

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 better understanding of the material, lower levels of anxiety during examination, and better writing than the traditional way of evaluation. Text-to-speech was useful to students with reading problems to interpret the questions on the examinations better, whereas speech-to-text allowed students with handwriting and spelling problems to make their knowledge clear. On the whole, these technologies contributed to the improvement of processing information, 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 a good policy support, teacher training, and more accessible assistive technologies are needed. The barriers can be addressed to facilitate the 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 tries to provide a fair learning experience that is accessible to all students including students with Specific Learning Disabilities (SLDs) [1–17]. SLDs are often defined by the consistent reading, writing, and comprehension challenges, which may severely interfere with the academic achievements of standard systems of evaluation. Smith and Jones [18]. These special difficulties are not always considered in traditional ways of examination, which leads to differences in academic performance among SLDs students. Assistive technologies (AT) and especially text-to-speech (TTS) and speech-to-text (STT) technologies have proven to be useful in alleviating these obstacles. TTS helps students with reading problems to understand the information in the exams, as they can listen to the text and STT helps students with writing problems as they can

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hear the words and write them down. These technologies help to enhance academic results and emotional well-being by ensuring a 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 the empirical studies on the application of AT in the realm of the secondary schools in the state of Kerala. The barriers to the implementation of AT in most instances are structural constraints, poor teacher training, and uneven implementation of the policy [2]. These gaps are important to be addressed so that every student irrespective of learning difference 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 the academic experiences of students, the results of their performance, and their emotional state. The research will combine the quantitative data acquired among the 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 the Study

The Specific Learning Disabilities (SLDs) have a great challenge in the traditional academic assessment, which is often based on reading, writing, and memorizing, the most problematic areas of students [4]. The traditional forms of examination might fail to determine their real potential and knowledge in their subjects, which will have a negative impact on their performance in school, anxiety, and low self-esteem. Assistive technologies (AT), including Text-to-Speech (TTS) and Speech-to-Text (STT) can provide a potential approach, as it allows students to read and write information more efficiently. Even as the use of assistive technologies in education is increasingly being appreciated worldwide, the adoption of these technologies in the Kerala secondary schools is still low because of structural issues, absence of teacher training and resistance to change [5]. The need to determine the effects of these technologies on students with SLDs in the educational setting of Kerala, especially during exams is urgent. This paper will help fill this gap by evaluating the effect of TTS and STT on improving comprehension, minimizing stress at exams, and writing [6].

Objectives of the Study

- i. To determine the usefulness of TTS and STT technologies in improving the academic performance of students with SLDs.
- ii. 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.
- iii. To determine the perception and experiences of special educators about the use and efficacy of assistive technologies in academic assessments.

RELATED LITERATURE REVIEW

In many studies, the importance of assistive technologies (AT) in helping the students with learning disabilities is emphasized. Studies have indicated that the text to speech (TTS) applications enhance reading comprehension, since students can read written materials using audio, and speech to text (STT) applications assist in alleviating writing challenges, including spelling and handwriting. There is also evidence showing that AT increases academic performance, 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 one of the major contributors to inclusive education, as it enables the closing of the achievement gap between students with and without disabilities. Nonetheless, the problem of accessibility and usability is still a significant concern, especially in resource-restricted environments where access to AT tools is affected by socioeconomic factors. The perception and readiness of the teacher is also a key factor to successful technology implementation in inclusive classrooms [8].

The available literature also mentions poor infrastructure, insufficient training, and lack of institutional support as the key obstacles to successful AT implementation. Professional development programs are critical towards providing educators with skills that would help in incorporating assistive technologies in academic assessment [9]. The present current tendencies indicate that assistive tools based on AI can support personalized learning with adaptive features, which facilitates engagement and independence. However, ethical issues like privacy of data and algorithmic bias are to be considered to make the use of these technologies responsible and fair [10].

Hypothesis

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

H01: The use of Text-to-Speech (TTS) and Speech-to-Text (STT) technologies does not significantly enhance the academic performance of students with Specific Learning Disabilities (SLDs) in examinations compared to traditional evaluation methods [11].

H02: Special educators do not perceive assistive technologies 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 assistive technologies (AT) in the shape of Text-to-Speech (TTS) and Speech-to-Text (STT) on the academic performance of students with Specific Learning Disabilities (SLDs) [13]. The fact that the quantitative and qualitative methods were combined together assisted the research to not merely measure the results, but also place 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 the statistically analyzable information about their perceptions, difficulties, and observations of the AT implementation in the examination contexts [14]. It was possible to compare the mean of the different educator related variables, such as years of experience, type of institution and training in using the AT because one-way ANOVA was used to compare the responses made. This provided a clue on the impact of these factors on the attitudes and perceived effectiveness of assistive tools. Trends were revealed in the statistical test that could be used to inform the policy and the professional development, including whether there was a better result with formal AT-trained educators. The importance of establishing the opinions of teachers to enhance effective application of technology in inclusive classrooms [15].

Participants

Special educators: There were 30 special educators of different secondary schools in Kerala involved by way of a structured questionnaire.

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

Methods of Data Collection

The research adopted both qualitative and quantitative methodologies to collect a holistic information about the effectiveness of assistive technologies in academic assessment among the students with specific learning disabilities (SLDs). The methods which were used included:

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 assistive technologies, effectiveness of the assistive technologies 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 assistive technologies in academic evaluation [16].

