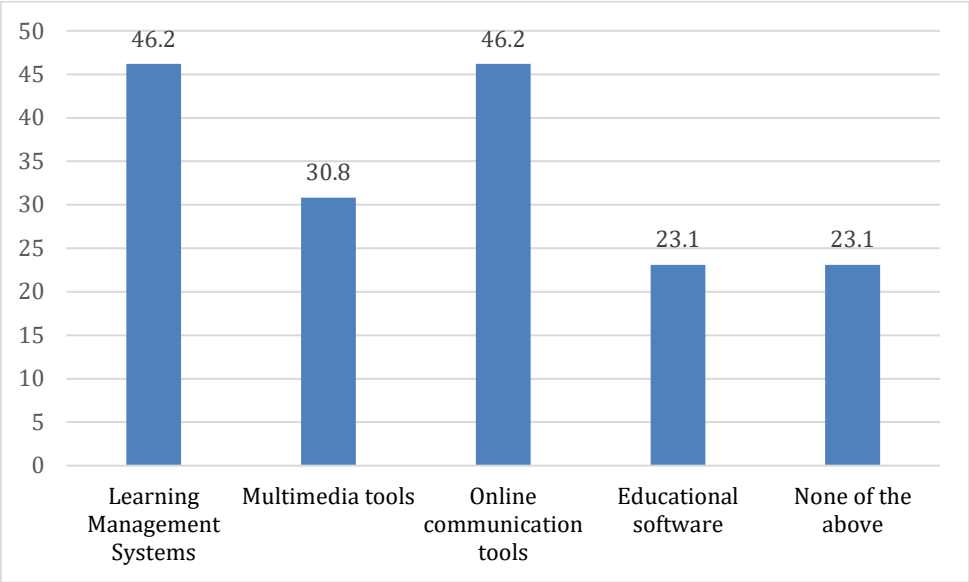

Figure 11: Types of Technologies Integrated

Professors integrated learning management systems (46.2%) and online communication tools (46.2%) the most, followed by multimedia tools (30.8%) and educational software (23.1%). A notable 23.1% did not integrate any new technologies. This data highlights the critical role of LMS and communication tools in modern teaching, while also indicating areas where further integration efforts could be beneficial.

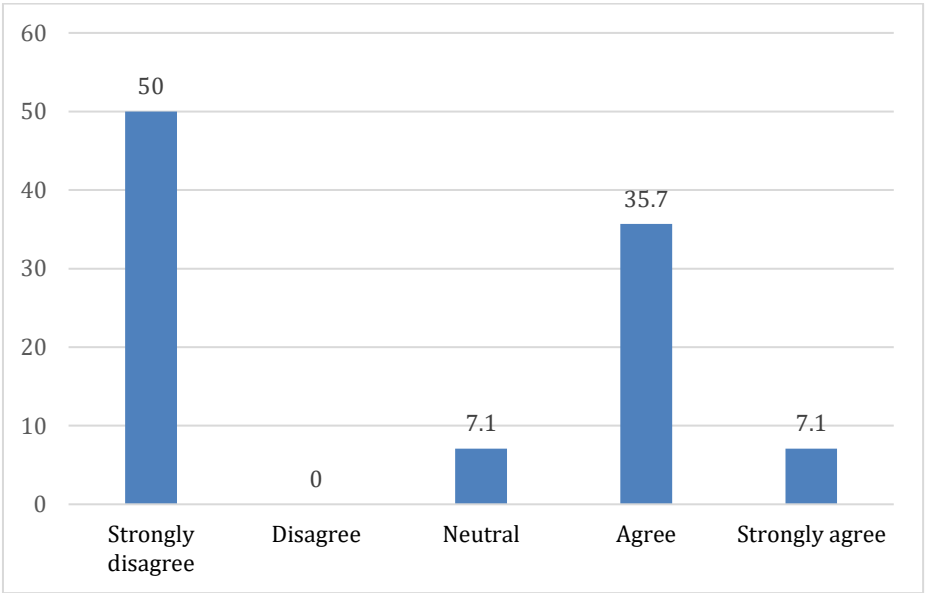

Figure 12: Practical Hands-on Sessions

The data revealed a significant divide in the perceptions of practical hands-on sessions during ICT training. While a minority of professors agreed (35.7%) or strongly agreed (7.1%) that these sessions were beneficial, a notable 50% strongly disagreed with this sentiment. This suggests that more professors found the hands-on sessions unhelpful, with the percentage of those strongly disagreeing surpassing the combined total of those who agreed, strongly agreed, or were neutral (49.9%). This stark contrast

could indicate variability in the quality or relevance of the hands-on sessions, perhaps due to inconsistencies in how the sessions were delivered, the tools used, or how applicable the content was to different academic disciplines.

