The role of the Artificial Intelligence in fostering personalized learning for students with learning disabilities

Lara Chamoun

Lebanese University- Pedagogy Faculty – M2 in Education technology

Chamoun.lara@outlook.com

Résumé

L'intelligence artificielle (IA) joue un rôle crucial dans la transformation de l'éducation inclusive grâce à l'apprentissage numérique ; grâce à ses capacités innovantes et à son intégration aux principes du Design Universel, l'IA affecte les trois piliers de l'apprentissage : l'enseignant, l'élève ayant des difficultés d'apprentissage et le contenu. Cette étude explore comment l'IA peut contribuer à créer un apprentissage personnalisé pour les élèves en difficulté au sein des écoles inclusives libanaises. Sélectionnant les classes élémentaires, l'étude explore les perspectives de 75 enseignants et thérapeutes des écoles inclusives publiques et privées, en examinant l'intégration de l'IA dans les pratiques pédagogiques et son impact sur l'apprentissage personnalisé. Par des enquêtes et des analyses de données, la recherche vise à répondre à la question suivante : Dans quelle mesure l'IA peut-elle favoriser l'apprentissage personnalisé pour les élèves en difficulté d'apprentissage dans les écoles inclusives libanaises, et quelles sont les défis auxquels sont confrontés les enseignants du primaire dans l'intégration efficace de l'IA dans leurs pratiques pédagogiques ? Les résultats révèlent l'importance des approches d'apprentissage personnalisé pour les élèves en difficulté d'apprentissage et les avantages de l'IA dans la création d'un apprentissage personnalisé, principalement dans la création d'un curriculum sur mesure, l'adaptation du contenu, la recommandation de ressources pédagogiques appropriées, et l'augmentation de l'engagement et de la motivation des élèves, souligné par les participants. Cependant, 80% des enseignants des écoles inclusives libanaises ne recourent pas aux outils de l'IA afin de soutenir

l'apprentissage personnalisé des élèves. Ceci pouvait entraver l'intégration efficace de l'IA dans les pratiques éducatives visant à favoriser l'apprentissage personnalisé des élèves en difficulté. L'étude a conclu à la nécessité d'une formation structurée et d'un cadre pour l'utilisation de l'IA dans l'éducation inclusive au Liban.

Mots-clés

Intelligence Artificielle, Troubles d'apprentissage scolaire, apprentissage personnalisée, Perception des enseignants

Abstract

AI plays a pivotal role in shaping today's digital learning landscape in inclusive education; through its innovative capabilities, and its integration with the Universal Design principles, AI affects the three main pillars of learning: The teacher, the student with learning difficulties and the content. This study examines the role of artificial intelligence (AI) in tailoring personalized learning experiences for students with learning disabilities within Lebanese inclusive schools. With a focus on elementary classes, the study investigates the perspectives of 75 teachers and therapists from both public and private inclusive schools, exploring AI's integration into teaching practices and its impact on personalized learning. Through surveys and data analysis, the research aims to answer the following question: To what extent can artificial intelligence foster personalized learning for students with learning disabilities in Lebanese inclusive schools, and what are the challenges faced by elementary teachers in effectively integrating AI into their teaching practices? Findings reveal the importance of personalized learning approaches for students with learning disabilities and potential benefits of AI in creating personalized learning, mainly in creating a tailored curriculum, adapting content, recommending appropriate educational resources, and increasing student engagement and motivation according to the teachers. They highlighted AI's ability to adapt instruction to individual students' needs, provide targeted support, and enhance engagement and motivation among students with learning disabilities. However, 80% of teachers in Lebanese inclusive schools concerns about their limited expertise in utilizing AI technologies effectively to support personalized learning for students. This gap in knowledge and expertise could hinder the effective integration of AI into educational practices to foster personalized learning for students with learning disabilities. The study

concluded the need for structured training and framework on the use of AI in special education.

