

Impact of Assistive Technologies in Academic Evaluation for Students with Specific Learning Disabilities Studying in Secondary Schools of Koshikode District, Kerala

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Abstract

The inclusion of assistive technologies (AT) in academic assessment has made the learning experience of students who have specific learning disabilities (SLDs) much more fruitful. This paper discusses the effects of text-to-speech (TTS) and speech-to-text (STT) as applied in the academic performance of secondary school students with SLDs in Kerala regarding their effectiveness in improving their examination performance, understanding, and confidence. This method was a mixed design, which required 30 special educators to be involved in the study by completing a structured questionnaire and providing direct observations of 15 students taking exams assisted using assistive technology and in the absence of it. The results show that TTS and STT technologies used by students led to a better understanding of the material, lower levels of anxiety during examination, and better writing than the traditional way of evaluation. TTS was useful to students with reading problems to interpret the questions on the examinations better, whereas STT allowed students with handwriting and spelling problems to make their knowledge clear. On the whole, these technologies contributed to the improvement of information processing, responding correctly, and feeling more confident during exams in students. Teachers also noted a high degree of independence, participation, and less stress amongst students who use assistive technology. Within the study, it is identified that good policy support, teacher training, and more accessible AT are needed. The barriers can be addressed to facilitate a highly inclusive, accessible, and very equitable academic evaluation system among students with SLDs.

Keywords: Academic evaluation, assistive technology, specific learning disabilities, speech-to-text, text-to-speech

INTRODUCTION

Inclusive education aims to provide a fair learning experience that is accessible to all students, including those with specific learning disabilities (SLDs) [1–17]. SLDs are often defined by consistent reading, writing, and comprehension challenges, which may severely interfere with the academic

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achievements of standard evaluation systems. Smith and Jones [18]. These special difficulties are not always considered in traditional examinations, which leads to differences in academic performance among students with SLDs. Assistive technologies (AT), especially text-to-speech (TTS) and speech-to-text (STT) technologies, have proven useful in alleviating these obstacles. TTS helps students with reading problems to understand the information in exams, as they can listen to the text, and STT helps students with writing problems as they can hear the words and write them down. These technologies help enhance academic results and emotional well-being by ensuring better understanding and written expression [1].

Although the potential of AT is increasingly being realized as a way of encouraging inclusion in education, there is still a gap in empirical studies on the application of AT in the realm of secondary schools in the state of Kerala. The barriers to the implementation of AT are structural constraints, poor teacher training, and uneven implementation of the policy [2]. These gaps are important to address so that every student, irrespective of learning differences, can be provided with equal opportunities to succeed in academic assessment. The proposed study aims to fill this gap by evaluating how TTS and STT technologies influence students' academic experiences, the results of their performance, and emotional state. The research will combine the quantitative data acquired from special educators with the qualitative observations of the students to make an addition to the existing discourse on inclusive education and to shape the future educational policy and practice in Kerala and further [3].

Significance of Study

SLDs pose a significant challenge in traditional academic assessment, which is often based on reading, writing, and memorizing, the most problematic areas for students [4]. Traditional forms of examination might fail to determine students' real potential and knowledge in their subjects, which will have a negative impact on their performance in school, anxiety, and low self-esteem. AT, including TTS and STT, can provide a potential approach, as they allow students to read and write information more efficiently. Even as the use of AT in education is increasingly being appreciated worldwide, the adoption of these technologies in Kerala secondary schools is still low because of structural issues, the absence of teacher training, and resistance to change [5]. It is urgent to determine the effects of these technologies on students with SLDs in the educational setting of Kerala, especially during exams. This study aims to fill this gap by evaluating the effects of TTS and STT on improving comprehension and minimizing stress during exams and writing [6].

Objectives of the Study

1. To determine the usefulness of TTS and STT technologies in improving the academic performance of students with SLDs.
2. To compare the effect of TTS and STT technologies on the performance of students in terms of understanding the material, expression, speed of processing, confidence, and emotional state during examinations.
3. To determine special educators' perceptions and experiences regarding the use and efficacy of AT in academic assessments.

