THE EFFECT OF ASSISTIVE TECHNOLOGY AND TEACHER TRAINING ON THE ACADEMIC SUCCESS OF HEARING–IMPAIRED STUDENTS
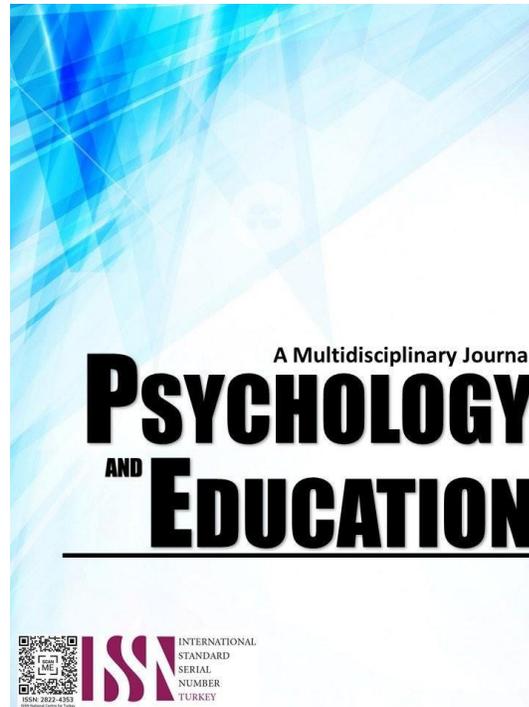
The Effect of Assistive Technology and Teacher Training on the Academic Success of Hearing–Impaired Students

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Abstract

The research was to ascertain the influence of assistive technology and teacher training on the academic success of the hearing-impaired students of Junior High School year 2024-2025 in Region XI. The application of mean and descriptive levels is employed in this study. The overall ratings on assistive technology and academic success of hearing-impaired students were rated and viewed as High. It means the assistive technology contributes heavily to informing academic success of all learners. The global outcomes for the teacher's training and academic success of hearing-impaired students rated and interpreted as High. It means that teacher's training has a significant effect on the academic success of hearing-impaired students. Overall performance for academic success of hearing-impaired students labelled and scored as High. The implication is that the significance of academic success with hearing-impaired students goes past grades; it affects their forthcoming prospects, assimilation into society, self-respect, social communication, and general development and, in essence, molds their lives in a positive way. Correlation of assistive technology reveals the positive association with academic success. It is an indication that the interaction between the assistive technology and teacher's training is central in forming academic success.

Keywords: *assistive technology, academic success, learners, hearing-impaired students, junior high school*

Introduction

Academic success can be described as the level to which a learner has attained learning objectives, usually measured in terms of grades, standardized examinations, and general performance at school (Baker & Smith, 2020). It measures a student's comprehension and command of the topic, as well as their capacity to use the knowledge effectively. Yet, as Wang et al (2023) points out, academic success involves more than grades and scores on tests but also the overall skill and knowledge development that leads to a student's lifelong learning and ability to adapt.

Globally, the issue of poor academic performance of students in the examinations is one of the most daunting issues that confronts students and teachers. This issue has educational, social, cultural and psychological facets (Al-Zoubi & Bani Younes,2015). According to Hassanein (2015), factors such as lack of resources, insufficient infrastructure, and inadequate policy support contribute to the low performance of HI learners globally. Vlachou and Malianou (2017) further stress that these barriers are especially prevalent in regions with limited financial resources, where even basic support services for HI students are not available.

In the Philippines, Villanueva and Santos (2018) found that many HI students report lower academic success compared to their hearing peers. These students often perform poorly on standardized tests and assessments that require auditory comprehension, and they face difficulties in subjects like language, science, and mathematics that rely on verbal communication. The study by Cabello et al. (2020) on the academic performance of HI students highlights that these students tend to score lower in examinations because they have not received the full benefits of assistive technology or teachers being trained. Many teachers are still not familiar with the specific strategies that are needed to support HI students, leading to less effective teaching methods and engagement, which contributes to low academic achievement. It significantly impacts Academic performance that leads to the low achievement of students.

In Region XI, specifically Davao City, Aguirre and Dalisay (2019) highlight that in schools where AT is available, issues such as improper maintenance, lack of training for teachers on how to use the devices, and insufficient support services continue to hinder academic success. Gonzales (2019) identifies the lack of infrastructure and funding for assistive technologies as one of the key barriers to academic success.

