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The Impact of Professional Development Needs on Teachers' Use of Assistive Technology in Jordanian Special Education Classrooms: Moderating Effects of Age, Education, and Teaching Experience

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Abstract

The effective use of assistive technology (AT) in special education depends largely on teachers' preparedness and opportunities for professional development (PD). Although PD is intended to enhance teachers' knowledge and skills, its translation into actual classroom practice remains inconsistent, particularly within the Jordanian context. This study investigates the impact of teachers' professional development needs on their level of AT use in Jordanian special education classrooms and examines whether age, level of education, and years of teaching experience moderate this relationship. Grounded in the Levels of Use (LoU) dimension of the Concern-Based Adoption Model (CBAM), the study employed a quantitative, cross-sectional survey of 374 special education teachers selected through purposive sampling. Structural equation modeling was used to test the direct and moderate effects. Results revealed a significant positive relationship between professional development needs and teachers' level of AT use ($\beta = 0.194$, $p < 0.001$), indicating that unmet PD needs strongly predict increased implementation efforts. Moderation findings showed that age, education level, and teaching experience each shaped how PD needs influenced AT use, with significant effects emerging among younger and older teachers, bachelor's and master's degree holders, and teachers with low or high experience. These results highlight the importance of differentiated and context-responsive PD programs rather than uniform training approaches. The study provides evidence to guide policymakers, school leaders, and PD designers in developing targeted strategies that improve AT adoption and support equitable learning opportunities for students with disabilities in Jordan.

Keywords: Professional Development, Teachers' Use of Assistive Technology, Special Education Classrooms, Jordanian, Levels of Use (LoU), Concern-Based Adoption Model (CBAM)

INTRODUCTION

The adoption of assistive technology (AT) in special education classrooms has become increasingly essential for supporting students with diverse learning needs [1]. Successful AT adoption depends not only on the availability of tools but also on teachers' preparedness, confidence, and ability to integrate these tools into instructional practices [2]. Professional development (PD) is therefore central to equipping teachers with the necessary knowledge and pedagogical competencies for meaningful AT use. However, existing research shows that PD does not consistently translate into actual classroom adoption, suggesting that additional factors influence teachers' ability to utilize AT effectively [3].

A growing body of literature indicates that teacher demographic characteristics such as age, educational background, and years of teaching experience may shape how teachers interpret and apply PD content [2]. For instance, younger teachers are often more comfortable adapting to new technologies, whereas more experienced teachers may rely on established instructional routines that influence their willingness to adopt innovations. Similarly, higher levels of education may enhance teachers' readiness and confidence in implementing AT [4]. These demographic variables may therefore moderate the relationship between teachers' PD needs and their level of AT adoption, either enhancing or diminishing the impact of PD on practice [5].

In Jordan, efforts to strengthen AT adoption in special education face persistent challenges, including limited training opportunities, variable teacher readiness, and inconsistent technology integration across schools [6]. Despite these challenges, few empirical studies have examined how teacher demographics shape the link between PD needs and AT adoption within the Jordanian context [7]. Addressing this gap is critical for designing targeted, effective training initiatives that respond to teachers' diverse backgrounds. Therefore, this study investigates the influence of teachers' professional development needs on their level of AT adoption, while examining the moderating effects of age, education level, and teaching experience [7].

Understanding these moderating effects offers practical value for policymakers, school leaders, and professional development planners. Identifying which demographic characteristics strengthen or weaken the influence of PD needs can support the development of differentiated evidence-based training programs rather than one-size-fits-all models [8]. Such targeted strategies can improve the effectiveness of AT initiatives, promote equitable access to technology-supported learning, and ultimately enhance educational outcomes for students with disabilities in Jordanian special education settings.

The Concerns-Based Adoption Model (CBAM) has long been recognized as an effective framework for identifying teachers' needs, assessing their concerns, and supporting the successful adoption of educational innovations [9]. Although the model has been implemented widely across global educational contexts, its application within Jordan remains limited. Existing work in the Jordanian context is restricted to a single study by Matar [7], which examined faculty members' stages of concern toward e-learning adoption. However, this study did not extend its investigation to professional development needs, levels of use, or the moderating influence of demographic variables elements that are essential for understanding technology adoption in real classroom settings, particularly in special education.