Key words

Artificial Intelligence, Learning Disabilities, Personalized Learning, Teachers' Perception

مستخلص

لعب الذكاء الاصطناعي دورًا حيويًا في التطور التعليمي الرقمي في التعليم الدامج؛ من خلال قدراته الابتكارية، واندماجه مع مبادئ التصميم العالمي، يؤثر الذكاء الاصطناعي على الأركان الثلاثة الرئيسية للتعلم: المعلم، الطالب ذوي صعوبات التعلمية، والمحتوى. تهدف هذه الدراسة إلى تقييم دور الذكاء الاصطناعي في تحفيز التعلم الشخصية لطلاب ذوي صعوبات التعلمية داخل المدارس الدامجة اللبنانية. مع التركيز على الصفوف الابتدائية، تستقصي الدراسة آراء 75 معلمًا وأخصائيًا من المدارس الدامجة الرسمية والخاصة، بحثًا في دور الذكاء الاصطناعي في ممارسات التدريس وتأثيره على التعلم الشخصي. من خلال الاستطلاعات وتحليل البيانات، يهدف البحث إلى الإجابة على السؤال التالي: إلى أي مدى يمكن للذكاء الاصطناعي تعزيز التعلم الشخصي لطلاب ذوي صعوبات في التعلم في المدارس الدامجة اللبنانية، وما هي التحديات التي يواجهها المعلم في دمج الذكاء الاصطناعي بشكل فعال في ممارساته التعليمية؟ تكشف النتائج عن أهمية النهج التعليمي الشخصي لطلاب ذوي صعوبات في التعلم والفوائد المهمة للذكاء الاصطناعي في إنشاء تعلم شخصي، خاصة في تعديل المنهاج، وتكييف المحتوى، وإيجاد الموارد التعليمية المناسبة لكل تلميذ من ذوي الصعوبات التعلمية، وزيادة اندماج الطلاب في التعلم وتحفيزهم. ومع ذلك، 80٪ من المعلمين في المدارس الشاملة اللبنانية يظهرون خبرة محدودة في استخدام تقنيات الذكاء الاصطناعي بشكل فعال لدعم التعلم الشخصي للطلاب. يمكن أن تعيق هذه الفجوة في المعرفة والخبرة دمج الذكاء الاصطناعي بشكل فعال في الممارسات التعليمية لتعزيز التعلم الشخصي للطلاب ذوي للصعوبات التعلمية. خلصت الدراسة إلى ضرورة وجود تدريب منظم وإطار لاستخدام الذكاء الاصطناعي في التعليم الدامج.

كلمات مفتاحية

1. Introduction

Inclusive education means that all children learn together in schools that recognize and respond to the diverse needs of students, ensure quality education for all through appropriate curricula, organization, teaching strategies and resource use (UNESCO, The Salamanca Statement and Framework for action on special needs education: Adopted by the World Conference on Special Needs Education, Access and Quality, 1994) and overcome the barriers to the presence, participation, and achievement of all students in general education classes (UNESCO, A Guide for Ensuring Inclusion and Equity in Education, 2017)

The integration of students with mild disabilities, such as the learning disabilities, in regular inclusive classrooms is a global phenomenon including Lebanon; the Lebanese curriculum is based on principles focused on the learner being the center of and partner in learning, providing equal opportunities and ensuring inclusion of children with learning disabilities. (The Lebanese National Framework Fot the General Education Curriculum, 2022). However, in regular classes, students with learning difficulties (LD), who are said to be less efficient at processing information, tend to have trouble catching up in class compared with other students (Gersten, 2001); Because, in diverse but constrained learning contexts with different types of learners, teachers have difficulty orchestrating multiple flows of information and tasks. (Dillenbourg, 2013)

To solve this issue, an inclusive Pedagogy approach is adopted by many school's systems; this approach aims to make learning as accessible and welcoming to all students as possible (Kardia, 1994). Looking at the bigger picture, all students, regardless of cognitive abilities or school resources, should have the same access to course materials and a clear understanding of professors' explanations. Inclusive pedagogy literature stresses the importance of fairness in access and transparent communication about expectations from professors.

UDL is best positioned as an educational framework for inclusive practice that draws on psychological and neuroscientific research in the learning sciences (Meyer A. &., 2006)It is built

around three guiding principles that map onto three proposed psycho-neurological networks which underpin effective learning (Meyer A. H.) These are:

- Affective networks: provide multiple means of engagement
- Recognition networks: provide multiple means of representation
- Strategic networks: provide multiple means of action and expression

To help students with learning disabilities in their inclusion journey, it's important to focus on the "disability of the instruction", not only the learning disability of the learner. UDL has also been applied to the educational activities of students with ID in order to examine a variety of interventions (e.g. modified stories, educational aids) the results of which may appear in students' interactions, perceptions, knowledge and behavior (Rao, 2017).