There is a requirement for further research on the academic performance of students especially to the students with disabilities. If the normal students are struggling in their academic performance how much more to the Students with Special Needs Education (SNED). It has been studied that inclusive education practices affect their performance (UNICEF, 2023). This highlights the need for research that assesses the inclusiveness of education policies and their impact (UNICEF, 2023).

Research Questions

The purpose of this study is to determine the importance of assistive technology and teacher's training to the academic success of hearing-impaired students in Davao City for the school year 2024-2025. Specifically, it sought to answer the following objectives:

1. To determine the use of assistive technology in learning in terms of:
    1.1. the use of interactive whiteboards and touchscreens; and

    1.2.   the use of sign language software/apps?
2.   To determine the level of teacher's training in terms of:
    2.1.   communication strategies for HI learners; and
    2.2.   professional development/on-going learning?
3.   To determine the level of academic success in terms of:
    3.1.   written task; and
    3.2.   performance task?
4.   To determine the significant relationship of hearing-impaired students between:
    4.1.   assistive technology and academic success; and
    4.2.   teacher's training and academic success.
5.   To determine the significant influence of assistive technology and teacher's training to academic success of hearing-impaired students.

Methodology

Research Design

This study employs a mixed-methods approach, specifically an explanatory sequential design. Mixed-methods research integrates both quantitative and qualitative data collection and analysis to provide a comprehensive understanding of the research problem (Clark & Ivankova, 2015). This approach allows for numerical findings to be validated and expanded through qualitative insights, offering a deeper understanding of the impact of assistive technology and teacher training on the academic success of hearing-impaired students.

In the quantitative phase, a descriptive correlational design will be used to examine the relationship between assistive technology, teacher training, and academic success. This non-experimental research design helps identify associations between variables without manipulating them (Seeram, 2019).

Following the quantitative phase, the qualitative phase will employ a phenomenological research design. Phenomenology focuses on individuals' lived experiences, making it a suitable approach to explore how students and teachers perceive and experience the impact of assistive technology and teacher training in educational settings (Flood, 2010). This phase aims to provide deeper insights into the contextual factors influencing academic success among hearing-impaired students.

Participants

This study will involve 62 junior high school hearing-impaired learners enrolled during the academic year 2024-2025. Participants will be selected using a purposive and stratified random sampling technique, ensuring that the sample represents different schools and demographics within Region XI. This sampling method allows for the careful selection of respondents who can provide relevant data to address the research questions (Rai & Thapa, 2015).

Instrument

To collect data, this study will assess the levels of assistive technology use, teacher training, and academic achievement of hearing-impaired learners. Additionally, it will examine the relationship between these variables. A survey questionnaire will be used as the primary data collection tool, and informed consent will be obtained from all participants.

In determining the level of assistive technology, the tool was divided into two indicators. It is a 10-item instrument with the following indicators: availability and accessibility of assistive technology and effectiveness of assistive technology in learning. Each indicator of the independent variable has a total of 5 items. In gathering the data on educational environment, the researchers created their own survey questionnaire. In evaluating the students' educational environment, the respondents used the following rating: 5 as strongly agree, 4 as agree, 3 as neutral, 2 as disagree, and 1 as strongly disagree.

To gather results for the second independent variable, teacher training, the researchers also created the questionnaire below. It is a 10-item instrument with the following indicators: professional development and training on special education and implementation of inclusive teaching strategies. In evaluating the second independent variable, the respondents used the following rating: 5 as strongly agree, 4 as agree, 3 as neutral, 2 as disagree, and 1 as strongly disagree.

For the dependent variable, academic success, the researcher also created the questionnaire below to gather information about the study. Each indicator of the dependent variable has a total of 5 items. Overall, the questionnaire has 10 items. The respondents answered the questionnaire using this scale: 5 as strongly agree, 4 as agree, 3 as neutral, 2 as disagree, and 1 as strongly disagree.

In summary, the research instrument has a total of 30 items. Part 1 for the first independent variable has 10 items, Part 2 for the second independent variable has 10 items and Part 3 for the dependent variable has another 10 items. A panel of specialists will validate the questionnaire and will undergo reliability testing.

