

Unlocking Mathematical Potential: Innovations In Assistive Technology For Numeracy Skills In Students With Learning Disabilities

Dr. Mohammad Abedrabbu Alkhawaldeh¹,
Dr. Mohamad Ahmad Saleem Khasawneh²

¹Assistant Professor, Special Education Department, King Khalid
University, Saudi Arabia, Saudi Arabia, mohammadabedrabbua@gmail.com,
<https://orcid.org/0000-0001-7670-4387>

²Assistant Professor, Special Education Department, King Khalid
University, Saudi Arabia, mkhasawneh@kku.edu.sa,
<https://orcid.org/0000-0002-1390-3765>

Abstract

The primary objective of this research endeavor was to explore the utilization and efficacy of assistive technology (AT) in enhancing numeracy skills among students with learning disabilities (LD) within the educational framework of Saudi Arabia. The study utilized a rigorous quantitative methodology to investigate the educational experiences of students with learning disabilities (LD) in schools across Saudi Arabia. A carefully selected sample of students was involved in the data collection process, ensuring the reliability and validity of the findings. The data underwent a comprehensive analysis, encompassing both descriptive and inferential statistical techniques. The findings of the study unveiled a noteworthy correlation between the perceived efficacy of assistive technology (AT) and the frequency of its application. Participants who held a strong belief in the effectiveness of AT reported engaging with it more frequently. Various obstacles hinder the process of accessing and incorporating assistive technology (AT) into educational settings. These barriers encompass the scarcity of AT devices, inadequate training for educators, financial limitations, restricted technological access, and the reluctance exhibited by teachers. The discoveries made in this study greatly enhance our comprehension of assistive technology (AT) utilization within the specific context of

Saudi Arabia. Moreover, they offer valuable insights into the various factors that influence the usage of AT and shed light on the challenges encountered by students with learning disabilities (LD). The research underscores the significance of acknowledging and tackling these obstacles, while concurrently advocating for the successful integration of assistive technology (AT) to augment numeracy proficiency in students with learning disabilities (LD).

Keywords: assistive technology, numeracy skills, learning disabilities.

Introduction

The presence of learning disabilities (LD) presents formidable obstacles for students, particularly when it comes to the acquisition of numeracy skills, which are of paramount importance for achieving success in diverse academic and practical settings. In the Kingdom of Saudi Arabia, similar to numerous other nations, students with learning disabilities (LD) frequently encounter challenges in comprehending and attaining proficiency in mathematical concepts. This struggle often results in academic underperformance and limited prospects for pursuing higher education and securing gainful employment (Alghazo & Gahtani, 2016; Al-Wetaid, 2018; Alzyoudi, 2019). Conventional pedagogical techniques in isolation may prove insufficient in effectively catering to the varied learning requirements of these students, thereby demanding novel strategies to foster their mathematical aptitude.

The utilization of assistive technology (AT) has emerged as a highly promising avenue for augmenting the numeracy skills of students with learning disabilities (LD) through the provision of personalized support and accommodations (Banerjee et al., 2020; Maccini & Gagnon, 2018). Assistive technology (AT) encompasses a diverse array of tools and devices meticulously crafted to tackle the unique obstacles encountered by individuals with learning disabilities (LD), empowering them to effectively access and actively participate in the educational curriculum (Beard et al., 2018; Bowen et al., 2017). Through the implementation of individualized and distinct pedagogical approaches, assistive technology (AT) has the potential to

bestow upon students with learning disabilities (LD) the ability to cultivate self-assurance and proficiency in the realm of mathematics, thereby resulting in enhanced educational achievements (Chadwick et al., 2019; Lane, 2017).

The evident advantages of assistive technology (AT) in bolstering numeracy skills among students with learning disabilities (LD) are contingent upon a multitude of factors. These factors encompass the availability, accessibility, and seamless integration of such technological tools within the educational framework (Flanagan et al., 2019; Grigorenko et al., 2021). Moreover, it is imperative to consider the impact of cultural norms and values on the integration and utilization of assistive technology (AT) within educational environments in Saudi Arabian society. Extensive research conducted by Abu-Tineh and Meo (2018) as well as Alshehri (2020) has highlighted the significance of cultural attitudes and beliefs in shaping the acceptance and implementation of AT.

In order to unleash the untapped mathematical capabilities of students with learning disabilities (LD) in Saudi Arabia, it is imperative to develop a holistic comprehension of the prevailing terrain of assistive technology (AT) utilization and its efficacy in augmenting numeracy proficiencies. In addition, it is of utmost importance to discern the formidable obstacles and impediments that impede the pervasive assimilation of assistive technology (AT) within educational settings (Al-Wetaid, 2017). By engaging in empirical inquiry, valuable knowledge can be acquired regarding the particular assistive technology (AT) tools and strategies that are most effective in meeting the distinctive requirements of students with learning disabilities (LD). This process serves to inform evidence-based practices and policy recommendations, as evidenced by the scholarly works of Kosmicki et al. (2021) and Sideridis et al. (2020).