In contrast to traditional teachers, whose roles were primarily as "lecturers, knowledge providers, and controllers of activities" (Hannafin, 1993) contemporary educators are now expected to act as "facilitators who help learners evaluate the quality and validity of new information, [...] mediators between learners and essential knowledge, and providers of scaffolding to aid understanding" (Amin, 2016)

AI-powered personalized education aims to address these challenges by providing engaging and tailored learning experiences that capture students' interests, offer individual attention, make learning relevant, and provide flexibility (Zia, 2023). It offers promising opportunities for enhancing personalized learning experiences for students, leading to improved educational outcomes by reshaping traditional teaching methods (Jin, 2023). And it plays a pivotal role in personalizing content delivery. Algorithms analyze student data, such as performance on quizzes, time spent on assignments, and areas of interest. Using this information, AI systems recommend specific learning materials, adapt the difficulty level of tasks, and suggest additional resources that align with the learner's current knowledge and objectives (Raza, 2023). AI plays a pivotal role in shaping today's digital learning landscape. As we've seen, by seamlessly integrating with Universal Design principles, AI helps create more inclusive and personalized learning experiences.

There are three main areas where the interaction between AI and Universal Design is having the most impact:

- Adaptive learning environments
- Voice and language technologies
- Assistive technologies.

This study addresses the following research question: "To what extent can artificial intelligence foster a personalized learning for students with learning disabilities in Lebanese inclusive schools, and what are the challenges faced by elementary school teachers in effectively integrating AI into their teaching practices?"

To explore the effectiveness of AI tools in personalizing learning for students with learning disabilities, we formulated the hypothesis:

- The integration of AI-powered personalized learning tools will alleviate the difficulties faced by students with learning difficulties (LD) by helping teachers with tailoring content delivery to their unique learning styles, and provide multiple means of engagement.
- The use of AI automating tasks for teachers will help organize information better, making learning environments more inclusive and effective for all students.

The aim of this study is to explore the importance and role of AI in creating personalized content for students with learning disabilities in order to facilitate their integration in the regular classroom environments; and in highlighting the gap between the theoretical knowledge of AI and its practical application in inclusive schools, and to understand the challenges and barriers faced by educators in implementing AI-driven personalized learning solutions. Additionally, the findings are expected to enhance the ongoing discourse on AI in education, offering educators guidelines on effectively using AI as a supportive tool while preserving their pedagogical autonomy to foster personalized learning in students with learning disabilities.

2. Methodology

2.1. Research design and data collection:

This study employs a quantitative research method, using a comprehensive questionnaire to examine the role and effectiveness of AI-based personalized learning tools for students with learning disabilities. It focuses on gathering detailed quantitative data from teachers and therapists to understand their experiences and perceptions of these tools. The questionnaire is designed to

capture a wide range of information, including the frequency and context of AI tool usage, the perceived benefits and challenges, and the overall impact on student learning outcomes and engagement. In order to provide a thorough analysis of how AI tools are being integrated into inclusive educational settings and their effectiveness in supporting students with learning disabilities.

To gather data for this study, a structured questionnaire was developed. The questionnaire is clear, concise, and easy to complete, ensuring high response rates and reliable data.

The questionnaire was administered using a secure, encrypted online survey platform, ensuring important data protection during both collection, storage and analysis. Additionally, participants were instructed not to include any identifying information, to maintain anonymity.

Participants were informed about the anonymity of the questionnaire during the consent process, ensuing that their responses will remain confidential. Participation was entirely voluntary. The questionnaire consisted of 6 main sections to comprehensively cover all aspects and variables relevant to the subject under investigation:

- Section 1: The role of the participant in the educational system.
- Section 2: The attitude towards personalized learning for students with learning disabilities.
- Section 3: The reliability of the AI tools used in creating personalized teaching.
- Section 4: The experience in AI and its applicability in the educational setting.
- Section 5: The effectiveness of the AI-tools in student's performance.
- Section 6: The challenges encountered.