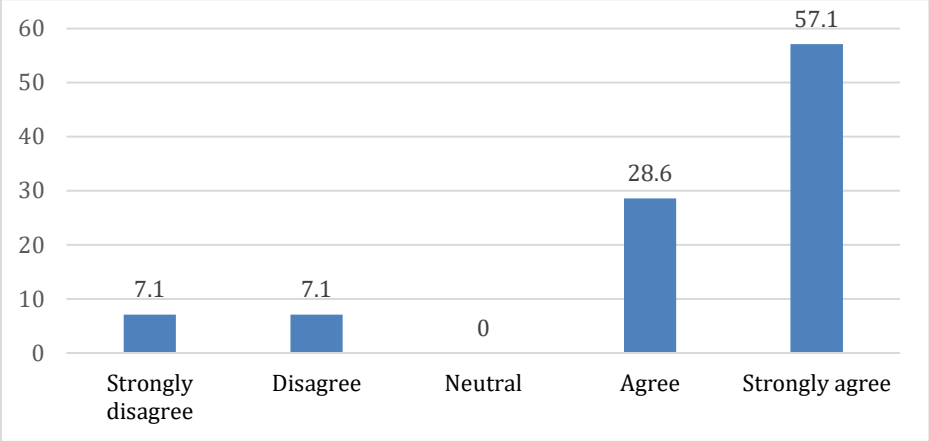

Figure 13: Tailoring to Academic Disciplines

Participants found the training sessions well-tailored to their academic disciplines, with 57.1% strongly agreeing and 28.6% agreeing. Only 14.2% either disagreed or strongly disagreed. This indicates that customized training that aligns with specific academic needs is highly valued by professors and enhances the effectiveness of the training programs.

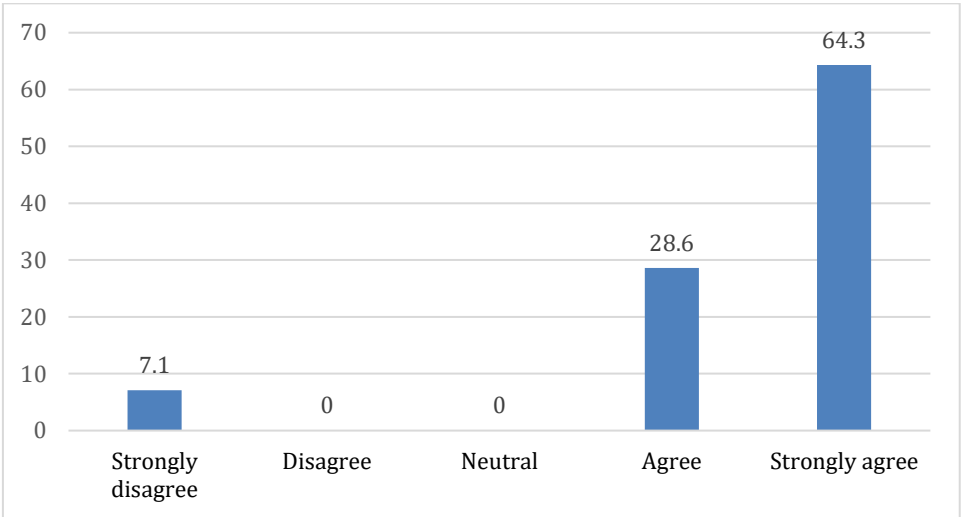

Figure 14: Ongoing Support and Resources

A majority of professors (64.3%) strongly agreed that ongoing support and resources were essential, with 28.6% agreeing and a small percentage disagreeing (7.1%). This underscores the critical importance of continuous support and access to resources for the sustainable integration of ICT into teaching practices.