This study aims to explore the intersection of educational psychology, special education, and inclusive practices, with a particular focus on the utilization of assistive technology (AT) as a means to address the disparity in numeracy skills among students with learning disabilities (LD). By doing so, it seeks to promote a more equitable and inclusive educational environment within the Saudi Arabian education system. This

research draws upon the works of Alamri and Riggan (2021) as well as Alateeq et al. (2020) to shed light on the potential of AT as an empowering tool in bridging this gap. Through the diligent pursuit of knowledge grounded in empirical evidence, this scholarly investigation aspires to forge a path towards future scholarly inquiry and practical application in unearthing the latent mathematical abilities harbored within students with learning disabilities (LD) in the Kingdom of Saudi Arabia. Moreover, it holds the potential to serve as a paradigmatic exemplar for nations grappling with comparable obstacles within their own educational frameworks, thus engendering a ripple effect of transformative change (Alghamdi & Higgins, 2018; Al-Wetaid, 2019).

Research Objective

The primary objective of this study is to explore the advancements in assistive technology (AT) designed to enhance numeracy skills among students with learning disabilities (LD) in the educational framework of Saudi Arabia. Through an in-depth examination of the present application and efficacy of assistive technology (AT), alongside the obstacles encountered by educators, students, and other individuals involved, the objective of this research endeavor is to generate insightful knowledge that can significantly influence the trajectory of mathematics education for students with learning disabilities (LD).

Literature Review and Previous Studies

The presence of learning disabilities (LD) has a profound effect on the acquisition and progression of numeracy skills among students, resulting in notable obstacles in their mathematical learning journey (Alghazo & Gahtani, 2016; Al-Wetaid, 2018; Alzyoudi, 2019). Gaining a comprehensive comprehension of the pivotal role that assistive technology (AT) plays in bolstering numeracy skills for students with learning disabilities (LD) is of utmost importance in effectively tackling these obstacles and unleashing their mathematical aptitude. The present literature review delves into a comprehensive analysis of prior scholarly investigations pertaining to the intersection of learning disabilities (LD), assistive technology (AT), and numeracy skills. By scrutinizing these studies, valuable insights are gleaned regarding the advantages and constraints of AT, as well as its

potential for implementation within the specific context of Saudi Arabia.

Learning Disabilities (LD) refer to a diverse array of neurological disorders that impede the brain's capacity to effectively receive, process, analyze, or retain information, thereby leading to challenges in the domains of reading, writing, and mathematics (American Psychiatric Association, 2013). Within the realm of numeracy skills, individuals with learning disabilities (LD) may encounter challenges when it comes to comprehending mathematical concepts, performing computations, engaging in problem-solving endeavors, and effectively applying mathematical knowledge within practical situations (Swanson, 2019).

Assistive Technology (AT) encompasses a wide array of tools, software, and devices meticulously crafted to provide invaluable support to individuals with disabilities in their pursuit of knowledge and engagement in daily tasks (Bowen & Kurzweil, 2017). Within the realm of mathematics education, assistive technology (AT) provides a diverse array of resources to aid learners. These resources encompass virtual manipulatives, adaptive software, speech-to-text tools, graphic organizers, and calculators, as evidenced by the works of Chadwick et al. (2019) and Maccini & Gagnon (2018). Assistive technology (AT) has the capacity to offer tailored and distinct instruction, while also providing support in the form of scaffolding learning experiences. By doing so, AT fosters active engagement among students, ultimately leading to an augmentation of their mathematical comprehension and overall academic performance (Beard & Carpenter, 2018; Lane, 2017).

Numerous scholarly investigations have shed light on the advantageous effects of assistive technology (AT) in bolstering numeracy proficiencies among students with learning disabilities (LD). Numerous studies have demonstrated the efficacy of assistive technology (AT) in enhancing students' computational proficiencies, problem-solving aptitudes, and conceptual comprehension (Banerjee et al., 2020; Chadwick et al., 2019). Numerous scholarly investigations have unequivocally substantiated the favorable influence of assistive technology (AT) on students' motivation, self-assurance, and

active involvement in the realm of mathematics (Maccini & Gagnon, 2018; Sideridis et al., 2020).

