Available online at www at www.jeltl.org
doi: http://dx.doi.org/10.21462/jeltl.v10i2.1610

Journal of English Language Teaching and Linguistics, 10 (2), 2025

The Use of AI in Supporting Neurodivergent Students: A Multilingual Classroom Study

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Received 17 May 2025| Received in revised form 16 June 2025 | Accepted 29 June 2025

APA Citation:
Lahmiyed, Y., Anasse, K., & Slimani, N. (2025). The Use of AI in Supporting Neurodivergent Students: A Multilingual Classroom Study. *Journal of English Language Teaching and Linguistics, 10(2), 2025,* 279-287. doi: http://dx.doi.org/10.21462/jeltl.v10.i2.1610

Abstract
This study examines the effectiveness of AI tools' integration into inclusive multilingual classroom settings, specifically in helping neurodivergent students. Research has shown that many students with Asperger's Syndrome often face difficulties with language and social interaction, especially in multilingual classrooms. These challenges not only affects their academic performance but also hinders their ability to connect with others. This study explores how Artificial Intelligence (AI) can be used to support Neurodivergent students, with a focus on a particular group of Asperger's Syndrome, through tools that are sensitive to language needs and tailored to individual learning profiles. The study conducted its research in a Moroccan private multilingual school, specifically in the region of Tangier-Tetouan-Al Hoceima, and draws on a mix of both qualitative and quantitative methods. It focuses on how AI tools; such as language learning apps, speech-to-text programs, and adaptive learning platforms, can support inclusion and engagement in the classroom. Moreover, data was gathered through case studies, interviews with teachers and parents, and classroom observations. Preliminary findings have shown that AI tools can support students in understanding language, improving their communication skills, and becoming more active in their learning. Teachers have also noticed that students responded positively to personalized learning experiences offered through AI and became more autonomous. These results suggest that AI has positively impacted education into a more inclusive setting by offering flexible and accessible support, especially for neurodivergent learners. This study also emphasizes the need for educational policies that recognize the value of technology in diverse classrooms. It offers

practical insights for creating learning environments that are more responsive, equitable, and supportive for all students.

Keywords: Artificial Intelligence (AI), Asperger's Syndrome, Autism Spectrum Disorder (ASD), Inclusive Education, Language-Sensitive Support

1. Introduction

Students with Autism Spectrum Disorder (ASD) face unique challenges in accessing inclusive educational opportunities. Finding schools that invite all students into inclusive multilingual classrooms is a challenge in Morocco but not impossible as awareness has increased and many schools have embraced the unique needs of each of their learners. This study focuses on a particular group within ASD who continuously struggle in both academic and social skills. These students diagnosed with Asperger's Syndrome often struggle in understanding language, communicating effectively, and navigating social situations (Klin et al., 2007). These learners often find difficulties with both verbal and non-verbal communication. Interpreting social cues, and experiencing language delays, are some challenges that these students face which can often create barriers to their learning and forming peer relationships (Happé, 1994). The primary focus of this study is to explore how we can better accommodate students diagnosed with Asperger's Syndrome using Artificial Intelligence (AI) tools and address their diverse needs.

This article examines the way AI may be used to adapt and provide customized learning experiences that assist neurodivergent students, particularly individuals diagnosed with Asperger's Syndrome (Chen, 2019). However, despite the growing usage of AI in the classroom, minimal research is done on how well AI technology can support this particular student group, especially in environments with a high level of language and cultural diversity.

Multilingual classrooms can be very enriching but can add another layer of complexity for students with Asperger's Syndrome. While already dealing with many challenges, being in a multilingual classroom would require them to navigate not only cognitive and social challenges but also linguistic ones (Bialystok, 2009). While traditional and conventional support strategies such as speech therapy and Individualized Education Programs (IEPs) have shown merit, they often fall short in addressing the specific language-related difficulties faced by students in these multicultural educational settings (Klingner & Vaughn, 2003). This highlights the need for innovative, linguistically responsive approaches that can harness the capabilities of AI to better support students with Asperger's Syndrome.

Moreover, this study explores the potential of AI in providing targeted, language-sensitive support for students with Asperger's Syndrome in multilingual inclusive classrooms. With a focus on AI tools such as language learning applications, speech-to-text software, and adaptive learning platforms, this research seeks to contribute to the development of more inclusive and linguistically responsive educational practices.

The primary objectives of this study are as follows:

1. To explore and examine the challenges students with Asperger's Syndrome are facing in multilingual inclusive classrooms.
2. To examine the effectiveness of implementing AI tools into multilingual inclusive classrooms, especially in supporting students with Asperger's.