Procedure

The following steps were undertaken by the researcher in the gathering of data for this study:

Asking permission to conduct the study. The researcher secured a certificate from the Research Ethics Council confirming that universal ethical norms were observed to preserve and maintain respondents' dignity. Once secured, the researcher requested an endorsement letter from the Vice-President of Academic Affairs who acted as OIC-Dean of the Graduate School, as well as the approval of the thesis adviser to conduct the study on the educational environment, social issues and academic achievement of hearing-impaired learners.

Seeking permission from the school's division superintendent. With the endorsement letter, the researcher sent a request letter to the Division Office of Davao City via the Schools Division Superintendent (SDS) to conduct the study, followed by a letter informing the school principals of the involved schools of the research study to be conducted on the respective hearing-impaired learners.

Administration and Retrieval of Questionnaires. The researcher properly explained the method of answering the offered questionnaires to the designated respondents of the study, with the agreement and full support of the SDS and school administrator. The researcher translated each question from the indicators throughout the administration of the survey questionnaire to ensure that the respondents understood each question and provide valid replies. The selected hearing-impaired learners in the school complied honestly and provided with all the necessary data needed in the survey questionnaire, the researcher retrieved all the answered survey questionnaires once done.

Gathering and Tabulation of Data. The data compiled and calculated following the successful administration and retrieval of the survey questionnaires. Subsequently, using Jamovi and the aid of a statistician, relevant statistical method used to collect the necessary data for interpretation and further analysis.

Interpretation of data – Jamovi was used by the statistician for complex statistical data analysis of data of this study.

Data Analysis

Mean: The mean, also known as the average, is a basic statistical measure that helps summarize a set of numbers. In this study, the mean was used to assess the average levels of assistive technology usage, teacher training, and academic success among hearing-impaired learners. By calculating the mean for each variable, we could get a clearer picture of the general trends or central tendencies of the data, which helped us understand how these factors are distributed within the sample.

Pearson-r: The Pearson correlation coefficient (Pearson-r) is a statistical method used to measure the strength and direction of the relationship between two continuous variables. In this research, Pearson-r was utilized to determine if there is a significant correlation between assistive technology, teacher training, and academic success of hearing-impaired learners. By calculating the Pearson-r, we were able to identify whether the use of assistive technology or the extent of teacher training has any meaningful association with the academic performance of these learners. A significance level of 0.05 was set for this analysis, meaning that we accepted a 5% chance of error when determining whether the relationship between the variables was statistically significant.

Linear Regression: Linear regression is a statistical technique used to predict the value of one variable based on the value of another. In this study, linear regression was applied to predict the academic success of hearing-impaired learners based on the levels of assistive technology and teacher training they received. By using linear regression, we were able to model the relationship between these two independent variables (assistive technology and teacher training) and the dependent variable (academic success). This allowed us to see how much of an impact these two factors have on the learners' performance and to predict academic outcomes based on different levels of assistive technology and teacher training.

Results and Discussion

This section delves into the findings from the data analysis and provides a comprehensive discussion of the results. The primary goal is to address the research questions and issues identified by carefully examining the data through the use of both statistical and non-statistical methods. The findings are organized and discussed according to the problem statement outlined at the beginning of the study.

Use of Assistive Technology on the Academic Achievement of Hearing-Impaired Learners

This study is focused on a primary variable in the use of assistive technology of hearing-impaired students in learning. This includes sub-indicators such as use of Interactive Whiteboards and Touchscreens and Sign Language Software/Apps. The use of mean and descriptive levels is presented in the following table.

The subsequent tables provide a detailed discussion of every indicator and its corresponding items. The implications of each are substantiated by relevant literature and studies. Within each sub-indicator, the highest and lowest items are examined, clearly representing the respondents' responses in the survey. These items also elaborate on their implications, potentially providing valuable insights to readers and beneficiaries. Furthermore, supporting global literature and studies validate or present contrasting perspectives to the results.

Table 1. *Summary of the use of Assistive Technology on the*

Academic Success of Hearing-Impaired Learners

Sub-Indicators	Mean	Description
Interactive Whiteboards and Touchscreens	3.67	High
Sign Language Software/Apps	3.62	High
Overall	3.64	High

Among the two sub-indicators under the use of assistive technology and academic success of hearing-impaired learners, the use of interactive whiteboards and touchscreens recorded the highest mean score of 3.67, interpreted as High. This indicates that hearing-impaired learners significantly benefit from these technologies in their academic success. Interactive whiteboards and touchscreens provide visual and interactive learning experiences, enabling students to engage with content more effectively. These tools support real-time collaboration, interactive lessons, and digital access to educational materials, which are essential for enhancing academic performance.