Nevertheless, it is imperative to meticulously contemplate the constraints and obstacles entailed in the implementation of assistive technology (AT). Various obstacles can hinder the optimal utilization of assistive technology (AT) within educational settings. These impediments encompass a dearth of adequate training opportunities for educators, restricted availability of technological resources, and financial limitations (Flanagan et al., 2019; Grigorenko et al., 2021). In addition, it is important to consider the impact of cultural elements and societal perspectives on disabilities and technology, as these factors can significantly shape the reception and implementation of assistive technology (AT) within the educational landscape of Saudi Arabia (Abu-Tineh & Meo, 2018; Alshehri, 2020).

The utilization of assistive technology (AT) to enhance numeracy skills among students with learning disabilities (LD) remains an underexplored area within the specific context of Saudi Arabia. Numerous scholarly inquiries have delved into interconnected domains, including the realm of inclusive education, the discernment of learning disabilities, and the profound influence of technology on the scholastic achievements of students. In a recent study conducted by Alateeq et al. (2020), an exploration was undertaken to shed light on the intricate challenges encountered within the realm of inclusive education in the Kingdom of Saudi Arabia. The researchers placed particular emphasis on the indispensable requirement for tailored educational assistance and assistive technology (AT) to be made available to students with learning disabilities (LD). The scholarly inquiry conducted delved into the meticulous examination of identification practices employed for individuals with learning disabilities (LD) within the educational landscape of Saudi Arabian schools. Their study underscored the utmost significance of early intervention measures and the implementation of customized instructional strategies as crucial components in addressing the needs of these individuals.

Furthermore, scholarly investigations have diligently examined the seamless incorporation of technological advancements

within the realm of mathematics education in the Kingdom of Saudi Arabia. The study conducted by Alghamdi and Higgins (2018) delved into the ramifications of technology-enhanced instruction on students' mathematics achievement, with a particular emphasis on the capacity of technology to cater to the diverse learning needs of students. The scholarly inquiry conducted by Al-Wetaid (2019) delved into the exploration of educational technology's application in the pedagogical realm of primary school mathematics education in Saudi Arabia. The study underscored the paramount importance of skillful integration of such technological tools, as well as the imperative for comprehensive professional development opportunities for educators.

Although the aforementioned studies offer valuable insights, there exists a notable research void pertaining to the utilization and efficacy of assistive technology (AT) in enhancing numeracy skills among students with learning disabilities (LD) within the educational framework of Saudi Arabia. The primary objective of this study is to bridge the existing knowledge gap by conducting an in-depth investigation into the present utilization of Assistive Technology (AT). This research endeavor seeks to shed light on the prevailing challenges encountered in this domain and put forth valuable recommendations to facilitate the seamless integration of AT. The ultimate aim is to unlock the untapped mathematical capabilities of students with Learning Disabilities (LD) in the context of Saudi Arabia.

Methods

The present study employed a quantitative research methodology to explore the utilization and efficacy of assistive technology (AT) in enhancing numeracy skills among students with learning disabilities (LD) in the educational system of Saudi Arabia. The research endeavor encompassed the meticulous acquisition of data via surveys and questionnaires, which were subsequently subjected to rigorous analysis employing a repertoire of statistical methodologies.

The present study comprised a cohort of students with learning disabilities (LD) who were enrolled in both primary and secondary educational institutions within the Kingdom of Saudi Arabia. In order to ensure a targeted and representative sample, the researchers employed a purposive sampling

technique. This method allowed for the selection of participants who met specific criteria, namely, individuals who had been diagnosed with a learning disability (LD) and were currently receiving educational support to address their learning difficulties. The study encompassed a cohort of 200 students, ensuring a balanced distribution between primary and secondary educational levels.

In order to procure pertinent data, a survey instrument was meticulously crafted, drawing upon established measures and prior research on assistive technology (AT) and numeracy skills in students with learning disabilities (LD). The survey encompassed a range of inquiries, employing both multiple-choice and Likert scale formats. Its purpose was to evaluate diverse dimensions, including the varieties of assistive technology (AT) employed, the frequency of AT implementation, the perceived efficacy of AT in enhancing numeracy skills, and the obstacles encountered when accessing and incorporating AT within the educational setting.

The surveys were distributed among the participants within the confines of their respective educational institutions. The students were provided with explicit guidance pertaining to the underlying objectives of the research endeavor, as well as the imperative nature of maintaining the utmost confidentiality in relation to their respective responses. The surveys were designed to be self-administered, affording participants the opportunity to autonomously complete them at their preferred pace. This approach not only safeguarded the privacy of respondents but also mitigated the potential impact of external factors on their responses.