RELATED LITERATURE REVIEW

In many studies, the importance of AT in helping students with learning disabilities has been emphasized. Studies have indicated that TTS applications enhance reading comprehension, as students can read written materials using audio, and STT applications assist in alleviating writing challenges, including spelling and handwriting. There is also evidence that AT increases academic performance and self-confidence, motivation, decreases anxiety, and increases task completion in students with dyslexia and other learning disabilities [7].

It is well known that assistive technology is a major contributor to inclusive education, as it enables the closing of the achievement gap between students with and without disabilities. Nonetheless, accessibility and usability remain significant concerns, especially in resource-restricted environments where access to AT tools is influenced by socioeconomic factors. The perception and readiness of teachers is also a key factor in the successful implementation of technology in inclusive classrooms [8].

The available literature also mentions poor infrastructure, insufficient training, and lack of institutional support as key obstacles to successful AT implementation. Professional development programs are critical for providing educators with the skills that would help them incorporate AT in

academic assessment [9]. Current trends indicate that AI-based assistive tools can support personalized learning with adaptive features, facilitating engagement and independence. However, ethical issues such as data privacy and algorithmic bias must be considered to ensure the responsible and fair use of these technologies [10].

Hypothesis

Based on the objectives of the study, the following hypotheses have been formulated:

H01: The use of TTS and STT technologies does not significantly enhance the academic performance of students with SLDs in examinations compared with traditional evaluation methods [11].

H02 is written as H03: Special educators do not perceive AT as effective tools for improving academic evaluation for students with SLDs compared to traditional evaluation methods [12].

Research Design

The research design of a mixed-method study presented a multidimensional and holistic understanding of the impacts of AT in the form of TTS and STT on the academic performance of students with SLDs [13]. The combination of quantitative and qualitative methods assisted the research in not merely measuring the results but also placing them in the context of the experience of the students and special educators. The quantitative section, which presupposed the administration of the structured questionnaires to 30 special educators, enabled the collection of statistically analyzable information about their perceptions, difficulties, and observations of AT implementation in the examination contexts [14]. It was possible to compare the means of the different educator-related variables, such as years of experience, type of institution, and training in using AT, because a one-way ANOVA was used to compare the responses. This provides a clue to the impact of these factors on attitudes and perceived effectiveness of assistive tools. Trends were revealed in the statistical test that could be used to inform policy and professional development, including whether there were better results with formal AT-trained educators. The importance of establishing teachers' opinions to enhance the effective application of technology in inclusive classrooms [15].

Participants

Special educators: Thirty special educators from different secondary schools in Kerala were involved through a structured questionnaire.

Students with SLDs: 25 students with SLDs were monitored while taking tests with and without AT assistance.

Methods of Data Collection

This study adopted both qualitative and quantitative methodologies to collect holistic information about the effectiveness of AT in academic assessment among students with SLDs. The methods used included the following.

Structured questionnaire of special educators: A questionnaire was developed and given to 30 special educators in different secondary schools in Kerala. The questionnaire contained closed and open-ended questions, and the main issues were the perceptions of the educators towards AT, effectiveness of the AT in the examinations, the observed results of students, and difficulties in the implementation. There was also a question about the proposed solutions of the educators concerning how to better incorporate and integrate AT in academic evaluation [16].

Direct observation of students: Direct observations were performed on 15 students with SLDs. All students were placed in examination situations with and without TTS and STT technology. The observations were made on the understanding, accuracy of response, and anxiety of the student, as well as the overall performance of the student in the examination. Conciseness and objectivity were ensured using observational checklists [17].

Informal interviews: Informal conversations were conducted with the selected students and special educators to gain a better understanding of personal experiences, difficulties, and perceived advantages of the assistive technology tools during examinations. These contacts were used to provide qualitative information to supplement the quantitative data [18].