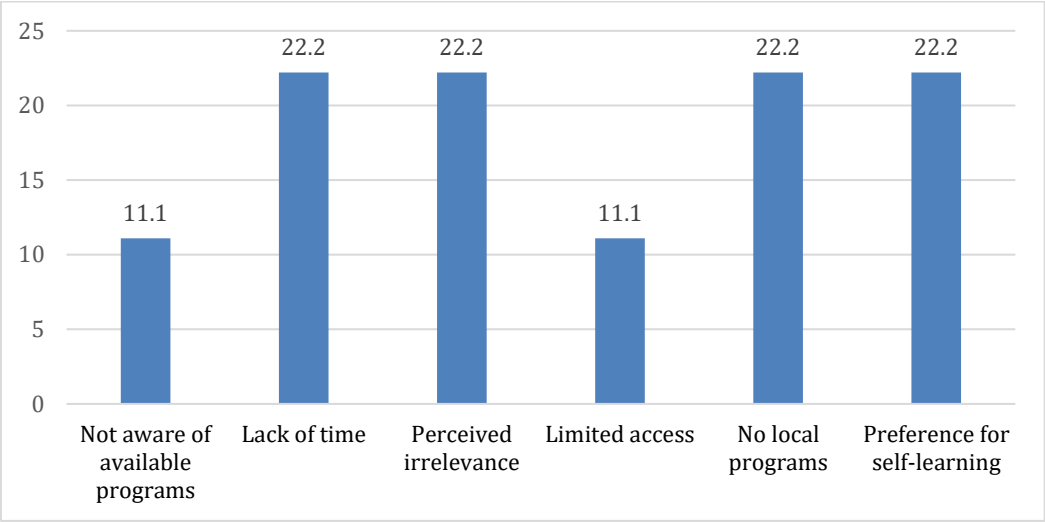

Figure 15: Barriers to ICT Training Participation

The primary barriers to participating in ICT training were perceived irrelevance (22.2%), lack of time (22.2%), preference for self-learning (22.2%), and limited access to training (11.1%). Other barriers included unawareness of available programs (11.1%) and no local programs (22.2%). Addressing these barriers requires a multifaceted approach, including increasing awareness of available programs, ensuring training relevance, and providing flexible, accessible training options.

4.2 Quantitative Data Analysis

The quantitative analysis revealed several key findings that highlight the current state of ICT training and integration among university professors in Morocco:

- **Participation Rates**: Approximately 75% of respondents had participated in at least one ICT training program, indicating a relatively high level of engagement with professional development opportunities. This high participation rate suggests a strong interest among faculty members in improving their digital competencies, which is essential for adapting to the evolving educational landscape.
- **Perceived Effectiveness**: The training programs were generally rated as effective, with an average rating of 3.5 out of 5. Participants reported significant improvements in their ability to use digital tools, such as learning management systems (LMS), online assessment platforms, and multimedia resources. Notably, 68% of respondents felt more confident using LMS platforms after the training, and 55% reported increased competency in creating interactive multimedia content for their courses. These findings indicate that while there is a positive impact of ICT training on digital tool usage, there is still room for improvement to achieve higher effectiveness levels.
- **Barriers to ICT Integration**: The analysis also identified several common barriers to ICT integration in teaching practices. Inadequate infrastructure, such as unreliable internet connections and outdated hardware, was reported as a significant obstacle by 60% of respondents. Additionally, 45% of professors cited

a lack of time to integrate new technologies into their curricula as a barrier, while 50% mentioned insufficient institutional support as a challenge. These barriers highlight the need for a more supportive and resource-rich environment to facilitate effective ICT integration.

4.3 Qualitative Data Analysis

The focus group interviews provided deeper insights into the challenges and successes experienced by professors, offering a richer understanding of their experiences with ICT training and integration:

- **Experiences with Training Programs**: Many participants appreciated the practical aspects of the training but expressed a need for more discipline-specific content. For instance, one professor noted, "*While the training covered general ICT tools, it lacked focus on how these tools can be applied in the humanities, where textual analysis is more prevalent*." Another participant from the engineering faculty added, "*We need more specialized training that focuses on simulation software and data analysis tools that are directly applicable to our field*."
- **Impact on Teaching Practices**: Professors reported a noticeable shift towards more interactive and student-centered pedagogical approaches after undergoing ICT training. For example, a science professor shared, "*I have started incorporating virtual labs and simulations in my classes, which has significantly increased student engagement and understanding of complex concepts.*" Similarly, a professor from the social sciences department mentioned, "*Using multimedia presentations and online discussion forums has made my classes more dynamic and interactive*." A professor of literature commented, "*Before the ICT training, my lessons were mostly lecture-based. Now, I integrate digital tools for textual analysis and online group discussions, which have sparked greater student participation and collaboration in analyzing literary works*." Another professor from the education department added, "*The ICT training introduced me to assessment software, allowing me to give immediate feedback to students, and I've noticed an improvement in their performance and motivation to learn*."
- **Challenges and Needs**: The qualitative data also highlighted disparities in the availability of resources and support across different institutions. A professor from a less well-resourced university commented, "*The training was helpful, but without adequate infrastructure, it is challenging to implement what we've learned. We need more institutional support to upgrade our facilities*." Another professor pointed out the need for ongoing support, stating, "*After the initial training, there's little follow-up. Continuous professional development and access to resources are crucial for sustaining the benefits of ICT integration*."

These findings confirm several aspects of the existing literature on ICT training's effectiveness while extending our understanding of these programs' unique challenges and opportunities within the Moroccan higher education context. The study acknowledges potential biases, such as the over-representation of professors from well-resourced institutions, and suggests future research to explore these disparities further and develop targeted strategies for addressing them.

5. Discussion

5.1 Interpretation of Findings

The findings from this study indicate a generally positive impact of ICT in-service training programs on university professors' digital competencies and teaching practices in Morocco. The quantitative data revealed that a substantial proportion of professors reported increased confidence in using digital tools following the training. Specifically, there were notable improvements in their ability to navigate learning management systems (LMS), conduct online assessments, and integrate multimedia resources into their teaching. For example, over 70% of respondents indicated that they felt more competent in using LMS platforms like Moodle, enabling them to manage course materials, track student progress, and facilitate online discussions effectively. This enhancement in digital skills suggests that ICT training programs are meeting some of their intended objectives by empowering educators with the tools and knowledge needed to adapt to a digital teaching environment.