To measure the attitudes and perceptions of the teachers and therapists, 2 types of questions were used: Linkert-Scale question (805% of the questions), and open-ended questions (20% of the questions).

2.2. Validity and reliability:

The questionnaire was reviewed by three experts: two university professors specializing in special education, and one university professor specializing in adaptations and the use of technology in

special education. This review ensured that all relevant aspects and variables were included. Additionally, a pilot test was conducted with a small, representative sample of seven teachers and therapists working in inclusive schools with students with learning disabilities. This pilot test was conducted to ensure the reliability of the tool.

2.3. Population:

The study was conducted across five inclusive schools, comprising 4 private and 2 public institutions located in the Beirut area, Mount Lebanon, Metn and Keserwan. All these schools have integrated technology into their teaching and educational practices. Participants included 60 elementary teachers and 15 therapists who work with students with learning disabilities. The sample was selected based on specific criteria to ensure diverse representation from different schools, thereby allowing an analysis of the influence of context on the use of technology. The sample includes teachers from various subjects and grade levels within elementary education, recognizing that this group represents a particularly challenging population in special education requiring personalized learning approaches. The diverse backgrounds of the teachers, who spend significant time with their students, provide valuable insights into the practical implications of using AI to create personalized content for students with learning disabilities. The therapists play a crucial role in bridging the gap between teachers and students, ensuring necessary adaptations and support.

3. Results:

This study showed that:

All participants, teachers and therapists, consistently rated the importance of personalized learning approaches very highly. The average rating on a Likert scale (1 = not important, 5 = very important) was 4.52; indicating a strong agreement on the significance of personalized strategies in educational settings (see Table 1).

Table 1: Distribution of Teachers' and Therapists' Agreement on Personalized Learning for Students with Learning Disabilities from 1-5 (Strongly disagree to Strongly agree); n=75
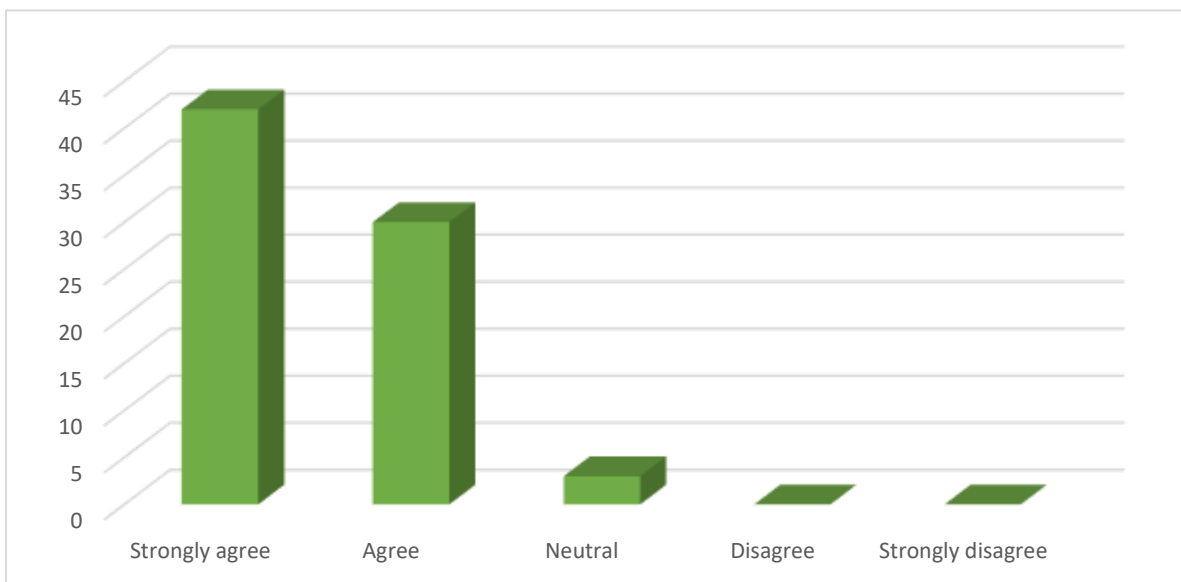

participants, teachers and therapists, agreed that artificial intelligence tools had an average level of reliability in creating and insuring personalized learning for students with learning disabilities in general, with a reported reliability rate of 56% on average among 9 items; and range from 68% - 76% with an average of 67.2% among 5 items, (see table 2); AI tools is beneficial in catering to various learning styles (visual, auditory, kinesthetic) scored the highest at 76%; Providing differentiated instruction, offering targeted support for specific learning challenges, and creating a more self-paced learning environment scored the lowest at 40%.