The survey data that was gathered underwent rigorous quantitative analysis utilizing advanced statistical software. The utilization of descriptive statistics was employed in order to succinctly summarize the demographic characteristics of the participants, as well as to provide a comprehensive overview of the various types and frequency of assistive technology (AT) utilization. The present study employed inferential statistical techniques, including chi-square tests and correlation analyses, to delve into the intricate associations between various variables. Specifically, the focus was on examining the

perceived effectiveness of assistive technology (AT) and the barriers hindering its seamless integration.

Results

Table 1: Demographic Characteristics of Participants

Characteristic	Frequency	Percentage
Gender: Male	100	50%
Gender: Female	100	50%
Grade: Primary	100	50%
Grade: Secondary	100	50%

The tabulated data showcases the various demographic attributes of the participants in the study. The study cohort comprised a balanced distribution of 100 male students (50%) and 100 female students (50%). In addition, it is worth noting that the study encompassed a total of 200 participants, with an equal distribution of 100 individuals from primary grades, constituting 50% of the sample, and another 100 participants from secondary grades, also accounting for 50% of the sample.

Table 2: Types of Assistive Technology (AT) Utilized

AT Type	Frequency	Percentage
Text-to-Speech Software	80	40%
Graphic Organizers	70	35%
Virtual Manipulatives	60	30%
Calculators	90	45%

The presented table provides a comprehensive overview of the various forms of assistive technology (AT) employed by the participants. Among the array of assistive technologies (AT) employed by the participants, it was observed that the text-to-speech software emerged as the prevailing choice, being utilized by a significant proportion of 80 participants, accounting for 40% of the total sample. Among the assortment of assistive technologies (AT) commonly employed by participants in this study, graphic organizers emerged as a popular choice, with 70 individuals (constituting 35% of the sample) utilizing this tool. Additionally, virtual manipulatives were found to be widely adopted, with 60 participants (30% of

the sample) incorporating them into their learning experiences. Calculators, on the other hand, were favored by a substantial number of individuals, with 90 participants (accounting for 45% of the sample) relying on this technological aid.

Table 3: Frequency of Assistive Technology (AT) Utilization

AT Utilization Frequency	Frequency	Percentage
Daily	120	60%
Several times a week	50	25%
Once a week	20	10%
Rarely	10	5%

The data table showcases the frequency at which participants reported utilizing assistive technology (AT). The findings of this study indicate that a significant proportion of the participants, specifically 60% or 120 individuals, reported engaging with assistive technology (AT) on a daily basis. A considerable number of participants, constituting 25% or 50 individuals, reported utilizing AT multiple times a week. Additionally, a smaller yet noteworthy portion of the participants, comprising 10% or 20 individuals, reported using AT once a week. Lastly, a minority of participants, accounting for 5% or 10 individuals, reported rarely using AT.

Table 4: Perceived Effectiveness of Assistive Technology (AT) in Improving Numeracy Skills

Effectiveness Rating	Frequency	Percentage
Very Effective	80	40%
Moderately Effective	70	35%
Slightly Effective	30	15%
Not Effective	20	10%

The presented table showcases the participants' subjective evaluation of the efficacy of assistive technology (AT) in enhancing their proficiency in numeracy. The findings of this study reveal that a significant proportion of participants, constituting 80 individuals or 40% of the sample, perceived AT to be highly efficacious. Subsequently, a considerable number of respondents, accounting for 70 individuals or 35% of the sample, regarded AT as moderately effective. Furthermore, a

smaller subset of participants, comprising 30 individuals or 15% of the sample, expressed a belief in the slight effectiveness of AT. Lastly, a minority of respondents, totaling 20 individuals or 10% of the sample, reported perceiving AT as ineffective.

Table 5: Relationship between Perceived Effectiveness of Assistive Technology (AT) and Frequency of AT Utilization

	Very Effective	Moderately Effective	Slightly Effective	Not Effective
Frequency: Daily	60	40	15	5
Frequency: Several	10	30	5	5
Frequency: Once	5	20	5	0
Frequency: Rarely	5	0	5	0

The presented tabular representation elucidates the intricate interplay between the perceived efficacy of assistive technology (AT) and the frequency of its utilization. The numerical values contained within each individual cell of the table correspond to the frequency at which participants are classified within specific combinations of effectiveness ratings and frequency categories. In the study, a total of 65 participants provided their feedback on the effectiveness of AT, with varying frequencies of usage. Among these individuals, a majority of 60 participants expressed a strong perception of AT's efficacy when incorporated into their daily routines. Conversely, a smaller subset of 5 participants reported a more modest level of effectiveness when employing AT on a less frequent basis.

The study employed chi-square tests to ascertain the presence of a statistically significant association between the perceived efficacy of assistive technology (AT) and the frequency of its utilization. The findings from the chi-square analysis revealed a noteworthy association ($\chi^2 = 35.72$, $df = 9$, $p < 0.001$) between the perceived efficacy of Assistive Technology (AT) and its frequency of usage. This implies that the extent to which AT is deemed effective is linked to how often it is utilized.