In addition, research on professional development highlights several limitations. While training programs often identify the skills teachers need, they frequently overlook teachers' evolving concerns and their actual level of use during the adoption process [10]. Scholars emphasize that professional development must be continuous, purposeful, and practice-oriented, incorporating mentoring and classroom-based applications to truly meet teachers' needs [5]. Few studies integrate teachers' professional development needs with their Level of Use (LoU), which represents how training translates into authentic instructional practice [11]. This gap is particularly pronounced in the field of special education in Jordan, where research on assistive technology use, teacher readiness, and practical implementation remains scarce.

Furthermore, demographic influences such as age, education level, and years of teaching experience have produced inconsistent findings in prior research on technology adoption [12-15], underscoring the need for context-specific investigation. A comprehensive examination that connects professional development needs, levels of use, and demographic moderating effects is therefore critical for understanding how special education teachers adopt assistive technology within the Jordanian educational context.

Guided by these gaps, the present study formulates two key research objectives. The first objective is to examine the relationship between teachers' professional development needs and their level of use of assistive technology in special education classrooms. The second objective is to explore whether demographic characteristics specifically age, level of education, and years of teaching experience moderate this relationship. Together, these objectives respond directly to the identified gaps and contribute to a more holistic understanding of assistive technology adoption among special education teachers in Jordan.

The successful adoption of assistive technology in special education extends beyond the provision of devices and resources; it critically depends on teachers' readiness, their professional development needs, and the extent to which they apply technology in their instructional practices. When teachers do not receive training that aligns with their actual needs, their capacity to meaningfully integrate assistive technology remains limited, ultimately affecting the quality of support provided to students with disabilities.

This study is significant because it focuses on two essential but understudied dimensions within the Jordanian special education context: teachers' professional development needs and their level of use of assistive technology. By examining these variables concurrently, the study provides a comprehensive understanding of how training demands translate into actual classroom practice. Furthermore, the study incorporates the moderating effects of demographic characteristics specifically age, level of education, and years of teaching experience-to explore how differences among teachers shape the relationship between professional development needs and technology use. Previous research has reported inconsistent findings regarding demographic influences on technology adoption [16, 17], reinforcing the importance of conducting a context-specific investigation in Jordan.

By addressing these gaps, the study contributes to new empirical insights that can support decision-makers in designing targeted professional development programs. Such evidence can inform more responsive training strategies, improve technology integration policies, and enhance the overall effectiveness of assistive technology use in special education classrooms.

LITERATURE REVIEW

Professional Development Needs

Professional development (PD) is a critical factor influencing the successful adoption of educational innovations and serves as a cornerstone for teacher growth and improvement [5]. It encompasses activities aimed at enhancing educators' knowledge, skills, and attitudes to improve student outcomes [18]. Evidence shows that differences in student achievement are closely linked to the quality of professional development teachers receive, highlighting its essential role in effective classroom practice [2].

Effective professional development extends beyond workshops or seminars, requiring structured, sustained, and contextually relevant programs that address teachers' instructional needs and facilitate the use of new teaching strategies [19, 20]. Mentoring, coaching, collaborative training, and reflective planning are key components that enhance pedagogical knowledge and professional growth [21-24]. Teachers are more likely to engage in PD when it aligns with their professional goals, improves subject knowledge, classroom management, or technology use, and accommodates their time and workload realities [16, 25].

Teachers' professional development needs are also shaped by broader social and contextual factors, including cultural shifts, technological advancements, and family structures that affect student learning [4]. Positive motivators for PD participation include the desire for improved teaching effectiveness, lifelong learning, peer influence, and administrative support.

Barriers to Professional Development:

Despite its importance, teachers face multiple barriers to participating in professional development. Technical barriers include limited teaching skills, reliance on textbooks, and inadequate exposure to technology [2, 5, 20]. Political barriers arise from a lack of support from school leadership, while cultural barriers relate to teachers' beliefs, attitudes, or prior experiences with PD [25]. Time constraints and financial limitations are also consistently reported as significant impediments to engagement [1, 11, 26-29]

These barriers can prevent teachers from accessing training that meets their professional development needs, limiting their readiness to adopt new educational innovations and integrating assistive technologies in classrooms [4]. Addressing these challenges through contextually relevant, sustained, and well-supported PD programs is essential for enhancing teacher competence, confidence, and ultimately, student learning outcomes [30, 31].