Document analysis: Academic performance records, examination scripts, and feedback forms were also analyzed to obtain a clear idea of the quantifiable effect of using assistive technology. They compared the performance in conventional exams and in the exams where AT were used [19].

Data analysis: The questionnaires were analyzed quantitatively using statistical techniques to determine the patterns and trends of the data. Observational qualitative data were thematically analyzed to derive information on students' behavior, understanding, and feelings.

DISCUSSION AND ANALYSIS

The mixed-method research design used in this study provided a multidimensional and holistic insight into the effects of AT in the form of TTS and STT on the academic performance of students with SLDs (Table 1). The combination of quantitative and qualitative methods helped the research to not only measure the results but also put them in the context of student and special educator experiences. The quantitative part, which implied the use of structured questionnaires among 30 special educators, allowed gathering statistically analyzable data concerning their perceptions, challenges, and observations of AT implementation in examination settings. The use of one-way ANOVA to compare the responses enabled the comparison of the means of various educator-related variables, including years of experience, type of institution, and training in using AT. This offers insight into the effects of these factors on attitudes towards and perceived effectiveness of assistive tools. The statistical test revealed trends that could inform policy and professional growth, such as whether formal AT-trained educators had more positive outcomes. The significance of learning teachers' views to promote effective use of technology in inclusive classrooms Table 2.

Simultaneously, the qualitative aspect of the study, which relied on the direct observation of 25 students with SLD in the examination rooms, provided valuable contextual information about the behavioral and emotional reactions of students to AT. Two conditions were observed: when assistive technologies were not applied (traditional method) and when AT interventions were used (TTS/STT tools). This enabled naturalistic performance, engagement comparison, level of confidence, and stress parameter. The observational data not only supported the quantitative results but also identified some less obvious dynamics, including perseverance and anxiety levels, as well as self-efficacy among students who used assistive tools. The fact that educators and students were triangulated greatly enhanced the results' validity.

Table 1. One-way ANOVA based on academic performance scores of students.

Source of Variation	Sum of squares (SS)	df	Mean square (MS)	F-value	Sig. (p)
Between groups (With AT vs without AT)	152.64	1	152.64	9.87	0.003
Within groups (Error)	371.20	48	7.73		
Total	523.84	49			

Significance level (α) = 0.05 $p = 0.003 < 0.05$

Table 2. Effect of educator variables on perceived effectiveness of assistive technology.

Source of variation	Sum of squares (SS)	Degrees of freedom (df)	Mean square (MS)	F-value	Significance (p)
Between groups	18.42	2	9.21	5.37	0.010*
Within groups	46.28	27	1.71		
Total	64.70	29			

Significant at the 0.05 level, $p = 0.010 < 0.05$

This enabled the research to relate the educator's views to real student performance, closing the gap between institutional preparedness and the student experience. For example, statistical analysis may indicate that educators, on balance, approve AT integration, whereas observational evidence may indicate an imbalance between the real implementation or assistance given at examinations.

Moreover, the mixed-methods design assisted in determining the barriers that were systemic in nature, such as the lack of training, unequal access to technology, or technological limitations, which could not be detected in response to the quantitative surveys. Lessons learned from this study play a critical role in developing inclusive policies and viable interventions that will enable equitable academic evaluation of students with SLDs. Overall, this combined methodology offers strong knowledge of the research problem. One-way ANOVA helped to objectively assess patterns in educator feedback, whereas qualitative observation complemented the analysis by defining the actual impact of AT on student performance in real time. Collectively, these approaches provide a good basis for recommendations that can be used to streamline the use of assistive technology in learning assessments. The study found a significant enhancement in the performance of students who used TTS and STT technology in examinations. The discussion presented several ideas that highlighted the beneficial role of AT in academic assessments [20].

Hypothesis 1

H₀₁: The use of TTS and STT technologies does **not** significantly enhance the academic performance of students with SLDs in examinations compared to traditional evaluation methods.