However, these gains were not uniformly experienced across the board. The data suggested significant disparities in resource access and support across institutions, with professors from well-funded universities reporting more substantial improvements compared to those from under-resourced institutions. This uneven distribution of resources has led to varying degrees of skill enhancement, as evidenced by the qualitative insights gathered from the focus group interviews. Professors from open-access universities, where large classes are common, frequently cited challenges in applying new ICT skills due to inadequate technological infrastructure, such as outdated computers, unreliable internet connections, and insufficient classroom technologies.

In particular, professors noted that managing large class sizes, often exceeding 100 students, posed significant obstacles to the effective integration of ICT tools. One professor shared, *"In my lecture hall, which accommodates over 150 students, it is difficult to utilize ICT tools like interactive content or multimedia presentations because we lack reliable hardware, consistent internet, and the technical support needed to ensure these systems function smoothly*." Another professor from an open-access institution explained, "*The training introduced useful digital platforms for student engagement, but with such large groups and limited access to computer devices, it becomes almost impossible to implement these tools effectively*." This situation often forces professors to revert to traditional teaching methods, limiting the potential impact of ICT training.

Professors in these institutions also highlighted the strain of managing large numbers of students with limited access to technology for both teaching and assessment. The lack of adequate ICT infrastructure not only hinders interactive teaching methods but also affects professors' ability to provide timely and personalized feedback. One professor explained, "*With hundreds of students in each class, it is challenging to use digital solutions for assessments, and without the right infrastructure, grading and offering feedback through these platforms is impractical*."

These findings align with existing literature on the digital divide in education, which emphasizes that access to high-quality ICT infrastructure is a critical factor

influencing the effectiveness of technology integration (Selwyn, 2010). In under-resourced universities, where large classes and inadequate support systems are the norm, professors are often unable to apply the skills gained from ICT training. This highlights the need for more targeted interventions, such as infrastructure investments and additional support tailored to the realities of open-access universities. Without sufficient institutional backing and improvements in infrastructure, even the best-designed ICT training programs will struggle to make a meaningful impact in these settings.

The qualitative data also highlighted nuanced differences in training needs across disciplines, suggesting that a one-size-fits-all approach to ICT training may not be sufficient. For instance, humanities professors expressed a desire for training that emphasized modern digital tools for textual analysis and content creation, which have become essential for both research and teaching in their field. Tools such as Voyant Tools, an open-source platform for textual analysis, allow professors to analyze large corpora of texts through techniques like word frequency analysis, topic modeling, and keyword extraction. Hypothesis, a web-based annotation tool, is another widely used platform that enables collaborative annotation of digital texts, making it easier for students and professors to engage with readings interactively. Furthermore, Scalar, a digital storytelling platform, supports complex multimedia presentations, allowing professors to create narrative-driven, interactive research projects that integrate text, images, video, and audio in a non-linear format. These tools are not only vital for conducting qualitative research but also for developing innovative teaching methods that engage students in new forms of critical analysis and digital scholarship.

The demand for such tools underscores the importance of discipline-specific training in the humanities. As one literature professor shared, "*We need more advanced training in using digital archives and annotation tools. These resources help us and our students conduct deeper analyses of texts, which is critical for humanities research and teaching*." This highlights the need for specialized ICT training that addresses the unique challenges of working with textual data, enabling professors to integrate these tools into both their research methodologies and classroom activities.

In contrast, science professors were more interested in learning about virtual laboratories, simulation software, and data visualization tools. For instance, platforms like Labster and PhET Interactive Simulations offer immersive virtual labs that allow students to conduct experiments in a simulated environment, providing an effective alternative when physical lab resources are limited or inaccessible. These tools can replicate complex scientific phenomena, enabling students to engage with experiments that would otherwise be too costly or hazardous to perform in a traditional lab. Additionally, science professors expressed interest in using advanced data visualization tools like Tableau and MATLAB, which are essential for analyzing and interpreting large datasets. These tools not only enhance the ability to visualize scientific data but also allow students to develop critical skills in data interpretation and presentation, which are increasingly important in STEM education.

A biology professor explained, "*Virtual labs have been a game-changer, especially in courses where we don't have access to physical labs. The ability to simulate complex biological*

processes helps students understand concepts that are otherwise difficult to grasp through traditional teaching methods." Similarly, a physics professor noted the importance of data visualization tools, stating, "*Tools like MATLAB allow me to teach data analysis and visualization in a way that's more intuitive for students, making abstract scientific concepts easier to understand*."

The clear distinctions in tool preferences between the humanities and the sciences illustrate the necessity of tailoring ICT training to specific disciplinary needs. A humanities professor is unlikely to benefit from training that focuses on virtual lab simulations, just as a science professor may find little value in learning about digital storytelling platforms. These discipline-specific tools are crucial for engaging students and enhancing learning outcomes, making it essential for ICT training programs to offer customized content that reflects the distinct pedagogical and research requirements of each academic field.

