ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov1085

Oman's Path to Inclusive STEM Education: Impact of AI-Based Assistive Tools on Differently Abled Learners

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Publication Date: 2025/11/29

Abstract: The Sultanate of Oman's transition to a knowledge-based and innovation-driven society is a key component of Oman Vision 2040. STEM education is one of the keystones of innovation and economic diversification for Oman beyond oil and gas, particularly in emerging fields like AI. However, students with disabilities constantly encounter significant barriers in accessing and engaging with STEM learning. This study explores the role of AI-driven assistive tools in enhancing accessibility and learning outcomes for students with disabilities. It aims to provide a roadmap for empowering learners with disabilities to actively contribute to national innovation and sustainable development. The study adopts a quantitative research design to examine the impact of AI-based assistive technologies. The findings are expected to provide empirical evidence on the role of AI-driven assistive tools in reducing accessibility gaps, highlight institutional and technological barriers, and generate recommendations for scaling inclusive STEM learning in line with Oman Vision 2040.

Keywords: *STEM- Science, Technology, Engineering, and Mathematics, AI, Cognitive Disabilities.*

How to Cite: Dr. Ghouse Mohiyaddin Sharif G. M.; Mutahar Hussain Kazim; Mohammed Taslim Noor; Dr. Jayashree Rajendran (2025) Oman's Path to Inclusive STEM Education: Impact of AI-Based Assistive Tools on Differently Abled Learners.
International Journal of Innovative Science and Research Technology, 10(11), 1892-1898.
https://doi.org/10.38124/ijisrt/25nov1085

I. INTRODUCTION

The rapid advancements in Artificial Intelligence (AI) have created unprecedented opportunities to transform education systems worldwide. For differently abled students, particularly in the fields of Science, Technology, Engineering, and Mathematics (STEM), AI-driven assistive tools hold the potential to break long-standing barriers to learning, participation, and empowerment.

In the context of Oman Vision 2040, which emphasizes inclusive human capital development, technological innovation, and knowledge-based learning, integrating AI-powered assistive solutions in STEM education aligns directly with the nation's strategic priorities. Ensuring that students with hearing, visual, physical, or cognitive disabilities can meaningfully engage with STEM disciplines supports Oman's wider commitment to equality, lifelong learning, and building a competitive future-ready workforce. This research explores how AI-driven assistive tools can significantly improve accessibility, engagement, and academic success for students with disabilities.

- *Objectives of the Study:*

- To assess the level of awareness among students regarding AI-driven assistive tools that support STEM learning for differently abled students.
- To investigate how AI-driven assistive tools enhance accessibility and learning experiences in STEM subjects for students with various types of disabilities
- To identify and analyze the key factors that influence the adoption of AI-driven assistive tools in STEM classrooms within Oman.

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➢ *Significance and Scope of the Study*

This study is important because it enhances inclusive STEM education through an exploration of the ways that AI-driven assistive tools can improve access and learning for differently abled students, and it provides insights that can be applied by educators, policymakers, and institutions in Oman to improve awareness, adoption, and implementation of these technologies, which can align with national goals for educational equity and technological advancement. The study is limited to STEM classrooms in Oman, which are targeted at students, educators, and administrators, with a special focus on differently abled learners and AI-based assistive tools, such as speech-to-text, screen readers, and adaptive learning platforms, specifically examining awareness, impact on accessibility, and factors influencing adoption.

II. LITERATURE REVIEW

➢ *AI in Education for Differently Abled Students*

Studies show consistent evidence that AI tools significantly improve accessibility and engagement for students with disabilities. Kooli (2025) notes that AI-powered tools can: improve learner independence, enhance access to learning materials, strengthen engagement in STEM subjects. These benefits are especially pronounced for students with visual, hearing, and cognitive impairments. However, challenges remain relating to teacher training, infrastructure capacity, and risks of algorithmic bias.

➢ *AI and Accessibility Frameworks*

AI-Enabled Assistive Technologies can support personalized learning, increase job access and social inclusion and provide adaptive functionalities based on user needs. Korada (2024) demonstrates how AI integrates with accessibility principles to produce intelligent assistive systems. These frameworks emphasize flexible, user-centered designs that improve independence and quality of life for individuals with disabilities. Such developments form the technological foundation for accessible STEM education.