Regarding experience with AI and its applicability in educational settings, the study revealed that 80% of participants have experience with AI tools. However, only 20% of them apply this experience in their practice. This indicates a significant gap between experience with AI and its actual implementation in educational practice, (see table 2).

Table 2: Percentage of reliability and applicability of the 9 advantages of using AI-tools to foster personalized learning for students with learning disabilities.
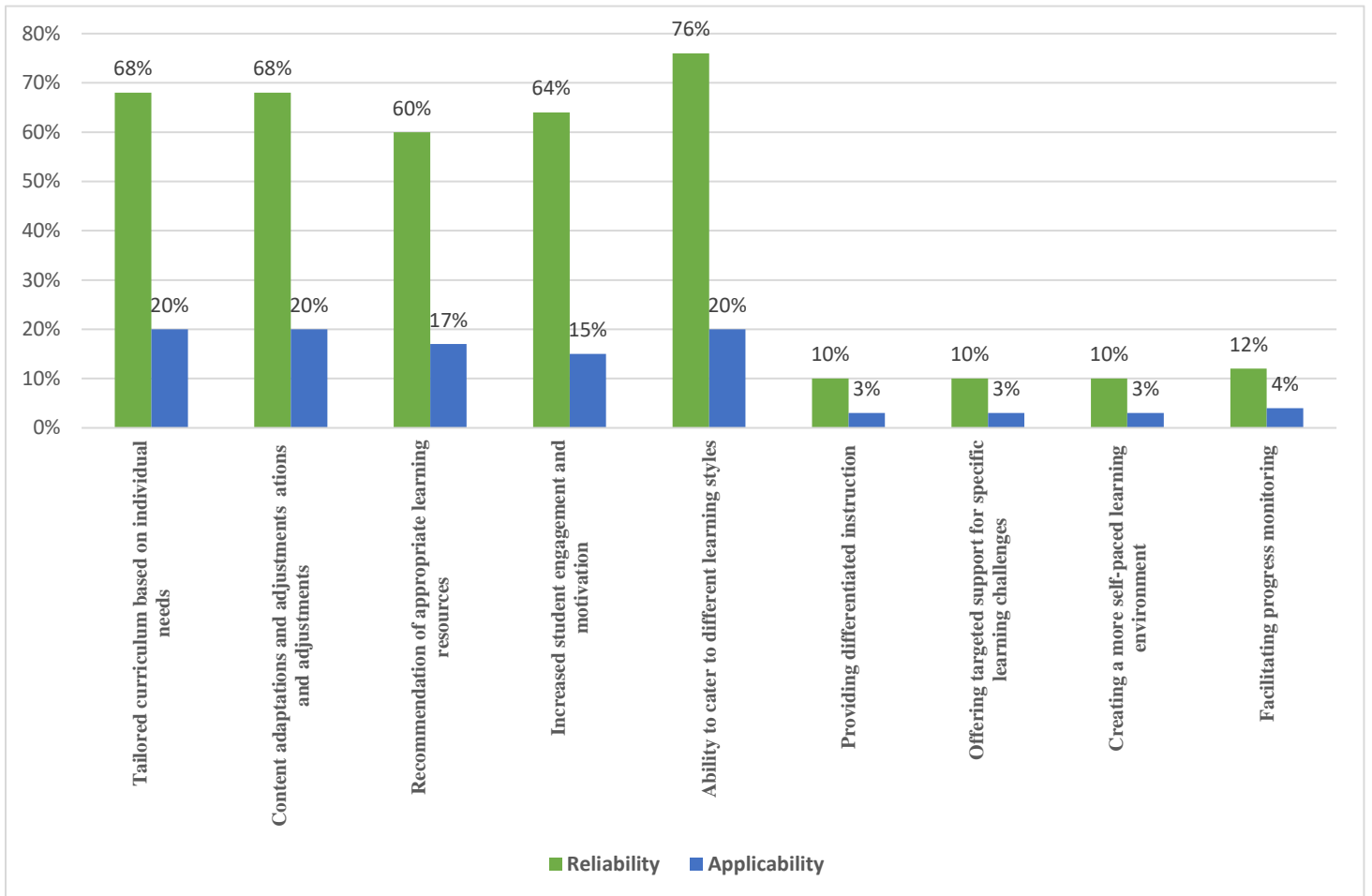
The 20% of the teachers and therapists who implemented AI tools reported high impact of AI use in 2 main areas: Learning (Mean = 4.20) and Engagement (Mean = 3.87) rated the highest, indicating significant perceived benefits of AI tools in these areas; a moderate impact on: Attention (Mean = 3.73) which is rated moderately high, suggesting that AI tools are somewhat effective in maintaining student attention; however it showed low impact on : communication (Mean = 2.27)