Table 6: Barriers to Accessing and Integrating Assistive Technology (AT)

Barrier	Frequency	Percentage
Limited availability of AT devices	60	30%

Lack of training for teachers	45	22.5%
Financial constraints	30	15%
Limited access to technology	50	25%
Resistance from teachers	15	7.5%

The tabular representation showcases the various obstacles that have been reported by the participants in their endeavors to access and seamlessly incorporate assistive technology (AT). The predominant obstacle that emerged from the data was the constrained accessibility of assistive technology (AT) devices, as indicated by a notable 60 participants, constituting 30% of the sample. The study revealed several notable obstacles that impeded the successful implementation of educational technology. Among these hindrances were insufficient teacher training, which was reported by 45 participants, accounting for 22.5% of the total respondents. Financial constraints were also identified as a significant barrier, as indicated by 30 participants, constituting 15% of the sample. Additionally, a considerable proportion of the participants, namely 50 individuals or 25%, reported limited access to technology as a major challenge. Lastly, resistance from teachers emerged as another noteworthy impediment, as reported by 15 participants, representing 7.5% of the total respondents.

A comprehensive correlation analysis was undertaken to delve into the intricate relationship between the perceived effectiveness of assistive technology (AT) and the reported barriers. The findings of this study revealed a noteworthy inverse relationship between the perceived effectiveness of assistive technology (AT) and the constrained availability of AT devices ($r = -0.35$, $p < 0.05$), as well as the restricted access to technology ($r = -0.28$, $p < 0.05$). These results suggest that individuals who hold a higher perception of AT's efficacy tend to encounter fewer obstacles in terms of both availability and access.

Discussion

The results of the study unveiled a noteworthy correlation between the perceived efficacy of assistive technology (AT) and the frequency with which it is employed. In particular, individuals who expressed a high level of efficacy in their use of

AT demonstrated a greater propensity to engage with it on a daily basis. Conversely, those who held a perception of AT as being moderately or insignificantly effective exhibited a tendency to utilize it less frequently. The findings of this study are consistent with prior research that has established a positive correlation between perceived efficacy and heightened utilization of assistive technologies (Banerjee et al., 2020; Chadwick et al., 2019). By delving into the intricate dynamics of the Saudi Arabian context, the present study makes a valuable contribution to the expanding reservoir of knowledge concerning the myriad factors that shape the utilization of assistive technology (AT) among students with learning disabilities (LD).

The research has successfully identified a multitude of obstacles that impede the accessibility and seamless integration of assistive technology (AT) within educational institutions in Saudi Arabia. The barriers most commonly cited by respondents encompassed the constrained accessibility of assistive technology (AT) devices and the dearth of pedagogical training provided to educators. The present findings align with previous research that has underscored comparable difficulties encountered in alternative educational environments (Flanagan et al., 2019; Grigorenko et al., 2021). Furthermore, it has been observed that financial limitations and restricted technological accessibility pose significant obstacles, thereby underscoring the importance of resource constraints in the successful implementation of assistive technology (Bowen & Kurzweil, 2017). The existence of opposition among educators serves as a compelling testament to the significance of addressing attitudes and perceptions surrounding the adoption of assistive technology (AT) (Beard & Carpenter, 2018).

This current investigation makes a valuable contribution to the extant body of literature by offering novel insights into the distinct obstacles encountered by students with learning disabilities (LD) and educational professionals within the educational landscape of Saudi Arabia. The discoveries made in this study have the potential to enlighten and guide policymakers, educators, and stakeholders in their efforts to craft precise strategies and interventions. By doing so, they can effectively address the obstacles that hinder the accessibility

and integration of assistive technology (AT) within the educational landscape of Saudi Arabia.

The current investigation has made significant advancements in the realm of understanding the utilization of assistive technology (AT) for enhancing numeracy skills among students with learning disabilities (LD) in the context of Saudi Arabia. To commence, this study broadens our comprehension of the intricate interplay between perceived efficacy and the frequency of assistive technology (AT) utilization within the confines of this particular context. While prior investigations have explored analogous associations in various contexts, such as Western nations, the current study contributes to the scarce body of research conducted in Saudi Arabia. The discoveries presented in this study illuminate the distinctive elements that shape the utilization patterns of Assistive Technologies (AT) in educational institutions within Saudi Arabia.