Direct observation of students: Direct observations were done on 15 students with SLDs. All students were put under examination situations with and without text-to-speech (TTS) and speech-to-text (STT) technology. The observations were done on the understanding, the accuracy of response and the 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: The informal conversations were conducted with the selected students and special educators to get a better understanding of personal experiences, difficulties, and the perceived advantages of the assistive technology tools during examinations. These contacts were used to give qualitative information to supplement the quantitative data [18].

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

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

DISCUSSION AND ANALYSIS

A mixed-method research design used in the study provided a multidimensional and holistic insight into the effects of assistive technologies (AT) in the form of Text-to-Speech (TTS) and Speech-to-Text (STT) on the academic performance of students with Specific Learning Disabilities (SLDs) [Table-1]. The combination of the quantitative and qualitative methods helped the research to not only measure the results but to also put them in a 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 made enabled the comparison of the mean of the various educator related variables including years of experience, type of institution and training in using the AT. This offered an insight into the effect of these factors on attitudes towards and perceived effectiveness of assistive tools. The statistical test unveiled trends that could inform the policy and professional growth, such as whether formal AT-trained educators had more positive outcomes. The significance of learning the views of teachers To promote effective use of technology in inclusive classrooms [Table-2].

Simultaneously, the qualitative aspect of the study that relied on direct observation of 25 students with SLD in the examination rooms provided valuable and contextual information about the behavioral and emotional reactions of students to AT. Two conditions were observed, when the assistive technologies were not applied (traditional method) and when AT interventions were used (TTS/STT tools). This enabled a naturalistic performance, engagement comparison, level of confidence, and stress parameters. The observational data did not only support the quantitative results but also identified some less obvious dynamics, including perseverance level 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 validity of the results. It enabled the research to relate the educator views to the real student performance, closing the gap between the institutional preparedness and the student experience. As an illustration, 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, the unequal access to technology, or the technological limitations, which could not be detected in response to the quantitative surveys. The lessons play a critical role in

coming up with inclusive policies and viable interventions that will enable equitable academic evaluation of the students with SLDs. Overall, this combined methodology offered strong, overall knowledge on the research problem. One-way ANOVA helped to objectively assess patterns in educator feedback, whereas qualitative observation helped to complement the analysis as it defined the actual impact of AT on student performance in real-time. Collectively, these approaches provide a good basis on recommendations that can be used to streamline the use of assistive technology in assessments of learning. In the study, it was found that there was a great enhancement in the performance of students who used TTS and STT technology in examination. The discussion presented several ideas that highlight the beneficial role of assistive technologies in academic assessments [20].

Hypothesis: 1

H01: The use of Text-to-Speech (TTS) and Speech-to-Text (STT) technologies does **not** significantly enhance the academic performance of students with Specific Learning Disabilities (SLDs) in examinations compared to traditional evaluation method.

Interpretation

The outcomes of the one-way ANOVA show that there is 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 with the traditional means of examination. The F-value (9.87) obtained with $p < 0.05$ confirms the hypothesis that the student with Specific Learning Disabilities had a significant improvement of the examination scores with the help of assistive technologies. Students who used TTS showed an improvement in understanding the questions presented in the exam, and STT provided the opportunity to answer the question clearly and correctly in written form. This helped in increasing the performance scores, anxiety, and the increase of confidence. The statistical data prove the effectiveness of assistive technologies in improving academic results during testing. Therefore, the results confirm that the use of TTS and STT in the examination practices has a positive effect on academic performance and inclusive assessment of the students with SLDs.

Hypothesis: 2

H02: Special educators do not perceive assistive technologies 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 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 compared to untrained teachers. The years of teaching experience and the

Table 1. One-way Anova table 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 0.05 level, $p = 0.010 < 0.05$

type of the institution also had a difference that affected the attitudes towards the adoption of assistive technology, but professional training turned out to be the most significant factor. These findings emphasize the need to have profession development programs that are structured to enhance competence, confidence, and effectiveness of educators in incorporating assistive technologies as part of academic assessment in students with specific learning disabilities.

Major Findings of the Study

1. *Enhanced comprehension:* Students with reading difficulties demonstrated a better understanding of examination questions when using TTS tools. The 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 in students who had difficulties in writing (spelling problems and writing handwriting). The fact that they could verbalize their answers and get them transcribed helped them to write better and more clearly. This helped in improved expression and lighter cognitive load of manual writing work.
3. *Less anxiety:* Availability of assistive technologies greatly diminished stressful situations related to exams in students. The accessibility to questions and the ability to express answers helped to 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 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 the assistive technologies as teachers observed.

CONCLUSION

This article shows why assistive technologies are important in transforming academic tests of students with specific learning disabilities (SLDs). These findings indicate that Text-to-Speech (TTS) and Speech-to-Text (STT) applications can help reach a significant degree of understanding, academic success, and emotional wellbeing by applying an assessment strategy that aligns with the cognitive abilities of the learners. These technologies not only help in academic equity, but also in building the trust in the students, removing the fear of the tests and contributing to the self-directed study. However, the successful implementation of assistive technologies in schools requires the solution of several systematic problems. These are the infrastructural and the unavailability of the dependable digital sources, the unavailability of the 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 the assessment practices in a meaningful way. Additionally, there is also a necessity to raise awareness of administrators, parents, and policymakers in schools and other environments regarding the benefits and potential of AT to drive the wider adoption and use. The interrelation between the stakeholder institutions of the government and technology developers can result in the more successful realization and support of AT interventions. The research, therefore, recommends that the inclusive state education policies ought to be established considering inclusion of AT as a normal support measure to the students with SLDs. This includes budgetary allocations on 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 the 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 to all the students.

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