Access to information is a crucial factor in academic achievement, as it influences students' ability to engage with material, conduct research, and complete assignments effectively. The findings of Hsu and Matzat (2018) support this result, emphasizing that students with better access to information resources tend to perform better academically. Their study highlights how interactive learning tools enhance critical thinking and research skills, leading to higher academic performance. Similarly, Head and Eisenberg (2022) examined the role of information literacy in academic success, finding that students who are trained in effective digital learning strategies—such as those facilitated by interactive whiteboards and touchscreens—achieve higher academic outcomes. These findings emphasize the importance of assistive technologies in improving access to information and fostering active engagement, ultimately enhancing academic success for hearing-impaired learners.

Meanwhile, the lowest mean score of 3.62 was recorded for the use of sign language software/apps, though it is still interpreted as High. This suggests that while sign language software plays a crucial role in supporting communication, its impact on academic success may vary depending on how actively learners engage with it. Research by Fredricks, Blumenfeld, and Paris (2017) emphasized that cognitive engagement is essential for academic success, with higher levels of engagement correlating to improved academic performance across subjects. Since sign language software promotes active learning by enhancing communication and comprehension, it remains a valuable assistive tool. However, its effectiveness may depend on factors such as the learners' proficiency in sign language and the availability of trained educators to facilitate its use.

Additionally, Cohen et al. (2021) highlighted the importance of teacher training in engaging hearing-impaired students. Their study found that educators who employ inclusive teaching practices—such as integrating both interactive technologies and sign language resources—experience higher levels of student participation and academic success. These findings indicate that while interactive whiteboards and touchscreens enhance engagement through digital interactivity, sign language software/apps contribute to effective communication, both playing essential roles in supporting the academic achievement of hearing-impaired learners.

Overall, the mean score for the use of assistive technology on academic success was 3.64, interpreted as High, reinforcing the positive impact of assistive tools in learning. This is supported by Lutz and Maguire (2019), who found that inclusive classroom environments—where various assistive technologies are integrated—lead to higher academic achievement. Furthermore, Hamre et al. (2021) examined the impact of classroom climate on student learning, concluding that positive teacher-student relationships and a supportive peer environment, strengthened through the use of interactive learning tools and sign language support, improve engagement and academic performance.

These findings underscore that both interactive whiteboards and touchscreens, as well as sign language software/apps, contribute to academic success by enhancing access to information, engagement, and communication. Their effectiveness is further amplified when paired with teacher training and inclusive teaching strategies, ensuring that hearing-impaired students receive the full benefits of assistive technology in their education.

Teacher's Training and Academic Achievement of Hearing-Impaired Learners

This paragraph is focused on the secondary variable in the teacher's training and academic achievement of hearing-impaired learners. This includes sub-indicators such as communication strategies for HI learners and professional development/on-going learning. The use of mean and descriptive levels is presented in the following table.

The subsequent tables provide a detailed discussion of every indicator and its corresponding items. The implications of each are substantiated by relevant literature and studies. Within each sub-indicator, the highest and lowest items are examined, clearly representing the respondents' responses in the survey. These items also elaborate on their implications, potentially providing valuable insights to readers and beneficiaries. Furthermore, supporting global literature and studies validate or present contrasting perspectives to the results.

Table 2. *Teacher's Training on the Academic Success of Hearing-Impaired Learners*

Sub-Indicators	Mean	Description

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Research Article

Communication Strategies of HI Learners	3.53	High
Professional Development/On-going Learning	3.60	High
Overall	3.57	High

Among the two sub-indicators under teacher training on the academic success of hearing-impaired learners, communication strategies for hearing-impaired (HI) learners recorded the highest mean score of 3.60, interpreted as High. This suggests that teachers' training in communication strategies is effective in supporting the academic success of hearing-impaired students. Effective teacher-student communication is essential for fostering a positive learning environment, as communication barriers can significantly impact academic achievement.