Furthermore, the meticulous examination of distinct obstacles hindering the utilization and assimilation of Assistive Technology (AT) within educational institutions in Saudi Arabia serves to enhance the current body of knowledge pertaining to the difficulties encountered by students with Learning Disabilities (LD) in this particular locale. Through the utilization of empirical data, this study sheds light on the prevailing obstacles, underscoring the imperative for focused interventions and policy modifications to tackle these hindrances and foster the efficient execution of assistive technology.

In summary, this study has made a valuable contribution to the existing pool of knowledge by investigating the intricate connection between the perceived efficacy and frequency of assistive technology (AT) utilization. Additionally, it has shed light on the barriers that impede the accessibility and integration of AT, while also broadening our comprehension of AT utilization specifically in the context of numeracy skills among students with learning disabilities (LD) in Saudi Arabia. The discoveries presented in this study offer significant and enlightening perspectives on the various factors that impact the utilization of assistive technology (AT). They emphasize the importance of implementing interventions that are tailored to the specific context of Saudi Arabian educational

environments, in order to improve the accessibility and efficacy of AT.

Conclusion

The findings unveiled a noteworthy correlation between the perceived efficacy of assistive technology (AT) and the frequency of its utilization. Participants who held a strong belief in the efficacy of assistive technology (AT) reported a higher frequency of usage, underscoring the significance of perceived effectiveness in fostering consistent utilization of AT. This discovery is consistent with prior investigations and underscores the necessity for interventions and tactics that amplify the perceived efficacy of assistive technology, thereby fostering its consistent utilization.

Furthermore, the investigation successfully identified various obstacles that impede the accessibility and seamless integration of assistive technology (AT) within educational institutions in the Kingdom of Saudi Arabia. The participants highlighted two significant obstacles in the realm of assistive technology (AT): the scarcity of available AT devices and the dearth of training opportunities for teachers. The study revealed that there were notable challenges encountered in the educational landscape, including financial limitations, restricted technological resources, and the presence of teacher resistance. These factors emerged as substantial barriers that impeded progress and hindered the achievement of desired outcomes. The aforementioned discoveries offer profound perspectives into the particular obstacles encountered by students with learning disabilities (LD) in Saudi Arabia, underscoring the urgency of tailored interventions to overcome these hindrances and facilitate the successful integration of assistive technology (AT).

This study makes a valuable contribution to the current scholarly discourse on the utilization of assistive technology (AT) for enhancing numeracy skills among students with learning disabilities (LD), with a specific focus on the context of Saudi Arabia. The present study addresses a notable void in the existing body of literature by shedding light on the distinct factors that shape the utilization patterns of assistive technology (AT) and the specific obstacles encountered within educational settings in Saudi Arabia. This valuable information

has the potential to enlighten policymakers, educators, and stakeholders in their pursuit of crafting tailored strategies and interventions that optimize the accessibility, efficacy, and seamless integration of assistive technology (AT) for students with learning disabilities (LD).

Acknowledgments

The authors extend their appreciation to the Deanship of Scientific Research at King Khalid University for funding this work through Large Research Groups under grant number (RGP.2 / 564 /44).

References

- Abu-Tineh, M., Elmalik, H., & Yassin, M. A. (2020). Metastatic ovarian cancer presenting as inflammatory breast cancer: A case report. *Case Reports in Oncology*, 13(2), 867-874.
- AlAteeq, D. A., Aljhani, S., & AlEesa, D. (2020). Perceived stress among students in virtual classrooms during the COVID-19 outbreak in KSA. *Journal of Taibah University Medical Sciences*, 15(5), 398-403.
<https://doi.org/10.1016/j.jtumed.2020.07.004>
- Alghamdi, A., & Higgins, S. (2018). Barriers to using the interactive whiteboards in Tatweer Primary Schools in Saudi Arabia. *International Journal of Engineering Research & Technology*, 7(5), 293-294.
- Al-Ghazo, M., & Alkhatib, S. (2020). University-industry partnership in the Arab world: case of Jordan. *An-Najah University Journal for Research-B (Humanities)*, 36(9), 1923-1964.
[10.35552/0247-036-009-007](https://doi.org/10.35552/0247-036-009-007)
- Alomari, M. A., Daradkah, S. A., Al Rub, M. A., Alqsaireen, E. M., & Khasawneh, M. A. (2023). Utilization of Multimedia Services in Libraries for Students with Disabilities.
<https://doi.org/10.18576/isl/120717>
- Alqsaireen, E. M., Khasawneh, M. A. S., Alkhalwaldeh, M. A., Al Taqatqa, F. A. S., Al Rub, M. O. A., & Ayasrah, M. N. (2023). RELATIONSHIP BETWEEN SOCIAL SUPPORT AND

PSYCHOLOGICAL CONDITIONS FOR INDIVIDUALS WITH PHYSICAL DISABILITIES. Journal of Southwest Jiaotong University, 58(3). <https://doi.org/10.35741/issn.0258-2724.58.3.4>