Interpretation

The outcomes of the one-way ANOVA show a statistically significant difference in the academic performance between the participants who learned with the help of assistive technologies (TTS and STT) and those who studied through traditional means. The F-value (9.87) obtained with $p < 0.05$ confirms the hypothesis that students with SLDs had a significant improvement in examination scores with the help of AT. Students who used TTS showed an improvement in understanding the questions presented in the exam, and STT provided the opportunity to answer the questions clearly and correctly in written form. This helped increase performance scores, reduce anxiety, and increase confidence. Statistical data prove the effectiveness of AT in improving academic results during the testing phase. Therefore, the results confirm that the use of TTS and STT in examination practices has a positive effect on academic performance and inclusive assessment of students with SLDs.

Hypothesis 2

H₀₂: Special educators do not perceive AT as effective tools for improving academic evaluation for students with SLDs compared to traditional evaluation methods.

Interpretation

The F-value (5.37) is statistically significant with p less than 0.05, and it shows that there is a significant difference in the perception of educators on the effectiveness of assistive technology in various groups. Formally trained teachers in assistive technology showed more favorable attitudes and had higher student performance results than untrained teachers. The years of teaching experience and the type of institution also had a difference that affected attitudes towards the adoption of assistive technology; however, professional training was the most significant factor. These findings emphasize the need for professional development programs that are structured to enhance the competence, confidence, and effectiveness of educators in incorporating AT as part of academic assessment for students with SLDs.

Major Findings of the Study

1. *Enhanced comprehension*: Students with reading difficulties demonstrated a better understanding of examination questions when using TTS. Auditory information processing

allowed them to interpret questions more accurately, improving response quality and overall performance.

2. *Better written expression:* STT tools were especially useful for students who had difficulties in writing (spelling problems and handwriting). The fact that they could verbalize their answers and get them transcribed helped them write better and more clearly. This helped improve expression and reduce the cognitive load of manual writing work.
3. *Less anxiety:* The availability of AT greatly diminished stressful situations related to exams for students. The accessibility of questions and the ability to express answers helped develop a feeling of independence, which led to a higher level of confidence and reduced anxiety. According to many students, they felt more in control and less anxious when they were assisted with such technologies during the examinations.
4. *Educator insights:* Special education teachers reported a higher level of participation, engagement, and less stress because of exams in AT students. It was also noted that learners were ready to solve more challenging questions and showed a higher level of concentration, which is the positive effect of AT, as teachers observed.

CONCLUSION

This article shows why AT are important in transforming academic tests for students with SLDs. These findings indicate that TTS and STT applications can help reach a significant degree of understanding, academic success, and emotional well-being by applying an assessment strategy that aligns with the cognitive abilities of the learners. These technologies not only help with academic equity, but also in building trust in the students, removing the fear of tests, and contributing to self-directed study. However, the successful implementation of AT in schools requires the solution of several systemic problems. These are the infrastructural issues, the unavailability of dependable digital sources, and the unavailability of localized or multilingual AT tools that could be utilized by the varied students. In addition, in the research, the significance of intensive and continuous teacher training is also given, which will equip the teachers with the ability and confidence to implement AT in assessment practices in a meaningful way. Additionally, there is also a necessity to raise awareness among administrators, parents, and policymakers in schools and other environments regarding the benefits and potential of AT to drive wider adoption and use. The interrelation between the stakeholder institutions of the government and technology developers can result in more successful realization and support of AT interventions. The research, therefore, recommends that inclusive state education policies ought to be established, considering inclusion of AT as a normal support measure for students with SLDs. This includes budgetary allocations for technological infrastructure, development of context-based electronic tools, and integration of AT training in teacher training programs. Regular monitoring and evaluation systems should also exist within it to establish the effectiveness of AT integration and make improvements based on data. All these steps will assist in changing the educational system into one that will not just accommodate the students with SLDs but also enable them to reach their full academic and personal potential. This is a change that should be made to ensure that inclusive education is no longer a theory but a reality to strictly ensure that equitable learning is achieved for all the students.

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