These insights underscore the necessity for discipline-specific training modules that cater to the unique pedagogical and content-related demands of different academic fields. The data suggest that for ICT training programs to be more effective, they should be tailored not only to the technological skills that educators need but also to the specific ways those technologies are used within their disciplines. This finding supports the argument made by Koehler and Mishra (2009) regarding the importance of Technological Pedagogical Content Knowledge (TPACK), which emphasizes that effective integration of technology in teaching requires an understanding of the complex interplay between technology, pedagogy, and subject matter content.

Furthermore, the study's findings highlight the importance of continuous support and professional development in maintaining and advancing the gains made through initial ICT training. While the training programs increased confidence and skills in using digital tools, the lack of ongoing support, such as follow-up training sessions, peer mentoring, and access to up-to-date resources, was cited as a barrier to sustained ICT integration. This reflects broader findings in the literature that suggest professional development must be ongoing and responsive to changing technological and educational landscapes to be effective (Guskey, 2002).

Finally, the study raises important considerations for policymakers and educational leaders in Morocco. To close the gap in ICT competencies between well-funded and under-resourced institutions, there is a clear need for equitable distribution of resources and infrastructure improvements. Investment in modern ICT facilities and reliable internet connectivity, especially in less privileged areas, will be critical in ensuring that all professors have the opportunity to benefit from ICT training. Additionally, the development of a more differentiated approach to training that aligns with the specific needs of different academic disciplines could enhance the relevance and impact of these programs.

By addressing these disparities and customizing training to meet specific needs, Moroccan higher education institutions can better support their faculty in adopting and effectively using technology to enhance teaching and learning. This study contributes to the growing body of literature on ICT in education by providing a detailed

understanding of the contextual factors that influence the success of ICT training programs, suggesting a need for policies that are both inclusive and adaptive to local needs.

5.2 Implications for ICT Training Programs

1) **Customization and Specialization**: Training programs must be tailored to meet the distinct needs of various academic disciplines. For instance, humanities professors could benefit from training on digital archives, annotation tools, and social media platforms for academic dissemination, while science and engineering faculties may require training in virtual labs, simulations, and advanced data analysis software. This customized approach enhances the relevance of training and increases the likelihood of sustained ICT integration into teaching practices. By providing discipline-specific training, educators can see the immediate applicability of ICT tools, fostering engagement and long-term technology use in their instruction.
2) **Infrastructure and Support**: A critical challenge identified in this study is the disparity in infrastructure available across institutions. Even when professors are trained in advanced digital tools, their ability to apply these skills is often constrained by outdated technology, unreliable internet connections, and inadequate software. To address these barriers, universities must invest in upgrading their technological infrastructure, ensuring that all faculty members have access to high-speed internet, modern computers, and reliable hardware and software. Additionally, ongoing technical support is crucial for resolving issues quickly and maintaining momentum in ICT integration. Establishing IT support teams, online help desks, and peer networks can provide timely assistance and help educators troubleshoot problems effectively.
3) **Continuous Professional Development (CPD)**: ICT training should be viewed as an ongoing process rather than a one-time event. The rapid pace of technological advancement necessitates continuous professional development to keep educators up-to-date with new tools and methodologies. Institutions should offer regular workshops, online courses, and follow-up sessions that reinforce initial training and introduce emerging technologies like augmented reality (AR), artificial intelligence (AI), and virtual reality (VR). CPD should also be collaborative and interactive, fostering peer learning through mentoring, professional learning communities (PLCs), and interdisciplinary projects. By fostering a culture of continuous learning, institutions can ensure that educators remain at the forefront of innovation in teaching.
4) **Institutional Policies and Leadership Support**: The success of ICT integration also hinges on strong institutional policies and leadership commitment. Institutions must develop clear guidelines on the use of digital tools and platforms, ensuring data security, privacy, and ethical standards. Leadership should incentivize and reward faculty who excel in ICT integration, perhaps through innovation grants or including ICT competencies in promotion and tenure criteria.

Leadership support is essential in creating a culture that embraces technological experimentation and innovative teaching practices, allowing educators to explore new pedagogies confidently.