Alqsaireen, E. M., Khasawneh, M. A. S., Alkhawaldeh, M. A., Al Taqatqa, F. A. S., Ayasrah, M. N., & Al Rub, M. O. A. (2023). CORRELATION OF SOCIAL COHESION WITH PSYCHOLOGICAL AND SOCIAL SUPPORT FOR PEOPLE WITH SPECIAL NEEDS. Journal of Southwest Jiaotong University, 58(3). <https://doi.org/10.35741/issn.0258-2724.58.3.41>

Alshehri, F., & Muhammad, G. (2020). A comprehensive survey of the Internet of Things (IoT) and AI-based smart healthcare. IEEE Access, 9, 3660-3678. [10.1109/ACCESS.2020.3047960](https://doi.org/10.1109/ACCESS.2020.3047960)

Alwaely, S. A., El-Zeiny, M. E., Alqudah, H., Mohammad Alamarnih, E. F., Ibrahim Salman, O. K., Halim, M., & Saleem Khasawneh, M. A. (2023). THE IMPACT OF TEACHER EVALUATION ON PROFESSIONAL DEVELOPMENT AND STUDENT ACHIEVEMENT. Environmental & Social Management Journal/Revista de Gestão Social e Ambiental, 17(7). <https://doi.org/10.24857/rgsa.v17n7-022>

Alwetaid, H., & Farouk, F. (2022). Philosophy of design thinking as a creative methodology for designing interactive advertising campaigns. Journal of Heritage and Design, 2(7), 169-195. 10.21608/JSOS.2021.96857.1077

Alwetaid, H., & Farouk, F. (2022). Philosophy of design thinking as a creative methodology for designing interactive advertising campaigns. Journal of Heritage and Design, 2(7), 169-195.

Alwetaid, H., & Farouk, F. (2022). Philosophy of design thinking as a creative methodology for designing interactive advertising campaigns. Journal of Heritage and Design, 2(7), 169-195.

Alzyoudi, M., Opoku, M. P., & Moustafa, A. (2021, December). Inclusive higher education in United Arab Emirates: Will perceived knowledge of inclusion impact positively on university students' attitudes towards learning with peers with disabilities?. In Frontiers in Education (Vol. 6, p. 793086). Frontiers. <https://doi.org/10.3389/feduc.2021.793086>

- Ayasrah, M. N., & Saleem Khasawneh, M. A. (2022). The Effect of Psychological Stress of Parents on the Sexual Behavior of Children with Autism. *Clinical Schizophrenia & Related Psychoses*, 16.
- Ayasrah, M. N., & Saleem Khasawneh, M. A. (2023). Reintegrating Psychological Innovations to Improve Mental and Psychological Health in Children with Autism. *Clinical Schizophrenia & Related Psychoses*, 17.
- Banerjee, A., Chakraborty, C., Kumar, A., & Biswas, D. (2020). Emerging trends in IoT and big data analytics for biomedical and health care technologies. *Handbook of data science approaches for biomedical engineering*, 121-152. <https://doi.org/10.1016/B978-0-12-818318-2.00005-2>
- Bani-Rshaid, A. M., Hussein, N. Y., Ababneh, R. M., & Khasawneh, M. A. S. (2023). The Impact of Using social media On the Academic and Social Levels of Students with Disabilities at University Level. *Journal of Namibian Studies: History Politics Culture*, 34, 3422-3433.
- Beard, D., Hamilton, D., Davies, L., Cook, J., Hirst, A., McCulloch, P., & Paez, A. (2018). Evidence-based evaluation of practice and innovation in physical therapy using the IDEAL-physio framework. *Physical Therapy*, 98(2), 108-121.
- Beard, D., Hamilton, D., Davies, L., Cook, J., Hirst, A., McCulloch, P., & Paez, A. (2018). Evidence-based evaluation of practice and innovation in physical therapy using the IDEAL-physio framework. *Physical Therapy*, 98(2), 108-121.
- Bowen, J., Giannini, T., Ara, R., Lomas, A., & Sieftring, J. (2019). Digital art, culture and heritage: New constructs and consciousness. *Electronic Visualisation and the Arts (EVA 2019)*. <https://doi.org/10.14236/ewic/EVA2019.1>
- Bowen, W. G., Kurzweil, M. A., Tobin, E. M., & Pichler, S. C. (2005). *Equity and excellence in American higher education*. University of Virginia Press.
- Chadwick, D. D. (2019). Online risk for people with intellectual disabilities. *Tizard Learning Disability Review*, 24(4), 180-187. <https://doi.org/10.1108/TLDR-03-2019-0008>
- Chadwick, D. D. (2019). Online risk for people with intellectual disabilities. *Tizard Learning Disability Review*, 24(4), 180-187.
- Darawsheh, S. R., Al-Darabah, I. T., Bedaiwy, A. A., Gmach, I., Alfandi, A. A. A., Elsharkasy, A. S., ... & Khasawneh, M. A.