Level of Use (LoU) in the Concern-Based Adoption Model (CBAM)

The Concern-Based Adoption Model (CBAM) offers a structured framework for understanding how teachers adopt and implement educational innovations. The model consists of three interrelated diagnostic dimensions: Stages of Concern, Innovation Configuration, and Levels of Use which work together to explain teachers' perceptions, behaviors, and progression during the change process [32]. The Stages of Concern focus on teachers' feelings and needs as they encounter an innovation, while Innovation Configuration identifies the various ways an innovation can be implemented and clarifies what constitutes ideal versus acceptable practice [1, 33-36]. Together, these two dimensions provide insight into teachers' readiness and the types of support they require.

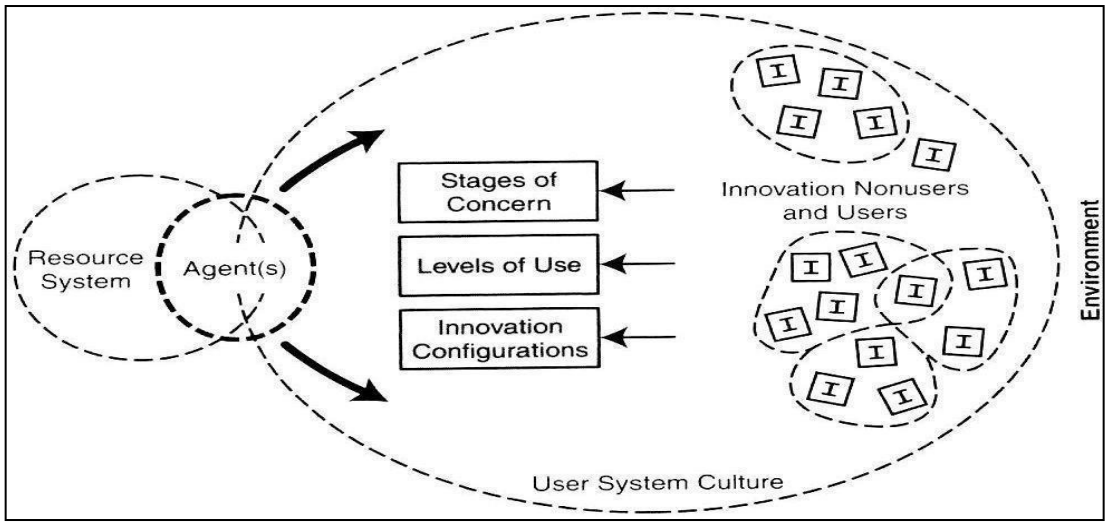

Figure 1: The Environment's Three Diagnostic Dimensions (Hall & Hord, 2010, p. 72)

The Levels of Use (LoU), the behavioral dimension of CBAM, offer the most direct method for assessing how teachers actually engage with an innovation in practice. The LoU distinguishes between non-users including Non-Use, Orientation, and Preparation-and users, who progress through Mechanical, Routine, Refinement, Integration, and Renewal levels [37]. This continuum captures teachers' real-world behaviors, ranging from minimal awareness to highly sophisticated, reflective, and collaborative use of innovation. In the context of assistive technology (AT), LoU provides a practical lens for determining whether teachers simply know about AT, are attempting to use it mechanically, have routinized its use, or are continuously refining and integrating it to meet diverse learner needs.

Previous research has shown that many teachers remain at the lower levels of use due to limited training, uncertainty, or lack of hands-on experience, while progression to higher levels requires sustained professional development, ongoing guidance, and structured opportunities for practice [2, 16]. Thus, the LoU framework is particularly relevant for evaluating AT adoption, as it highlights not only the presence or absence of use but the quality, depth, and sustainability of teachers' engagement. By focusing on behavioral indicators rather than intentions alone, the Levels of Use provide a comprehensive understanding of teachers' implementation of assistive technology and the factors that facilitate or hinder their progression along the adoption continuum.