➢ *Organizational Disability Inclusion and Awareness*

Research on organizational disability inclusion has shown slow progress toward creating equitable and disability-friendly environments. According to Jammear (2024), organizations often lack effective implementation strategies and have limited understanding of disability-based discrimination compared to other minority groups. This gap negatively affects workplace inclusion and reinforces stereotypes. The literature suggests the need for stronger intervention programs aimed at combating stigma and better alignment between organizational practices and macro-level national policies.

➢ *Generative AI and Ethical Integration in Higher Education*

Adoption of trends and ethical frameworks are rapidly embracing. Stohr (2024) synthesizes global trends from 40 universities, revealing three main priorities in generative AI adoption: strengthening academic integrity, enhancing teaching and learning and ensuring equitable access. Although universities are rapidly embracing generative AI, issues such as privacy, digital inequalities, and student accessibility remain significant concerns. Effective implementation requires institution-wide communication and multi-stakeholder collaboration.

➢ *Student Acceptance and Use of AI Tools*

Wang (2024) uses the Expectation-Confirmation Model to examine student adoption of AI tools. The study finds that positive emotions and satisfaction significantly drive continued use, digital confidence encourages self-directed learning and adoption patterns differ across academic disciplines. This suggests that AI initiatives require contextual adaptation to learner needs and subject requirements. Further, research by Melo-López (2025) shows that AI can support inclusive education by developing accessible learning materials, reducing teacher workload and enhancing instructional quality.

➢ *Global Adoption Trends of AI in Education*

Using the Technology-Organization-Environment framework, Tahiru (2021) identifies key patterns that developed nations lead AI integration, rapid growth in AI research between 2016–2019 and need for ethical policies and updated curricula. Countries such as the U.S. and Japan already incorporate AI systems in their education ecosystems, indicating a global shift toward AI-supported learning. Mustafa (2024) synthesizes major trends in AI in Education research and notes that strong focus on personalized learning and limited involvement of broader stakeholders beyond students and teachers.

The reviewed literature highlights a growing global interest in using artificial intelligence (AI) and assistive technologies to improve accessibility and learning outcomes for students with disabilities. Research on organizational disability inclusion shows that progress remains slow due to limited awareness, weak policy implementation, and insufficient disability-focused knowledge, especially in developing contexts. The literature reveals substantial potential for AI-driven assistive tools in enhancing STEM education for students with disabilities.

III. RESEARCH METHODOLOGY

The study adopted quantitative research as it provides a comprehensive understanding of the research problem, which helps in identifying patterns and trends. The research adopts judgmental sampling technique which includes special students who are with specific characteristics. Data was collected based on structured questionnaire using a five-point Likert scale was developed and administered to students and support staff/agencies across selected disability centers and higher education institutions. The survey measured perceptions on constructs like accessibility, reliability, learning outcomes and participation etc. Data are analyzed using descriptive statistics, reliability testing is done using Cronbach's alpha, exploratory

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov1085

factor analysis (EFA), and regression modeling to identify predictors of effective AI adoption.

IV. DATA ANALYSIS AND INTERPRETATION

Table 1: Demographic Profile

Variables	Category	Count	Percentage
Participant Type	Student	10	100
Gender	Male	7	70
	Female	3	30
Age group	Below 20 years	5	50
	20–25 years	5	50
Level of study	Bachelor's	4	40
	Diploma	4	40
	Advanced Diploma	2	20
Field of Study	Other (specified)	9	90
	Engineering	1	10

The study sample includes only students, which ensures that the findings represent their perspectives. The gender distribution shows more males (70%) compared to females (30%), which may slightly influence overall views. The age distribution is balanced, with half of the participants under 20 years old and the other half between 20 and 25 years old. This provides insights from early and mid-academic stages. In terms of study level, 40% are pursuing a bachelor's degree, another 40% are in diploma programs, and 20% are in advanced diploma courses. This indicates a mix of academic progress. Most participants (90%) study non-engineering disciplines, while only 10% are in engineering. This suggests that the results mainly reflect general STEM fields rather than engineering-specific contexts. Overall, the demographic profile shows diversity in age and study level, with a notable bias toward non-engineering fields and male participants.