5) **Monitoring and Evaluation**: To ensure the success and longevity of ICT training programs, robust monitoring and evaluation mechanisms must be implemented. Regular assessments of both the immediate and long-term impact of training on teaching practices and student outcomes are crucial. Universities should gather feedback through surveys, interviews, and performance data to identify areas for improvement and adjust training programs accordingly. This continuous feedback loop allows institutions to refine their ICT strategies and ensure that educators are effectively utilizing digital tools in ways that improve teaching and learning.
6) **Integration of Emerging Technologies**: Universities and policymakers should encourage the exploration and integration of emerging technologies, such as AI, AR, VR, and learning analytics, into educational settings. These technologies offer exciting possibilities for creating immersive learning environments and providing personalized learning experiences. Training programs should introduce educators to these tools, providing hands-on experimentation opportunities and demonstrating their pedagogical applications. Pilot projects using these technologies could help assess their impact on teaching and learning outcomes, offering valuable insights to guide future investments in ICT infrastructure and training.
7) **Fostering a Culture of Innovation**: Universities should actively foster a culture of innovation by encouraging experimentation with new digital tools and teaching methods. This can be achieved by providing educators with the freedom and resources to pilot innovative projects, as well as recognizing and rewarding those who excel in ICT integration. Creating innovation hubs or centers for teaching and learning can offer collaborative spaces for educators to explore emerging technologies, share best practices, and develop cutting-edge pedagogies. Institutions that embrace innovation are better positioned to leverage technology to improve the quality of education and prepare students for a rapidly evolving digital world.

By addressing these key areas, ICT training programs can be more effectively designed to meet the evolving needs of educators and institutions. This will not only enhance the quality of teaching and learning in higher education but also equip professors with the skills needed to prepare students for the demands of the digital age.

These findings align with and contribute to the existing literature on the effectiveness of ICT in-service training for educators. Globally, numerous studies have documented the positive effects of ICT training on educators' digital competencies and teaching practices. Lawless and Pellegrino (2007) found that effective professional development programs significantly enhance teachers' abilities to integrate technology into their teaching, which is mirrored in the improvements in Moroccan professors' competencies reported in this study. Similarly, Ertmer and Ottenbreit-Leftwich (2010)

highlighted enhancements in teachers' tech skills post-training, reinforcing the positive impact observed among Moroccan university professors. Both studies emphasize that well-structured, comprehensive ICT training programs can lead to meaningful improvements in educators' ability to use technology effectively in their instruction.

Disparities in resource access and support are well-documented issues in ICT integration across educational institutions worldwide. Jimoyiannis and Komis (2007) emphasized how differences in institutional support can lead to uneven outcomes in ICT training effectiveness. This study's findings, which show more substantial improvements in well-funded universities compared to under-resourced institutions, reflect these global challenges. Tondeur *et al.* (2012) also found that institutional support is critical for the success of ICT training programs. Their research, which focused on the factors influencing technology integration in education, aligns with the disparities reported in the Moroccan context, where variations in infrastructure and administrative support significantly affect training outcomes.

The need for discipline-specific training is increasingly recognized in the literature. Koehler and Mishra's (2005) TPACK framework advocates for tailored training that considers the unique pedagogical and content-related demands of different academic fields. This study's findings, which reveal nuanced differences in training needs across disciplines, underscore the importance of designing ICT training that addresses these specific needs. For example, humanities professors expressed a preference for tools that support textual analysis and content creation, while science professors were more interested in virtual laboratories and simulation software. This need for customized training modules aligns with evaluations from the European Schoolnet Academy (2015), which suggest that discipline-specific training is more effective in enhancing teachers' ICT competencies. These evaluations show that when training is closely aligned with educators' specific content areas and instructional contexts, it results in greater confidence and competence in using ICT tools.

Similarly, the ISTE Standards for Educators (2017) stress the importance of ongoing learning and adapting digital tools to meet educational objectives. The data from this study reflect these standards, as many professors expressed a desire for continuous learning opportunities to enhance their digital literacy and pedagogical skills. The findings also echo challenges documented in other contexts, such as the need for institutional support and adequate resources for effective ICT integration. Ensuring that educators have access to ongoing professional development, updated digital resources, and a supportive learning environment is crucial for the long-term success of ICT initiatives in education.

However, this study also sheds light on unique challenges within the Moroccan context. The centralized nature of the education system in Morocco often means that policies and training programs are not tailored to the diverse needs of different universities. For example, while some institutions have embraced digital transformation and have the necessary resources to support ICT integration, others lag behind due to limited funding and inadequate infrastructure. Another notable challenge is the country's linguistic diversity, with professors and students often working in Arabic, French, and

English. This linguistic plurality complicates the development and delivery of ICT training programs, as many digital tools and resources are primarily available in English, while most instruction in public universities is conducted in Arabic or French. This language barrier can limit the accessibility of training materials and digital resources, especially for professors who are less proficient in English.

This disparity highlights the need for localized research and policymaking that take into account the specific socio-economic, linguistic, and cultural contexts of Moroccan universities. Addressing these challenges requires a more decentralized approach to policy implementation, allowing institutions the flexibility to adapt ICT training and support to their specific needs. This could involve creating region-specific policies that account for local constraints and opportunities, ensuring a more equitable and effective deployment of ICT resources across the country. Additionally, developing ICT training programs in multiple languages and adapting tools for local linguistic contexts would enhance accessibility and effectiveness.