3. To analyze the perceptions of both teachers and parents in regard to AI implementations in education settings.

This study aims to bridge this gap by exploring the following research questions:

1. How does the implementation of AI tools affect the learning experiences of neurodivergent students in multilingual classrooms?
2. What are the perceptions of educators regarding the efficacy of AI in supporting neurodivergent learners in linguistically diverse settings?
3. What challenges and opportunities arise from integrating AI technologies in multilingual classrooms catering to neurodivergent students?

This article is structured as follows: The first section covers the rationale and background of this study. It also includes background literature of the specific challenges students with Asperger's Syndrome face daily in Multilingual classrooms. It also explores the role of AI technologies in supporting students with ASD, specifically students diagnosed with Asperger's Syndrome. The methodology section describes in detail the investigation techniques used; qualitative and quantitative methods; in order to analyse and collect this study's data. This is then followed by presenting the study's results; both qualitative and quantitative; by highlighting the impact of AI use in multilingual classrooms on supporting students with ASD. The discussion section interprets the findings in light of existing research. Finally, this article concludes with key findings and offers suggestions for future research.

2. Literature Review

AI technologies have rapidly transformed modern education, with a strong emphasis on inclusion. AI-driven platforms such as adaptive learning systems, speech recognition tools, and intelligent tutoring systems are designed to personalize instruction and improve accessibility for diverse learners (Holmes et al., 2022; Zhang & Da Costa, 2020). These technologies are particularly beneficial in supporting students with neurodevelopmental conditions who require individualized learning strategies (Chounta & Avouris, 2019).

Several studies (e.g., Al-Azawei et al., 2021; Malik & Akram, 2022) have shown that AI can enhance engagement and learning outcomes among students with Autism Spectrum Disorder (ASD) and ADHD by offering visual, auditory, and tactile inputs tailored to learner profiles. AI's potential to track learning behavior in real-time also allows educators to adjust instruction and support accordingly (Lai & Hwang, 2019).

Neurodivergent students often struggle with communication, emotional regulation, and cognitive overload in traditional classroom environments (Gul et al., 2020). AI-powered systems like emotion recognition software, text simplification engines, and customized learning analytics platforms have demonstrated promise in reducing such barriers (Zhao et al., 2023; Costa et al., 2021). For example, the use of conversational agents (chatbots) has been shown to support social development in learners with Asperger's Syndrome by simulating structured peer interactions (Yin et al., 2020). Meanwhile, AI tools like CoWriter and Ghotit have improved literacy and writing outcomes for students with dyslexia and speech-language disorders (Kozleski & Waitoller, 2021).

AI applications are also valuable in multilingual education, offering real-time language translation, pronunciation coaching, and vocabulary scaffolding (Li et al., 2022; Kohnke et al., 2021). Tools such as Google Translate, LingQ, and speech-to-text platforms help learners access content and participate more confidently in instruction delivered in unfamiliar languages (Dizon, 2020).

Furthermore, in multilingual classrooms where neurodivergence and language diversity intersect, studies such as Ahmad et al. (2023) and Pourhosein Gilakjani (2020) stress the importance of tools that allow cross-linguistic understanding while adapting to sensory sensitivities, something AI can do better than static teaching resources. While each of these areas; AI, inclusive education, neurodivergence, and multilingual learning; has received attention individually, very few studies examine how these dimensions interact simultaneously (Rahman et al., 2022; Torres & Nguyen, 2023). There is a need for empirical classroom-based research that demonstrates how AI can bridge linguistic, cognitive, and social challenges in real multilingual learning environments.

This current study aims to address this gap by exploring the implementation of AI tools in a multilingual Moroccan school with a focus on students diagnosed with Asperger's Syndrome, offering a novel contribution to the intersection of these fields.

3. Research Methods

3.1 Research Design

This study uses a mixed-methods approach that integrates quantitative and qualitative methods to understand the role of AI in supporting students with Asperger's Syndrome in an inclusive multilingual classroom setting. This study seeks to improve the effectiveness of the results through convergent triangulation by employing both methods.

3.2 Participants

This study took place in a Multilingual primary International school in Tangier, Morocco. The participants were selected using purposive sampling as follows; 10 students, aged between 8 to 12 years old, were diagnosed with Asperger's Syndrome. Additionally, 5 of their teachers were included from the same classrooms along with 4 of their parents. The selected participants had useful insights and experience regarding inclusive settings as well as the use of AI educational technologies in multilingual classrooms. Each student had educational plans (IEPs) which were tailored to their needs.

3.3 Data Collection

Both qualitative and quantitative methods were used to gather data during a six-month period. This included questionnaires, observations, and case studies.

3.3.1 Case Studies

Each neurodivergent student diagnosed with Asperger's Syndrome was carefully monitored for using any AI tools in the classroom. These AI technologies consisted of language processing tools, speech-to-text programs, and adaptive learning programs that supported neurodivergent students throughout their learning. Great development was shown from these case studies, particularly students' language and social skills have drastically developed.