Table 1: Level of Use of Innovation (LoU)

L	Levels of Use		Behaviors Associated with Level of Use
Non-Use	0.	Non-Use	No interest shown in innovation; no action taken
	1.	Orientation	Begins to gather information about the innovation
	2.	Preparation	Begins to plan ways to implement the innovation
Users	3.	Mechanical	Concerned about mechanics of implementation
	4A.	Routine	Comfortable will innovation and implements it as taught
	4.	Refinement	Begins to explore ways for continuous improvement
	5.	Integration	Integrates innovation with other initiatives; does not view it as an add-on; collaborates with others.
	6.	Renewal	Explores new and different ways to implement innovation

THE RELATIONSHIP BETWEEN PROFESSIONAL DEVELOPMENT AND LEVELS OF TECHNOLOGY USE

Professional development (PD) has been widely recognized as a critical driver in advancing teachers' engagement with innovations and facilitating higher levels of use in the classroom. Several studies indicate that when PD programs are aligned with teachers' specific needs, teachers are more likely to move from non-use or lower levels of use toward higher, more sophisticated stages of implementation [32, 38]. Schaaf [2] emphasized that ESE teachers often begin at the lower stages of use due to gaps in knowledge and confidence with assistive technology (AT), but targeted PD programs that include hands-on practice, problem-solving, and opportunities to analyze different AT options enable teachers to progress to the Mechanical, Routine, and Refinement stages. These studies underscore that PD is not just about exposure but about equipping teachers with the skills and strategies needed for meaningful integration.

Inquiry-based and practice-oriented PD approaches have also been shown to influence LoU. Hollins [17] reported that teachers who participated in a year-long inquiry-based PD program developed AT competencies while exploring accessible aspects of the curriculum, moving beyond initial experimentation toward integration in daily instruction. Similarly, Wittmann and Olivier [39] demonstrated that PD programs combining adult learning principles with practical classroom applications helped teachers progress from Orientation and Preparation stages to Routine and Refinement stages. These findings highlight that PD programs designed to meet teacher needs for both content knowledge and pedagogical strategies directly impact their ability to implement innovations consistently and effectively. Furthermore, empirical evidence suggests that PD reduces barriers and fosters confidence, which are key determinants of higher levels of use. Lamond, Caccese [40], Almethen [41] found that teachers who received comprehensive training in AT, including face-to-face workshops and coaching, reported higher LoU because the training addressed knowledge gaps, practical challenges, and individual learning preferences. Similarly, Matar [7], Dodge and Karam [42] showed that when PD addresses teachers' specific concerns-ranging from personal efficacy to classroom management teachers are more likely to move toward the Integration and Renewal stages of use. Overall, literature consistently demonstrates a strong relationship: well-structured, need-based professional development not only enhances teachers' knowledge and skills but also facilitates their progression through the Levels of Use, ultimately promoting more effective and sustainable adoption of educational innovations [43].

- **H1:** There is a significant relationship between professional development needs and teachers' level of use of assistive technology in Jordanian special education classrooms.

DEMOGRAPHIC VARIABLES AS MODERATORS

Demographic variables, including age, level of education, and years of teaching experience, are often considered potential moderators in educational research. Moderators are variables that can influence the strength or direction of the relationship between independent and dependent variables [44]. In the context of professional development and technology adoption, demographic characteristics may shape teachers' concerns, perceptions, and levels of use (LoU) of innovations such as assistive technology [45]. While some studies reported no relationship between demographic variables and teachers' concerns [32, 46], others indicated that age, level of education, and teaching experience might influence how teachers adopt innovations and engage in professional development [4, 47].

The Moderation Effect of Age

The effect of age on teachers' adoption of technology and innovations is inconsistent across studies. Adams, Bondy [48] noted that younger faculty with less experience showed higher levels of technology integration and fewer concerns regarding adoption. Petherbridge [49] similarly found that older faculty displayed lower anxiety and less interest in learning new educational technologies. In contrast, Hao and Lee [50], Kar [51] reported no significant relationship between age and the adoption of e-learning or blended learning systems. These mixed findings suggest that age may influence teacher adoption in certain contexts, but it is not a consistent predictor across all educational settings.

- **H2:** Age moderates the relationship between professional development needs and teachers' level of use of assistive technology in Jordanian special education classrooms.

The Moderation Effect of Level of Education

Teachers' level of education has generally shown minimal impact on innovation adoption and concerns. Studies by Asiri [52], Gudyanga and Jita [53], Al-Shammari [54] found no statistically significant differences between teachers with different educational qualifications. Nevertheless, more educated teachers sometimes exhibited fewer concerns when seeking information about innovations or making instructional decisions. This indicates that the level of education may have a subtle, context-specific moderating effect rather than a universal influence.