Hattie and Donoghue (2019) examined the role of teacher-student communication in educational success, concluding that clear, open communication between teachers and students enhances engagement and academic outcomes. Their findings reinforce the importance of training educators in specialized communication strategies for HI learners, such as visual aids, captioning, sign language, and speech-to-text technologies. Furthermore, a 2023 report by the National Center for Educational Statistics emphasized that diverse learners face unique communication challenges, and providing tailored support—such as language services, mentoring, and accessible learning materials—improves access to information and academic success. These studies collectively underscore that teachers' training in communication strategies is critical for reducing learning barriers and improving the academic performance of hearing-impaired learners.

Meanwhile, professional development and ongoing learning recorded the lowest mean score of 3.53, still interpreted as High. This suggests that while teachers receive training in professional development, there is room for further enhancement. Ongoing training ensures that teachers remain updated on best practices, assistive technologies, and inclusive teaching methodologies, all of which contribute to the academic success of hearing-impaired learners.

Kuntze and de Boer (2019) emphasized that continuous professional development is essential in fostering inclusive classroom environments that enhance both academic and social development. They found that teachers who undergo ongoing training are more equipped to address the diverse learning needs of hearing-impaired students, leading to improved student engagement and performance.

Additionally, the 2023 report by the National Deaf Center highlighted that professional development programs that focus on inclusive teaching practices improve both teacher effectiveness and student outcomes. These findings indicate that regular training and exposure to evolving educational strategies are necessary for sustaining high-quality education for hearing-impaired learners.

Overall, teacher training on the academic success of hearing-impaired learners recorded a mean score of 3.57, interpreted as High, reinforcing its positive impact on both communication and continuous professional development. Training programs that emphasize effective communication strategies and ongoing professional learning ensure that teachers are well-prepared to meet the needs of hearing-impaired students.

Paul and Lee (2021) further emphasized that training in social communication skills benefits hearing-impaired learners by enabling better interactions with both teachers and peers, while Kuntze and de Boer (2019) highlighted that well-trained teachers foster supportive classroom environments that improve both communication skills and academic outcomes. These findings collectively illustrate that ongoing teacher training is crucial in addressing communication challenges, promoting professional growth, and enhancing the academic success of hearing-impaired learners.

Thus, continued investment in teacher training programs—particularly in communication strategies and professional development—is essential to ensuring inclusive, high-quality education for hearing-impaired students.

Level of Academic Achievement of Hearing-Impaired Learne

This paragraph is focused on the dependent variable, the academic success of hearing-impaired learners. This includes sub-indicators such as written tasks and performance tasks. The use of mean and descriptive levels is presented in the following table.

The subsequent tables provide a detailed discussion of every indicator and its corresponding items. The implications of each are substantiated by relevant literature and studies. Within each sub-indicator, the highest and lowest items are examined, clearly representing the respondents' responses in the survey. These items also elaborate on their implications, potentially providing valuable insights to readers and beneficiaries. Furthermore, supporting global literature and studies validate or present contrasting perspectives to the results.

Table 3. *Summary of the Level of Academic Achievement of Hearing-Impaired Learners*

Sub-Indicators	Mean	Description
Written Tasks	3.45	High
Performance Tasks	3.57	High
Overall	3.51	High

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Among the two sub-indicators under academic achievement of hearing-impaired learners, performance tasks emerged as the highest mean score of 3.57 interpreted as High. This indicates that the academic achievement of hearing-impaired learners in terms of performance tasks is good. The academic achievement of hearing-impaired learners, particularly in terms of performance tasks, is influenced by various factors, including instructional strategies, accessibility of materials, and the learning environment.

In 2019, a study by Hodge and Connolly highlighted that differentiated instruction significantly improves the performance of hearing-impaired learners on performance tasks. The study found that utilizing visual aids, hands-on activities, and collaborative learning opportunities allows these students to better engage with the material and demonstrate their understanding.

In addition, a study by Rayan and Bader (2021) emphasized the role of accessible resources in enhancing performance tasks for hearing-impaired students. The researchers noted that providing materials in multiple formats—such as captioned videos and written instructions—facilitates better comprehension and execution of assignments, leading to improved academic performance. Overall, these studies indicate that strategic instructional approaches and access to diverse resources are crucial for enhancing the academic achievement of hearing-impaired learners in performance tasks. By addressing these factors, educators can better support the success of these students.