3.3.2 Classroom Observations

Weekly structured observations of classroom activities were carried out by paying particular attention on how AI tools are integrated in lessons. The objective of these observations was to evaluate how well students interact with AI tools, particularly how well they were able to overcome language barriers in multilingual classrooms. Observations also emphasized peer connections, language awareness and participation.

3.3.3 Interviews

Teachers and parents had semi-structured interviews, using questionnaires and group discussions, in order to gather their perspectives on the integration of AI technologies in multilingual classrooms and how effective they perceive them to be in supporting students with Asperger's Syndrome. On one hand, teachers were given a questionnaire that emphasizes their experiences using AI tools, any challenges faced, and the observed impact on student participation and communication. On the other hand, parents were asked about any development noticed in their child's communication, social skills, and academic progress outside of school.

3.3.4 Questionnaires

To quantify the impact of AI tools on the students' language acquisition and social communication, pre- and post-study surveys were administered to teachers and parents. These surveys assessed students' abilities in reading comprehension, social communication, and academic performance before and after the intervention.

3.4 Data Analysis

Data was analyzed using both qualitative and quantitative techniques. NVivo software was used to conduct a thematic analysis of the data which revealed consistent patterns related to the use of AI technologies by both the students and teachers in multilingual classrooms. Key themes included language barriers, AI tool usability, student engagement, and teacher and parent perceptions. Descriptive statistics were used to examine survey data in order to assess how students' academic achievement, social communication, and language comprehension had changed before and after the AI intervention. Each student's pre- and post-survey scores were compared using the paired t-test to see if there had been any notable changes throughout the study.

3.5 Rationale for methods

The collection of case studies, classroom observations, and interviews led to a rich understanding of the effectiveness of the AI tools in multiple contexts. The qualitative data was able to provide in-depth views of students' and teachers' experiences supplemented by quantitative data which offered a measurable interpretation of educational outcomes. This use of both qualitative and quantitative methods ensures validity and generalizability on how AI impacts students with Asperger's Syndrome and the general effectiveness of the tools in delivering language- sensitive support.

4. Results

4.1 Quantitative Results

4.1.1 Survey Results

The pre- and post-study surveys showed a significant improvement in the students' language comprehension and social communication. Both parents and teachers reported an average gain of 25% in social interaction scores and 30% in reading comprehension scores. Students' performance before and after the intervention differed statistically significantly ($p < 0.05$) according to paired t-tests, especially in their capacity to use language for social interactions in the classroom.

4.1.2 Academic Performance

Teachers noticed more engagement and completion of tasks, particularly in reading and language-related subjects. Using AI tools for language support showed 20% test score improvements, particularly in writing and comprehension.

4.2 Qualitative Results

4.2.1 Teacher Feedback

Teachers stated that using AI tools has drastically improved students' participation in classroom activities. The use of speech-to-text and real-time translation greatly lowered students' language barriers, allowing them to take part in group discussions and easily comprehend instructions. They have also noticed enhanced social communication as kids were better able to express themselves and comprehend their peers. AI tools have also offered personalized learning paths that let students advance at their own speed which made the learners more confident and engaged.

4.2.2 Parent Feedback

Students with Asperger's Syndrome have shown great improvement in terms of their social behavior and communication skills at home. Many parents have noticed that their children are showing more confidence and engaging actively with their families. Parents have also valued the personalized support these AI tools have offered and how easy and flexible it can be implemented daily with their children.

4.2.3 Student Experiences

Students have positively interacted with AI technology during the case studies. They appeared more motivated during learning activities that use AI. Students expressed a preference for using AI tools over traditional methods, stating that they felt more empowered and independent in their learning. It has also increased their collaborative and social skills.

4.3 Key Themes Identified in Qualitative Analysis

4.3.1 Language Sensitivity

Using AI technologies has helped create a language-sensitive environment for students with Asperger's Syndrome. It offered translation and speech recognition, addressing both their language and communication barriers.

4.3.2 Engagement

Students with Asperegr's Syndrome have shown more signs of engagement in classroom activities when AI tools were involved, particularly in group work and when AI tools supported them to interact with peers.

4.3.3 Personalized Support

Teachers and parents stated that AI tools provided positive personalized educational support, which was essential in meeting the unique needs of students with Asperger's Syndrome within multilingual contexts.

4.3.4 Social Communication

AI tools played a key role in improving students' social communication, allowing them to engage more confidently with their environment.

4.4 Additional Observations

Students when using AI tools have demonstrated significant progress in understanding non-verbal communication cues, which not only built their confidence but also showed teachers their

ability to now interpret body language and tone. These developments were particularly noticeable in collaborative and group-based activities.