By examining the broader context and comparing findings with existing literature, this study not only reinforces established knowledge but also contributes new insights into the complex dynamics of ICT integration in Moroccan higher education. The results suggest that while global best practices provide a valuable framework, there is a need for localized strategies that consider the unique challenges and opportunities present in different educational settings.

6. Limitations and Future Research Directions

While this study provides valuable insights into the effectiveness of ICT in-service training programs for university professors across Morocco, several limitations must be acknowledged. Firstly, the focus on Morocco as a whole may limit the generalizability of the findings to other regions within the country or to similar countries with different educational contexts, resources, and technological infrastructures. Although the study covers a broad range of universities, differences in regional educational policies, access to technology, and faculty preparedness may influence the applicability of the results to other settings.

Additionally, the reliance on self-reported data from questionnaires and interviews could introduce bias, as participants may overestimate or underestimate their competencies and experiences. Self-reported measures are subject to social desirability bias, where respondents may provide answers, they believe are more acceptable or favorable. This bias can affect the accuracy of the findings related to professors' perceived improvements in digital competencies and the effectiveness of the ICT training programs. Future research should explore ICT training across a more diverse set of Moroccan universities, including those in rural and less-resourced areas, to capture a broader spectrum of experiences and challenges. This would provide a more comprehensive understanding of the barriers and enablers of effective ICT integration across different educational environments. Additionally, longitudinal studies are needed to assess the long-term impact of these training programs on teaching practices and student outcomes.

Such studies would help determine whether the improvements in digital competencies observed immediately after training are sustained over time and translated into meaningful changes in pedagogical practices.

Moreover, there is a growing need to explore the integration of emerging technologies, such as artificial intelligence (AI) and virtual reality (VR), in educational settings. As digitalization in education continues to evolve, understanding how these advanced technologies can be harnessed to enhance learning experiences will be crucial. Future studies could investigate the potential of AI-driven adaptive learning platforms to personalize training for educators or the use of VR to simulate classroom scenarios for professional development. These innovative approaches could offer new pathways for enhancing ICT training and supporting educators in the digital age.

By addressing these limitations and exploring new areas of research, future studies can build on the findings of this study to develop more effective, inclusive, and sustainable ICT training programs for educators in Morocco and beyond.

7. Conclusion

This study provides a broad evaluation of the effectiveness of ICT in-service training for university professors in Morocco, offering valuable insights into the current state of ICT adoption and the challenges faced by educators. The findings highlight a significant variation in training experiences, with a clear need for more practical, hands-on sessions that align closely with the specific technological environments and pedagogical needs of professors. The study underscores the importance of personalized training programs that consider the diverse disciplinary backgrounds and institutional contexts of participants. Moreover, the results indicate that while many professors recognize the potential benefits of ICT in enhancing teaching and learning, several barriers—such as inadequate infrastructure, lack of institutional support, and insufficient follow-up—hamper effective integration. These challenges are consistent with the broader literature on ICT adoption in education, reinforcing the need for comprehensive and continuous professional development initiatives.

The implications of this study are deemed significant for policymakers, educational administrators, and curriculum designers. To enhance the effectiveness of ICT training programs, it is crucial to move beyond generic workshops and provide specialized, context-specific training that addresses the actual technologies and platforms used in classrooms. Additionally, there is a need for ongoing support systems, including technical assistance and peer learning opportunities, to foster a sustainable culture of ICT integration in higher education.

Conflict of Interest Statement

The author declares that there are no conflicts of interest related to the publication of this article. All opinions, analyses, and conclusions presented in this research are solely those of the author and do not reflect any funding sources, or external influences. The author

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Bibliography

Adeoye, Y. M., Oluwole, A. F., & Blessing, L. A. (2013). Appraising the Role of Information Communication Technology (ICT) as a Change Agent for Higher Education in Nigeria. *International Journal of Educational Administration and Policy Studies*, *5*(8), 177-183. Retrieved from https://www.researchgate.net/publication/369107652_APPRAISING_THE_ROLES_OF_INFORMATION_AND_COMMUNICATION_TECHNOLOGY_ICT_AS_A_CHANGE_AGENT_FOR_UNIVERSITY_LIBRARIES_IN_KWARA_STATE_NIGERIA

Baser, D., Kopcha, T. J., & Ozden, M. Y. (2015). Developing a technological pedagogical content knowledge (TPACK) assessment for preservice teachers learning to teach English as a foreign language. *Computer Assisted Language Learning*, *29*(4), 749–764. https://doi.org/10.1080/09588221.2015.1047456

Bose, S., & Sharma, H. (2023). Public Spending on School Education in Delhi: The Gaps that Covid-19 Highlights. Retrieved from http://nceindia.org.in/wp-content/uploads/2023/03/Public-Spending-Delhi.pdf

Bouziane, A. (2019). *ELT issues in Morocco: a research-based perspective*. Moroccan Association of Teachers of English. Retrieved from https://www.researchgate.net/publication/336832520_ELT_Issues_in_Morocco_A_Research-based_Perspective