and identifying specific struggles (Mean = 2.13) indicating that participants found AI tools less effective in these aspects (see table 3).

Table 3: The impact of the AI tools use on student's performance in different areas, based on the teacher's perception and the therapist's assessments

	N	Minimum	Maximum	Mean	Std. Deviation
Learning	15	3	5	4.20	.676
Engagement	15	1	5	3.87	1.302
Attention	15	2	5	3.73	.961
Communication	15	1	4	2.27	.884
Identifying_specific_struggles	15	1	4	2.13	1.060
Valid N (listwise)	15				

Regarding the challenges encountered in the implementation and use of AI, 75% reported reported issues related to a lack of training about the tool, and 68% the lack of compatibility with the existing curriculum (see Table 4).

Table 4: percentage of the challenges encoutered
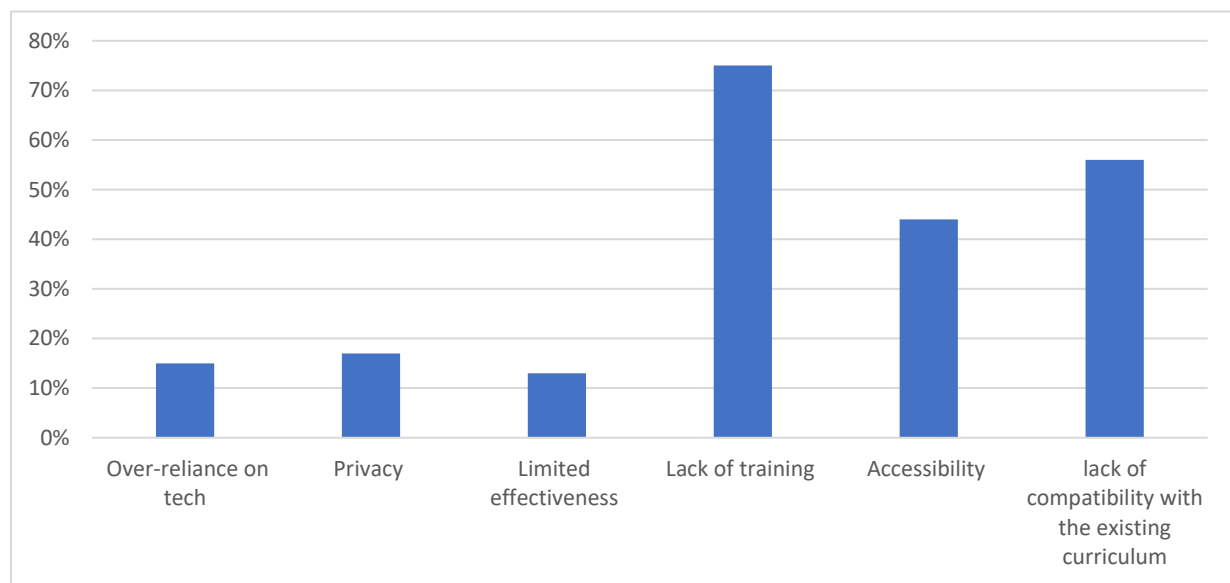
4. Discussion:

The study findings revealed widespread agreement among participants regarding the importance of personalized learning for students with learning disabilities. However, there was a lack of compatibility in the perceived reliability of AI tools to ensure personalized learning in general. Overall, the reliability score was relatively low at 54%. However, the study identified moderate reliability in five specific areas over 9, where AI tools can be integrated, aligning with the criteria and goals of personalized learning for students with learning disabilities. This means there are specific contexts and applications where they are viewed more favorably according to the teachers and therapists working in inclusive schools with students with learning disabilities: Creating a tailored curriculum, Adapting and adjusting educational content for students, providing students with appropriate resources, catering content to respond to different learning styles for students with learning disabilities and increasing student's engagement and motivation.