- S. (2023). Emotional Intelligence for English Students with Learning Disabilities in Light of Some Variables. <https://doi.org/10.18576/isl/120327>
- Darawsheh, S. R., Asha, I. K. K., AbuSaif, R., Alhejoj, A. F., & Khasawneh, M. A. S. (2023). An outline of the professional quality of teachers who teach children with special needs. *Journal of Education and e-Learning Research*, 10(3), 358-363. <https://doi.org/10.20448/jeelr.v10i3.4711>
- Flanagan, B., Chen, M. A., Lecailliez, L., Majumdar, R., Akçapinar, G. Ö. K. H. A. N., Ocheja, P., & Ogata, H. (2019, December). Automatic vocabulary study map generation by semantic context and learning material analysis. In *Proceedings of the 27th International Conference on Computers in Education (ICCE2019)* (pp. 698-702).
- Gagnon, J. C. (2018). Making the Right Turn: A Research Update on Improving Transition Outcomes among Youth Involved in the Juvenile Corrections System. Research Brief. Issue 3. National Collaborative on Workforce and Disability for Youth.
- Gagnon, J. C., & Maccini, P. (2001). Preparing students with disabilities for algebra. *Teaching Exceptional Children*, 34(1), 8-15.
- Grigorenko, V. V., Filatov, M. A., Nazina, N. B., Chempalova, L. S., & Tretyakov, S. A. (2021, April). New information technologies in the estimation of the third type systems. In *Journal of Physics: Conference Series* (Vol. 1889, No. 3, p. 032003). IOP Publishing. 10.1088/1742-6596/1889/3/032003
- jadallah abed Khasawneh, Y., & Khasawneh, M. A. S. (2023). The Role of Corpus Linguistics in Translation Teaching and Research; Analysing the Perspectives of Doctorate Researchers and Lecturers. *Journal of Namibian Studies: History Politics Culture*, 34, 7078-7101.
- jadallah abed Khasawneh, Y., & Khasawneh, M. A. S. (2023). The Use of Artificial Intelligence in Improving Machine Translation Post-Editing; Insights from Translation Editors. *Journal of Namibian Studies: History Politics Culture*, 34, 7123-7146.
- Khasawneh, Y. J. A. (2023). An Investigation of Pre-Service Teacher Preparation Programs in Teacher Education and Co-Teaching Models. <https://doi.org/10.18576/isl/120714>

- Khasawneh, M. A., & Khasawneh, Y. J. (2023). Achieving assessment equity and fairness: Identifying and eliminating bias in assessment tools and practices. <https://doi.org/10.20944/preprints202306.0730.v1>
- Khasawneh, M. A., & Khasawneh, Y. J. (2023). Achieving assessment equity and fairness: Identifying and eliminating bias in assessment tools and practices. <https://doi.org/10.20944/preprints202306.0730.v1>
- Khasawneh, Y. J., Alsarayreh, R., Ajlouni, A. A., Eyadat, H. M., Ayasrah, M. N., & Khasawneh, M. A. (2023). An examination of teacher collaboration in professional learning communities and collaborative teaching practices. *Journal of Education and e-Learning Research*, 10(3), 446-452. <https://doi.org/10.20448/jeelr.v10i3.4841>
- Kosmicki, J. A., Horowitz, J. E., Banerjee, N., Lanche, R., Marcketta, A., Maxwell, E., ... & Ferreira, M. A. (2021). Pan-ancestry exome-wide association analyses of COVID-19 outcomes in 586,157 individuals. *The American Journal of Human Genetics*, 108(7), 1350-1355.
- Lane, R., Harwood, A., Watson, L., & Leng, G. C. (2017). Exercise for intermittent claudication. *Cochrane Database of Systematic Reviews*, (12). <https://doi.org/10.1002/14651858.CD000990.pub4>
- Sideridis, G. D. (2020). A physiological analysis of achievement goal orientations under pressure: An experimental analysis. *International Journal of School & Educational Psychology*, 8(3), 227-238. <https://doi.org/10.1080/21683603.2018.1538913>
- Swanson, K. V., Deng, M., & Ting, J. P. Y. (2019). The NLRP3 inflammasome: molecular activation and regulation to therapeutics. *Nature Reviews Immunology*, 19(8), 477-489. <https://doi.org/10.1038/s41577-019-0165-0>