Moreover, the lowest mean score of 3.45 belongs to written tasks interpreted as High. This indicates that the learner's academic successin terms of written tasks is good. The academic success of hearing-impaired learners in terms of written tasks is significantly influenced by various factors, including accessibility of resources, and the development of writing skills. In 2020, a study by Garrison and Eriks-Brophy examined how access to assistive technology impacts the writing performance of hearing-impaired students. The findings indicated that tools like speech-to-text software and word prediction programs facilitate better engagement with writing tasks, allowing these learners to focus more on content rather than the mechanics of writing.

In addition, a 2021 study by Paul and Lee highlighted the connection between language proficiency and writing achievement. The researchers noted that hearing-impaired students who receive comprehensive language support—such as exposure to rich vocabulary and syntax—tend to perform better in written assignments. These studies collectively demonstrate that targeted access to assistive technologies and language proficiency support are essential for enhancing the academic success of hearing-impaired learners in written tasks. By addressing these areas, educators can significantly improve outcomes for these students.

The overall results for academic success of hearing-impaired learners scored a mean score of 3.51 and interpreted as High. This indicates that the academic success of hearing-impaired learners is good. The importance of academic success among hearing-impaired learners extends beyond grades; it impacts their future opportunities, social integration, self-esteem, communication skills, and overall development, ultimately shaping their lives positively. For instance, achieving academically helps hearing-impaired learners build confidence and enhances their ability to engage socially in mainstream educational environments.

According to McCracken and McCarthy (2021), students who perform well academically are more likely to form positive peer relationships, which are crucial for social development. In addition, academic success boosts self-esteem and motivation. Research by Paul and Lee (2022) highlighted that hearing-impaired students who excel academically demonstrate higher self-confidence and are more likely to engage proactively in their education.

Table 4. *Significance of the Relationship of the Use of Assistive Technology, Teacher's Training and Academic Success*

	Success		
	R	p-value	Remarks
Use of Assistive Technology	.613	.001	Significant
Teacher's Training	.627	.001	Significant

Table 4 presents the correlation results between use of assistive technology, teacher training, and the academic success of hearing-impaired learners. The findings indicate that the use of assistive technology has a moderate positive relationship with academic success, with an R-value of 0.613. Additionally, the p-value of 0.001, which is less than the alpha level of 0.05 (two-tailed), confirms that this relationship is statistically significant at the $p < .001$ level. This suggests that as the use of assistive technology increases, the academic success of hearing-impaired learners also improves. The statistical significance of this relationship indicates that the probability of this result occurring by random chance is less than 1%, reinforcing the crucial role of assistive technology in enhancing the academic outcomes of hearing-impaired students.

Similarly, teacher training exhibits a stronger positive relationship with academic success, as reflected in an R-value of 0.627. With a p-value of 0.001, which is also less than the alpha set at 0.05, the correlation between teacher training and academic success is statistically significant at the $p < .001$ level. This confirms that as teacher training improves, the academic success of hearing-impaired learners also increases. The strong correlation suggests that teachers' ability to implement effective communication strategies, utilize assistive technologies, and create inclusive learning environments has a direct impact on student performance.

These findings align with previous research highlighting the positive effects of assistive technology and teacher training on academic success. According to Renshaw (2018), a supportive educational environment characterized by engaged and well-trained teachers enhances student motivation and academic performance. Moreover, Wang et al. (2021) found that access to modern educational tools

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and resources significantly improves student learning outcomes, as learners are better equipped to engage with instructional materials and apply effective learning strategies.

Regarding the relationship between teacher training and academic success, the results of this study align with prior research emphasizing the importance of supportive social environments. Wang et al. (2021) emphasized that positive peer relationships and community engagement contribute to greater student resilience and academic success.

Furthermore, Blad (2022) noted that educational programs addressing social issues—such as mentorship initiatives and mental health support—are instrumental in improving academic outcomes, particularly for at-risk students. These studies collectively highlight that a well-trained teaching force, equipped with inclusive strategies and continuous professional development, plays a crucial role in fostering academic success among hearing-impaired learners.

In summary, the results confirm that both assistive technology and teacher training have significant positive relationships with the academic success of hearing-impaired learners. The statistical significance of these relationships underscores the importance of integrating assistive technologies into the learning process and investing in comprehensive teacher training programs. Ensuring that educators are well-equipped with effective communication strategies, professional development opportunities, and inclusive teaching practices will further enhance the academic outcomes of hearing-impaired students.