This can be considered an expansion of the modern roles of teachers as described in the literature review.

These findings confirm the hypotheses that the integration of AI-powered personalized learning tools can significantly alleviate difficulties faced by students with learning difficulties (LD) and that the use of AI in automating tasks for teachers can enhance the inclusivity and effectiveness of learning environments. AI can provide multiple means of engagement as described in the literature review, making learning more accessible and effective for students with learning disabilities; The participants reported a high reliability rating (76%) in catering to various learning styles supporting this hypothesis.

The study highlights a significant gap between educators' experience with AI tools and their application in educational practice. While 80% of teachers and therapists working with students with learning difficulties reported having experience with AI, only 20% of them applied this experience in their practice.

The challenges reported by participants, such as the lack of training and compatibility issues with the existing curriculum, may help explain the gap between educators' experience with AI and its application in practice.

In contrast, the study found that the 20% of participants who applied AI tools in their practice reported satisfactory results in student engagement and learning outcomes. This suggests that,

despite the challenges faced in implementing AI, its effective use can lead to positive outcomes for students with learning disabilities. These findings support the hypothesis that AI can help organize information better and make learning environments more inclusive and effective, at the same time it underscores the potential of AI tools to enhance personalized learning experiences and improve educational outcomes, highlighting the importance of addressing barriers to their implementation.

5. Conclusion:

Despite the increasing integration of AI techniques into educational research (Jin, 2023) the overall reliability and applicability of AI tools in ensuring this personalized approach is still low to moderate in inclusive schools in Lebanon. Although AI tools demonstrate high effectiveness and promising results in improving student learning outcomes, performance, and engagement;

A significant gap exists between educators' familiarity, experience and perception of the effectiveness of AI and its practical application in educational settings. While 80% of the teachers and therapists have experience with AI, only a small fraction of 20% apply these tools in their classrooms. This discrepancy is primarily due to barriers such as insufficient training and compatibility issues with existing educational frameworks.

To fully benefit from the potential of AI in inclusive education, it is essential to address the identified barriers through awareness sessions, training programs for educators, better integration of AI tools into curricula.

Additionally, future research should focus on identifying specific AI applications that are compatible with the Lebanese educational system to facilitate their seamless integration.

References

A practical reader in universal design for learning2006*Harvard Education Press.*pp. vii–xi

AI in Education: Personalized Learning and Adaptive Assessment2023*Research gate*

1994 *Creating inclusive college classrooms* Ann Arbor: University of Michigan

Design for classroom orchestration. 2013*Computers & Education*69, 485–492.

Exploring the impact of artificial intelligence on teaching and learning in higher education.2017*Research and Practice in Technology Enhanced Learning*12(1), 22.

Redefining the role of teachers in the digital era. 2016 *The International Journal of Indian Psychology,* 40-45

Supporting students' self-regulated learning in online learning using artificial intelligence applications. 2023*International Journal of Educational Technology in Higher Education*20(1), 37

Teaching reading comprehension strategies to students with learning disabilities: A review of research. 2001*Review of Educational Research,*71(2), 279–320.

Technology in the Classroom: The Teacher's New Role and Resistance to It1993*Education, Computer Science*26-31

2022*The Lebanese National Framework Fot the General Education Curriculum*Beirut

Transforming Education: AI-Powered Personalized Learning Revolution2023*Techopedia*

UDL and intellectual disability: What do we know and where do we go? 2017*Intellectual and Developmental Disabilities,*55, 37–47.

UNESCO1994*The Salamanca Statement and Framework for action on special needs education: Adopted by the World Conference on Special Needs Education, Access and Quality*Paris: UNESCO

UNESCO2017*A Guide for Ensuring Inclusion and Equity in Education*Paris: UNESCO

*Universal design for learning: Theory and practice.*2014 CAST Professional Publishing.