Ching Sing Chai, Joyce Hwee Ling Koh, & Chin-Chung Tsai. (2013). A Review of Technological Pedagogical Content Knowledge. *Journal of Educational Technology & Society*, *16*(2), 31–51. http://www.jstor.org/stable/jeductechsoci.16.2.31

Conseil Supérieur de l'Éducation, de la Formation et de la Recherche Scientifique. (2019). Cadre de performance 2019. *CSEFRS*. https://www.csefrs.ma/wp-content/uploads/2019/10/Cadre-de-performance-2019-FR-web.pdf

Conseil Supérieur de l'Éducation, de la Formation et de la Recherche Scientifique. (2021). L'enseignement au temps de COVID-19: Enjeux et défis. *CSEFRS*. https://www.csefrs.ma/wp-content/uploads/2021/11/Rapport-Enseignement-au-temps-de-COVID.pdf

El Ferouali, S., & Ouhadi, S. (2023). *Digital transformation in Moroccan higher education: A literature review*. *African Journal of Management and Educational Technologies*, *8*(1), 1-15. https://revues.imist.ma/index.php/AJMET/article/view/44921/24599

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255-284. https://doi.org/10.1080/15391523.2010.10782551

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. John Wiley & Sons. Retrieved from https://www.wiley.com/en-sg/Blended+Learning+in+Higher+Education%3A+Framework%2C+Principles%2C+and+Guidelines-p-9781118269558

Inan, F. A., & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Educational Technology Research and Development, 58*(2), 137-154. https://doi.org/10.1007/s11423-009-9132-y

ISTE. (2017). *ISTE standards for educators.* International Society for Technology in Education. https://www.iste.org/standards/for-educators

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: Implications of a teacher preparation programme. *Teacher Development, 11*(2), 149-173. https://doi.org/10.1080/13664530701414779

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2020). *Horizon report: 2020 higher education edition.* EDUCAUSE. Retrieved from https://library.educause.edu/resources/2020/3/2020-educause-horizon-report-teaching-and-learning-edition

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131-152. https://doi.org/10.2190/0EW7-01WB-BKHL-QDYV

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70. https://citejournal.org/volume-9/issue-1-09/general/what-is-technological-pedagogical-content-knowledge

Laabidi, Y., & Laabidi, H. (2016). Barriers affecting successful integration of ICT in Moroccan universities. Journal of English Language Teaching and Linguistics, 1(3), 203-214. DOI: http://dx.doi.org/10.21462/jeltl.v1i3.29

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614. https://doi.org/10.3102/0034654307309921

Oroma, J. O., Kiden, S., Maghendha, M. W., & Ntiyani, S. (2013, May). Perspectives on underutilisation of ICT in education in Tanzania, Uganda and Kenya. In *2013 IST-Africa Conference & Exhibition* (pp. 1-11). IEEE. Retrieved from https://www.researchgate.net/publication/261054832_Perspectives_on_underutilisation_of_ICT_in_education_in_Tanzania_Uganda_and_Kenya

Ouatik, A., Riyami, B., Mansouri, K., & Qbadou, M. (2019). Towards ICT integration in higher education in Morocco: Challenges and opportunities. In *2019 1st International Conference on Smart Systems and Data Science (ICSSD)* (pp. 1-4). IEEE. https://doi.org/10.1109/ICSSD47982.2019.9003069

Romrell, D., Kidder, L., & Wood, E. (2014). The SAMR model as a framework for evaluating mLearning. *Online Learning Journal*, *18*(2). https://doi.org/10.24059/olj.v18i2.435

Selwyn, N. (2012). Education in a Digital World: Global Perspectives on Technology and Education (1st ed.). Routledge. https://doi.org/10.4324/9780203108178

Tondeur, J., van Braak, J., Ertmer, P.A. *et al.* Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Education Tech Research Dev* 65, 555–575 (2017). https://doi.org/10.1007/s11423-016-9481-2

UNESCO. (2011). *ICT competency framework for teachers.* Paris: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000213475

UNESCO. (2018). *ICT competency framework for teachers.* Paris: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000265721

UNESCO. (2021). *ICT in education: A global overview.* Paris: UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000377157

Unwin, T. (2005). Towards a framework for the use of ICT in teacher training in Africa. *Open Learning: The Journal of Open, Distance and e-Learning*, *20*(2), 113–129. https://doi.org/10.1080/02680510500094124

Voogt, J. M., Knezek, G. A., Cox, M. J., Knezek, D., & Brummelhuis, A. T. (2013). Under which conditions does ICT have a positive effect on teaching and learning? A Call to Action. *J. Comput. Assist. Learn., 29*, 4-14. https://doi.org/10.1111/j.1365-2729.2011.00453.x

Wenger, E. (1999). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press. Retrieved from https://www.cambridge.org/highereducation/books/communities-of-practice/724C22A03B12D11DFC345EEF0AD3F22A#overview