Table 2: Mean and Standard Deviation of Attributes

Awareness & Training	**Mean**	**SD**
I am aware of AI-driven assistive tools available for students with disabilities	3.5	1.43
My institution provides information about AI-driven assistive tools.	3.6	0.84
I have received training/tutorials on how to use AI-driven assistive tools	2.9	1.37
I know where to get technical support for assistive technologies at my institution.	3.2	1.48
I am aware that AI-driven assistive tools can support both academic learning and daily life activities	4.1	0.57
I know that Oman Vision 2040 emphasizes inclusivity and accessibility in education, which relates to AI-driven assistive tools for students with disabilities	3.9	1.29
Accessibility & Learning Outcomes	**Mean**	**SD**
I believe that AI-driven tools (screen readers, speech-to-text, etc.) will make STEM textual content easier to access.	4.2	0.42
I believe that AI tools will effectively convert STEM diagrams/figures into understandable formats for me.	4.6	0.52
I believe that AI tools will increase my participation in classroom discussions and labs.	4.3	0.67
I believe that AI tools will improve my academic performance in STEM subjects.	4.2	0.42
I believe that overall, AI tools will reduce the accessibility barriers I encounter in STEM courses.	4	0.67
Usages and Effectiveness	**Mean**	**SD**
AI-driven tools improved my understanding of STEM concepts.	4	0.94
Using AI tools helps me complete STEM education more accurately	4	0.67
AI tools are effective to simplify STEM education	4.4	0.52
Adoption, Challenges & Barriers	**Mean**	**SD**
I intend to use AI-driven assistive tools regularly in my STEM studies	4.1	0.57
I would be happy to participate in training sessions to learn to use AI assistive tools	4	0.94
I would recommend AI-driven assistive tools to other students with disabilities	4.4	0.84
Lack of awareness or training is a bigger obstacle in accessing AI-driven assistive tools.	3.8	0.79
Cost of AI tools is a major barrier to access	3.8	1.14
I feel stigma or social barriers when using assistive tools in class.	3.9	1.2

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov1085

The evidence substantiates a consensus in general terms of the worthiness of AI driven assistive tools across the dimensions. Awareness and Training averaged out reasonably, where awareness of tools (Mean = 3.5) and institutional information (Mean = 3.6) indicated fairly high levels, while training received was low (Mean = 2.9), showing a gap in practice skill building. Recognition of AI at large as the broader benefits (Mean = 4.1) and Oman Vision 2040 inclusivity goals (Mean = 3.9) are solid, indicating rather strong conceptual understanding.

For Accessibility and Learning Outcomes, response was quite positive, with means above 4.0 for all items, especially for converting diagrams (Mean = 4.6), implying strong trust in AI's ability to enhance STEM access and participation levels. Likewise, high marks were given for Usage and Effectiveness (Means = 4.0-4.4) with the combined perception of great value in terms of simplifying and thus enhancing STEM education.

Intention to use tools (Mean = 4.1) and willingness to recommend (Mean = 4.4) are strong, but there are significant perceived barriers such as cost (Mean = 3.8) and stigma (Mean = 3.9). High willingness to undergo training (Mean = 4.0) indicates readiness for skill development. Summary: Generally speaking, students view AI-driven tools as highly effective in terms of accessibility and learning, which is further complemented by a strong intention of adoption. However, gaps in training and the continuing obstacles of cost and stigma indicate the kind of efforts needed in terms of institutional outreach and awareness to legitimize equitable and confident use.