- **H3:** Level of education moderates the relationship between professional development needs and teachers' level of use of assistive technology in Jordanian special education classrooms.

The Moderation Effect of Years of Teaching Experience

The role of teaching experience as a moderator has yielded mixed results. Petherbridge [49], Orr and Simmons [55] reported that teachers with more years of experience tended to have lower unrelated concerns and were more ready to adopt innovations. Conversely, studies by Asiri [52], Walker [56] found no significant impact of teaching experience on adoption of blended learning or technology integration. Other research suggested that experienced teachers might either be slower to adopt innovations due to reliance on traditional methods or more confident in using ICT [55, 57]. Overall, teaching experience appears to have a complex and context-dependent moderating effect on teachers' professional development and technology adoption.

- **H4:** Years of teaching experience moderate the relationship between professional development needs and teachers' level of use of assistive technology in Jordanian special education classrooms.

RESEARCH FRAMEWORK

A conceptual framework was developed to clarify the relationships among the variables examined in this study, as illustrated in Figure 2. The framework emphasizes the direct relationship between teachers' professional development needs and their level of use of assistive technology in special education classrooms. In addition, it incorporates the moderating influence of key demographic factors, namely age, level of education, and years of teaching experience on this relationship. Within the diagram, straight lines represent the direct effects, whereas dashed lines illustrate the moderating pathways. By integrating the Level of Use dimension of the CBAM model with demographic moderators, the framework offers a

comprehensive and systematic perspective on the factors that shape teachers' adoption and effective utilization of assistive technology in Jordanian special education settings.

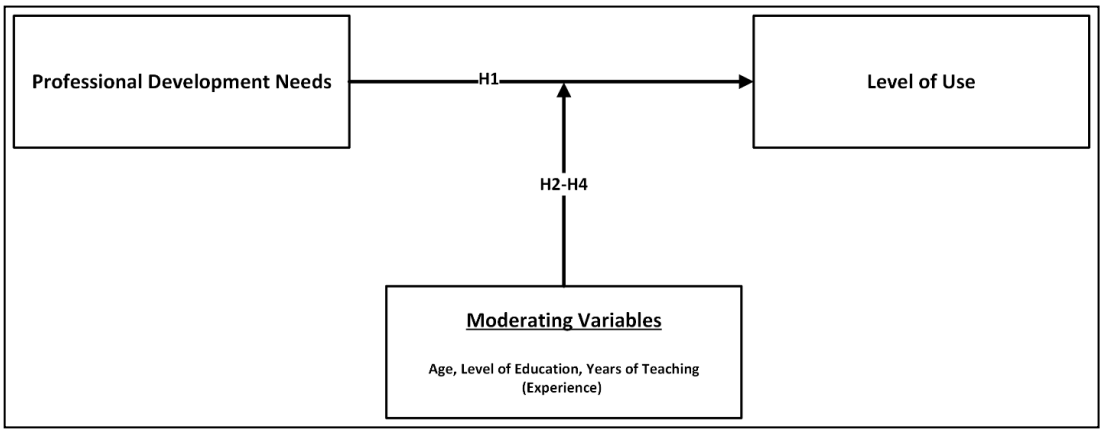

Figure 2: Research Framework

METHODOLOGY

This study employed a quantitative, correlational research design using a cross-sectional survey approach. The purpose was to examine the direct relationship between professional development needs (independent variable) and the level of use of assistive technology among teachers (dependent variable), while also assessing the moderating effects of demographic variables specifically age, educational level, and years of teaching experience.

The study was conducted across public schools in Jordan, which collectively employ approximately 875 special education teachers (Ministry of Education, 2021). Teachers in these settings typically hold qualifications ranging from bachelor's to doctoral degrees in special education or closely related fields [6]. The target population for this study consisted of all special education teachers working in Jordanian public schools. Key characteristics considered in defining the population included teachers' age, academic qualifications, teaching experience, current engagement with assistive technology, and willingness to participate in professional development initiatives.

A purposive (homogeneous) sampling technique was adopted to ensure the selection of participants with meaningful exposure to assistive technology. Participants were required to (i) be actively employed as special education teachers, (ii) currently use or intend to adopt assistive technology in their instructional practices, and (iii) be willing to engage in professional development programs related to technology adoption. This sampling approach ensured that respondents possessed the specific knowledge and experience needed to address the research objectives effectively [58-61].