5. Discussion

The purpose of this study is to investigate how AI technologies can support language-sensitive learning for students with ASD, particularly students diagnosed with Asperger's Syndrome in multilingual classrooms. The findings highlight the positive impact of AI tools on improving students' communication and participation, addressing key language barriers faced by students with Asperger's Syndrome.

5.1 Interpretation of Results

Integrating AI technologies such as speech-to-text softwares and real-time translation has demonstrated positive improvements in terms of students' progress as the qualitative results have described. It has improved the students' language comprehension and social communication. It has also increased their reading comprehension and total exam scores which highlights the importance of using AI tools in multilingual classrooms to support the students' unique needs, particularly those diagnosed with Asperger's Syndrome. Data has clearly shown how AI can facilitate individualized learning pathways and mitigate the communication difficulties often experienced by these students. These results are consistent with the body of research showing how effective AI is at creating tailored, customizable learning environments for students with specific needs (e.g., Finkelstein et al., 2020; Grigorenko et al., 2019).

Qualitative data has also shaped support for this study's purpose. Both teachers and parents have revealed that students' diagnosed with Asperger's Syndrome have increased their confidence and engagement. AI technologies have made understanding and using language easier for students with Aspereger's Syndrome, which helped them feel motivated and involved. Teachers have also emphasized how these AI tools have fostered a language-sensitive atmosphere. This is also emphasized in Smith & Liu's (2018) study who suggest that AI, by supporting a variety of language abilities, can enhance linguistic diversity and inclusion in the classroom. Furthermore, AI technologies have allowed students with Aspereger's to learn in their own pace which created a safe environment for them to grow academically. This was very crucial for neurodivergent students as they require special teaching techniques tailored to each individual.

5.2 Implications and significance

The results demonstrate the importance of language-sensitive materials in promoting inclusive education for students with Asperger's syndrome. The educational experiences of these children could be significantly altered by AI technology, especially in multilingual settings where traditional methods might not be enough to get beyond language barriers and social communication deficits. AI can be used into inclusive education strategies to support academic achievement and social engagement, both vital aspects of Asperger's Syndrome children' overall development.

This study also highlights the value of individualized learning for neurodivergent students, demonstrating how AI technologies can be an essential instrument in guaranteeing fair educational opportunities for learners from a variety of language backgrounds. Future special education practices will be significantly impacted by this, since AI can be applied not only to support language but also to support social skills training, emotional control, and other frequently disregarded areas.

5.3 Limitations and Future Directions

Although the study's results are encouraging, a number of limitations need to be acknowledged. A larger number of participants could be used in future studies to improve the

generalizability of the findings, as the sample size of 10 students is very small. Furthermore, this study was only carried out for a brief period of time; subsequent research could examine the long-term impacts of AI interventions on social communication and language acquisition.

Future research should examine the fundamental elements of AI tools, such as speech recognition, interactive simulation, and personal feedback that have the biggest impact on students diagnosed with Asperger's Syndrome. Future studies could also investigate on how AI can support students with Asperger's syndrome on developing their emotional intelligence and other social skills they need. In order to comprehend how these technologies may be used on a broader scale, research is also needed to evaluate the scalability and cost-effectiveness of such AI interventions across a variety of educational settings, ranging from the private to the public school sector.

Last but not least, it is critical to consider the cultural context in which AI technologies are integrated, particularly in multilingual settings for this instance Morocco, where AI technologies must take into consideration linguistic obstacles and cultural peculiarities in order to properly support language-sensitive learning.

6. Conclusion

Neurodivergent students, particularly students diagnosed with Asperger's Syndrome have shown great development when using AI technologies in the classroom. This study's results have shown that these AI tools, such as speech-to-text and real-time translation, not only improved their social communication but even lowered language barriers. Students have shown great progress academically and demonstrated higher levels of confidence when using AI. AI-driven technologies have offered individualized learning experiences that students with Asperger's Syndrome have always wanted.

These findings have significant relevance for inclusive education. It highlights the need to using AI technologies for promoting specialized teaching strategies that can assist neurodivergent students, especially in multilingual classrooms. With both short-term and long-term advantages for enhancing the academic and social development of students with Asperger's Syndrome, the beneficial effects seen in this study support the importance of integrating AI technologies into special education procedures.

Future studies ought to focus on broadening the range of AI applications, investigating their efficacy in various cultural and educational contexts, and analyzing their long-term impacts. The precise AI characteristics that best assist students with Asperger's Syndrome, as well as the scalability and affordability of these interventions in various educational contexts, require more research. This study adds to the expanding corpus of research on artificial intelligence in education and lays the groundwork for more inclusive, individualized teaching methods that can accommodate the various demands of every student.

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