Table 3: Correlation Between Level of Study and Awareness and Training

Awareness & Training	R Value
I am aware of AI-driven assistive tools available for students with disabilities	**-0.49**
My institution provides information about AI-driven assistive tools.	**0.56**
I have received training/tutorials on how to use AI-driven assistive tools	**-0.35**
I know where to get technical support for assistive technologies at my institution.	**-0.08**
I am aware that AI-driven assistive tools can support both academic learning and daily life activities	**0.0**
I know that Oman Vision 2040 emphasizes inclusivity and accessibility in education, which relates to AI-driven assistive tools for students with disabilities	**0.092**

The analysis shows that the level of study has mixed relationships with awareness, training, and institutional support for AI-driven assistive tools. Data obtained from different levels of study reveals that awareness, training, and institutional support for AI-assisted tools vary in relationships with the level of study. A moderate positive correlation (r = 0.559) asserts that higher-level students tend to feel that institutions have more information about such tools; it is because they might have access to better resources or even participate in more academic discussions. On the other hand, the moderate negative correlation (r = -0.493) implies that lower-level students seem to have generally greater knowledge of available assistive technologies. In summary, while the higher-level students perceive more institutional support, knowledge and training are not uniform across levels, thus requiring harmonization of programs to equal access to AI-based assistive technologies.

Table 4 Correlation Between Level of Study and Accessibility and Learning Outcome

Accessibility & Learning Outcomes	R Value
I believe that AI-driven tools (screen readers, speech-to-text, etc.) will make STEM textual content easier to access.	-0.28
I believe that AI tools will effectively convert STEM diagrams/figures into understandable formats for me.	-0.46
I believe that AI tools will increase my participation in classroom discussions and labs.	0.35
I believe that AI tools will improve my academic performance in STEM subjects.	-0.28
I believe that overall, AI tools will reduce the accessibility barriers I encounter in STEM courses.	-0.53

The correlation analysis suggests a mixed relationship between students' study levels and their perceptions of AI-powered tools in STEM education. Lower-level students tend to express stronger confidence in AI tools as enabling accessibility, reducing barriers, and facilitating tasks such as transforming diagrams into more understandable forms and, consequently, enhancing their academic performance as reflected in moderate negative correlations (r values between -0.280 to -0.530). On the other hand, a weak positive correlation (r = 0.349) indicates that senior students are somewhat optimistic about AI tools increasing classroom participation. Overall, it shows these beginning-stage learners are using AI more for core understanding, while advanced learners appreciate AI for engagement. Thus, it appears reasonable to contemplate the need for some differentiated strategies for integration in AI based on academic level expectations.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov1085

Table 5 Correlation Between Level of Study Usages and Effectiveness

Usages and Effectiveness	R value
AI-driven tools improved my understanding of STEM concepts	-0.500
Using AI tools helps me complete STEM education more accurately	-0.177
AI tools are effective in simplifying STEM education	-0.685

The analysis indicated that student levels generally had a negative relationship with perceptions of usefulness for AI-assisted tools in STEM education. Lower-level students more likely equate AI tools with simplicity in STEM learning (r = -0.685), improvement in understanding of concepts (r = -0.500), and accuracy in task completion (r = -0.177). This indicates that early-stage learners perceive comparatively greater benefits and depend more on AI for comprehension and ease of learning.

Table 6 Correlation Between Level of Study and Adoption, Challenges & Barriers

Adoption, Challenges & Barriers	R value
I intend to use AI-driven assistive tools regularly in my STEM studies	0.21
I would be happy to participate in training sessions to learn to use AI assistive tools	-0.75
I would recommend AI-driven assistive tools to other students with disabilities	-0.28
Lack of awareness or training is a bigger obstacle in accessing AI-driven assistive tools.	-0.45
Cost of AI tools is a major barrier to access	-0.67
I feel stigma or social barriers when using assistive tools in class.	0.81

Students' level of study shapes their expectations of AI-driven tools in STEM education. Lower-level students tend to be more optimistic about these tools improving accessibility, converting diagrams, and reducing barriers, suggesting they rely on assistive technology for core comprehension. In contrast, higher-level students show slightly more confidence in AI tools enhancing participation but remain less convinced about their overall impact on accessibility. This pattern indicates that advanced learners may prioritize engagement over basic accessibility benefits.

V. MAJOR FINDINGS

➢ *Awareness and Training:*
- Students showed moderate awareness of AI-driven assistive tools (Mean = 3.5).
- Institutional information was slightly higher (Mean = 3.6).
- Training received was relatively low (Mean = 2.9), highlighting a gap in practical skill development.