The sample size was estimated in accordance with SEM's general guidelines, which recommend a minimum of 200 participants to achieve stable and reliable results [62-65]. In addition, the required sample size was calculated using Cochran's formula (1977) to ensure adequate statistical power and representativeness [26, 27, 64, 65]. Based on these combined considerations, the final sample size was set at 374 participants, allowing for potential non-responses and ensuring robustness for SEM analysis.

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Data was collected using a structured questionnaire comprising measures of teachers' professional development needs, level of use of assistive technology, and relevant demographic characteristics. Both descriptive and inferential statistical analyses were employed. SEM was used to examine the direct effect of professional development needs on the level of use of assistive technology, while moderation analysis was performed to determine whether age, educational level, and teaching experience influenced these relationships.

FINDINGS OF THE STUDY

Demographic Profiles of the Respondents

Table 2 presents the demographic characteristics of the 374 respondents, including their age, gender, educational qualifications, and years of teaching experience.

Table 2: Descriptive Statistics of Respondents

Age		
Categories	**Frequency (n)**	**Percent (%)**
22-29	67	17.9%
30-39	171	45.7%
40 and above	136	36.4%
Total	**374**	**100%**
Level of Education		
Categories	**Frequency (n)**	**Percent (%)**
Bachelor	193	51.6%
Master	94	25.1%
Doctoral	87	23.3%
Total	**374**	**100%**
Years of Teaching Experience		
Categories	**Frequency (n)**	**Percent (%)**
1-9	176	47.1%
10-19	157	42.0%
20 and above	41	11.0%
Total	**374**	**100%**

Results of Direct and Indirect Relationship (Moderation)

As shown in Table 3, the path coefficient analysis revealed a strong positive relationship between professional development needs and the level of use of assistive technology in special education classrooms ($\beta = 0.194$, $t = 5.536$, $p < 0.001$). This indicates that teachers with higher professional development needs are more likely to demonstrate increased use of assistive technology in their teaching practices. The magnitude of the t-statistic and the extremely low p-value highlight the robustness and statistical significance of this relationship, emphasizing that addressing teachers' professional development requirements is closely linked to greater engagement and effective integration of assistive technology in special needs education.

Table 3: Significance of Path Coefficient

Path	Bata (β)	T Value	P Value
Professional Development Needs -> Level of Use	0.194	5.536	**0.000**

The results in Table 4 demonstrate the moderating effects of age, educational level, and teaching experience on the relationship between professional development needs and teachers' level of use of assistive technology. The findings show that age moderated the relationship, with the strength and significance of the association differing across age groups; younger and older teachers showed significant positive effects, whereas the middle age group did not. Likewise, the level of education also served as a significant moderator, as teachers with bachelor's and master's degrees demonstrated significant relationships between professional development needs and level of use, while the relationship was not significant among doctoral degree holders. Furthermore, years of teaching experience moderated the relationship with teachers in lower and higher experience categories showing significant effects, whereas those in the mid-experience range did not. Collectively, these results highlight that demographic characteristics shape how professional development translates into actual practice, reinforcing the importance of designing differentiated and targeted professional development programs for special education teachers.

Table 4: Moderation Results for the Relationship Between Professional Development Needs and Level of Use of Assistive Technology

Moderator	Categories	Path	Bata (β)	P-value
Age	22–29	PD→ LoU	0.229	0.007
	30–39	PD→ LoU	0.052	0.599
	40 and above	PD→ LoU	0.181	0.016
Education Level	Bachelor	PD→ LoU	0.145	0.034
	Master	PD→ LoU	0.259	0.010
	PhD	PD→ LoU	0.007	0.950
Years of Experience	1–9	PD→ LoU	0.154	0.018
	10-19	PD→ LoU	0.086	0.329
	20 and above	PD→ LoU	0.328	0.002

The study revealed a significant positive relationship between teachers' professional development needs and their level of use of assistive technology (AT) in special needs education. This indicates that teachers who report greater professional development needs are more likely to engage with and integrate AT into their teaching practices. The results highlight the importance of addressing teachers' training and support requirements to enhance effective technology adoption.

According to the findings, educators face several challenges in implementing AT, primarily related to professional development needs. These challenges include insufficient training and competency, technological barriers, resource and funding constraints, and knowledge gaps regarding available AT solutions. Limited access to necessary hardware, inadequate technical support, and issues with hardware and software compatibility were identified as significant obstacles, which can hinder the effective integration of AT in classrooms.

Regarding the moderating role of demographic variables, multi-group analysis demonstrated that age, level of education, and years of teaching experience significantly influenced the strength of the relationship between professional development needs and AT use. Specifically, the relationship was statistically significant for teachers aged 22–29 and those aged 40 and above, but not for teachers aged 30–39. For educational attainment, teachers with bachelor's

and master's degrees showed a significant relationship, whereas teachers holding a PhD did not. Similarly, teachers with 1–9 years and 20 or more years of teaching experience exhibited a significant positive relationship, while those with 10–19 years of experience did not. Gender was not a significant moderator, as the strength and significance of the relationship were consistent across male and female teachers.

These findings suggest that professional development programs and interventions should be tailored to teachers' age, educational background, and teaching experience to maximize the effectiveness of AT use. Addressing barriers related to training, resources, and technological support is essential to ensure that teachers can successfully translate professional development into practical classroom applications. Overall, while professional development needs are universally important, their impact on technology adoption is influenced by certain demographic characteristics and contextual challenges, emphasizing the need for targeted, supportive, and resource-informed interventions.

CONCLUSION AND IMPLICATIONS OF THE STUDY

This study provides valuable insights into the adoption and use of assistive technology (AT) in Jordanian special education classrooms. The findings reveal a significant positive relationship between teachers' professional development needs and their level of AT use, indicating that teachers with greater training and support requirements are more likely to integrate technology into their teaching. The study also identifies challenges that hinder AT implementation, including lack of training and competency, technological barriers such as hardware and software compatibility issues, limited resources and funding, insufficient technical support, and knowledge gaps about available AT solutions. These findings highlight the importance of providing targeted professional development and adequate resources to facilitate effective technology adoption.

Demographic variables were found to moderate the relationship between professional development needs and AT use. Age, educational level, and years of teaching experience influenced the strength of this relationship, with teachers aged 22–29 and 40 and above, those with bachelor's and master's degrees, and those with 1–9 or 20+ years of experience showing a significant positive association. In contrast, teachers aged 30–39, those holding PhDs, and teachers with 10–19 years of experience did not demonstrate significant relationships, while gender was not a significant moderator. These results suggest that professional development programs should be tailored to teachers' demographic characteristics, emphasizing context-specific and differentiated approaches to maximize the impact of training on AT use.

The study has important theoretical and practical implications. It validates the Concerns- Based Adoption Model (CBAM) as an effective framework for examining technology adoption in special education and reinforces the role of professional development in fostering readiness and competence. Practically, the findings emphasize the need for structured, hands-on, and collaborative training programs, enhanced access to resources and technical support, and mentorship opportunities that account for teachers' age, experience, and educational background. By addressing these factors, educational institutions can promote inclusive, technology-enhanced learning environments that improve teaching practices and educational outcomes for students with special needs.

LIMITATIONS AND SCOPE FOR FUTURE WORK

This study has several limitations that should be acknowledged. First, its cross-sectional design restricts data collection to a single point in time, limiting the ability to capture changes in teachers' professional development needs and technology use over time. Second, the exclusive use of quantitative methods, specifically self-administered questionnaires, may not fully capture the nuances of teachers' experiences, perceptions, and classroom practices. Third, the focus on public schools in Jordan constrains the generalizability of the findings, as private or international schools may differ in resources, governance, and teacher characteristics. Additionally, reliance on self-reported data introduces potential biases, such as social desirability and recall inaccuracies, which could affect the accuracy of the results.

Future research should adopt longitudinal or mixed method approaches to provide a more comprehensive understanding of how teachers' professional development needs and levels of AT use evolve over time. Expanding the study to include private schools, international schools, and diverse educational contexts would enhance generalizability and offer insights into different implementation environments. Investigating the perspectives of students and parents regarding AT use can provide a more holistic, student-centered understanding of its impact on learning and engagement.

Furthermore, intervention studies assessing the effectiveness of professional development programs, mentorship initiatives, and collaborative learning opportunities are recommended. Future studies should also explore the influence of resource allocation, technological infrastructure, and support systems on AT adoption. By addressing these areas, subsequent research can inform evidence-based strategies and policies to improve teacher preparation, optimize technology integration, and enhance educational outcomes for students with special needs.

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