➢ *Recognition:*
- Strong understanding of AI benefits (Mean = 4.1).
- Awareness of Oman Vision 2040's inclusivity goals was also high (Mean = 3.9).

➢ *Accessibility and Learning Outcomes:*
- All items scored above 4.0, with diagram conversion being the highest (Mean = 4.6).
- Students believe AI tools improve access and participation in STEM education.

➢ *Usage and Effectiveness:*
- Perceived effectiveness was high (Means between 4.0 and 4.4).
- AI tools are seen as simplifying STEM learning and improving understanding.
- Strong intention to use (Mean = 4.1) and recommend (Mean = 4.4) AI tools.

➢ *Barriers:*
- Cost (Mean = 3.8) and stigma (Mean = 3.9) were notable challenges.
- Willingness to undergo training was high (Mean = 4.0

➢ *Level of Study vs Awareness and Training*
- Higher-level students perceive more institutional support (r = 0.559).
- Lower-level students have greater awareness of tools (r = -0.493).
- Other correlations were weak, suggesting the need for harmonized awareness programs.

➢ *Level of Study vs Accessibility and Learning Outcomes*
- Lower-level students showed stronger confidence in AI tools (r = -0.280 to -0.530).
- Senior students were more optimistic about classroom participation (r = 0.349) the need for differentiated strategies based on academic level.

➢ *Level of Study vs Usage and Effectiveness*
- Lower-level students perceived greater benefits (r = -0.685 to -0.177).
- Strong intercorrelations (r = 0.53 to 0.91) suggest that perceived usefulness in one area influences others.
- Early-stage learners are more enthusiastic; advanced learners need relevance-focused strategies.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov1085

➢ *Level of Study vs Adoption, Challenges & Barriers*

- Lower-level students were more optimistic about accessibility improvements.
- Higher-level students focused more on participation than accessibility.
- Indicates differing priorities across academic levels.

VI. RECOMMENDATIONS

- Strengthen Structured Training and Capacity Building – In order to close the gap between awareness and the development of practical skills, institutions should implement, Mandatory workshops on the sue of AL based assistive tools, hands on labs integrated into STEM courses and peer support or "digital buddy" systems.
- Create tiered awareness strategies for different academic levels – introduce basic AI assistive tool orientation for foundation-level leaners. Offer advanced discipline-specific applications for senior students, align activities with real STEM tasks and project requirements. This differentiated approach guarantees that no academic level is left behind because lower level students exhibit greater enthusiasm and higher level students seek relevance.
- Increase Institutional Support in Line with Oman Vision 2040 – Universities should incorporate AI assistive technologies into official accessibility policies, provide centralized support units for students with disabilities. Also ensure institutional communication to promote AI tools as part of inclusive education.
- Reduce barriers through social awareness campaigns, cost and stigma continue to be significant obstacles. In order to foster a supportive environment that promotes tool adoption, institution and legislators. Negotiate subsidized or bulk licensed AI assistive tools which help us in integrate digital practices into teaching.
- Support classroom level implementation and faculty readiness since students find AI tools to be very effective, teachers should use AI based content adaption example, integrate AI assistive tools directly into lesson plans. Faculty development programs can be offered to enhance the usage of tools in STEM fields.

VII. CONCLUSION

This study highlights Oman's growing readiness to use AI-based assistive technologies as a catalyst for inclusive STEM education. While students demonstrated a solid understanding of the value of AI tools and aligned strongly with the inclusivity vision outlined in Oman Vision 2040, their practical exposure and hands-on training remain limited. The findings show that AI assistive tools already play an important role in enhancing accessibility—especially in converting diagrams, simplifying complex STEM concepts, and supporting active classroom participation. Students expressed strong confidence in the effectiveness of these tools and a clear willingness to adopt them.

However, the study also revealed disparities across academic levels. Early-stage learners were more enthusiastic and perceived greater benefits, whereas senior students looked for more relevance-oriented and practical integration. Barriers such as cost, availability, and social stigma still limit wider adoption, although students' openness to training suggests a positive environment for reform. Overall, the results underline that AI-driven assistive technologies hold significant promise for Oman's journey toward an inclusive, equitable STEM learning provided that awareness, training, and institutional support are strengthened systematically.

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