Table 5. *Significance of the Influence of the Use of Assistive Technology,*
Teacher's Training and Academic Success

Individual Influence of Predictors	Academic Success			
	Standardized Coefficient	t	p-value	Remarks
Use of Assistive Technology	.455	3.527	.001	Significant
Teacher's Training	.478	3.805	.001	Significant
Combined Influence of Predictors				
R	.706			
R2	.498			
Adjusted R2	.481			
F	29.3			
P	.001			Significant

Table 5 presents the results of the multiple regression analysis, conducted at a significance level of $\alpha = 0.05$ (two-tailed). Results indicate that the standardized beta coefficient of assistive technology use is 0.455, with a t-statistic of 3.527 and p = 0.001, which is less than the 0.05 level of significance. This coefficient estimate suggests that for every unit increase in the use of assistive technology, academic success is expected to increase by 0.455 units, holding other factors constant. The corresponding t-value of 3.527, which exceeds the conventional threshold of 2, further confirms that this relationship is statistically significant.

Similarly, the standardized beta coefficient of teacher training is 0.478, with a t-statistic of 3.805 and p = 0.001, which is also less than the 0.05 level of significance. The coefficient estimates of 0.478 indicates that for every unit increase in teacher training, academic achievement is expected to increase by 0.478 units, holding other variables constant. The t-value of 3.805, which surpasses the common threshold of 2, affirms that this relationship is statistically significant.

The R-squared value of 0.498 indicates that 49.8% of the variability in academic achievement is explained by the independent variables (assistive technology use and teacher training). However, 50.2% of the variance remains unexplained, suggesting that other factors not included in the model contribute to academic success. The Adjusted R-squared value of 0.481 accounts for the number of predictors in the model and confirms that 48.1% of the variability in academic achievement is explained by the independent variables.

While the model demonstrates explanatory power, additional unmeasured factors likely play a role. Additionally, the F-value of 29.3 and p-value of 0.001 indicate that the overall regression model is statistically significant, confirming that assistive technology use and teacher training together significantly predict academic success among hearing-impaired learners.

These findings align with previous research. Thapa et al. (2013) emphasized that an effective educational environment and well-trained teachers are crucial factors influencing academic success. A supportive educational atmosphere, characterized by access to modern resources and effective teaching strategies, fosters student success (Thapa et al., 2013).

Moreover, their study highlights that a positive learning climate—marked by strong teacher-student interactions—enhances student motivation and engagement, ultimately leading to better academic outcomes. Similarly, Duffy and Lent (2021) underscored the importance of comprehensive strategies that integrate technology and teacher training to maximize learning opportunities for diverse student populations.

For the assumption checks, the researchers attached the tables in the appendices for reference. Here are the following results for the

assumption checks:

Linear Relationship (Pearson-r)

The assumption of a linear relationship is met for both Overall Average Use of Assistive Technology (p-value = 0.001) and Overall, Teacher Training (p-value = 0.001) in relation to academic success, as indicated by the significant Pearson correlation values. This supports the validity of using these predictors in a linear regression model.

Normality Test (Shapiro-Wilk)

Statistic (W) = 0.967: The Shapiro-Wilk test statistic is close to 1, which generally indicates that the data do not deviate significantly from a normal distribution. Values closer to 1 suggest stronger evidence of normality. The p-value is 0.094, which is greater than the common significance level of 0.05. The Shapiro-Wilk test suggests that the residuals of the regression model are reasonably close to normality. This supports one of the key assumptions for linear regression, ensuring that the statistical inferences (such as p-values and confidence intervals) from the model are valid.

Collinearity (VIF for each Independent Variable)

The collinearity statistics help assess whether the predictors in the model are highly correlated, which can affect the reliability of regression analysis. The VIF values for both Overall Average Use of Assistive Technology and Overall, Teacher Training are 1.41. This is well below the common threshold of 5, indicating a very low level of multicollinearity. Therefore, the assumption is met.

Residual Plot

The Residuals vs. Fitted Plot is used to assess whether certain assumptions of linear regression are met, specifically linearity and homoscedasticity (constant variance of residuals). In the resulting plot, the residuals appear randomly scattered around 0, indicating that the model is appropriately capturing the linear relationship between the independent variables and the dependent variable. The residual plot supports the assumptions of linearity and homoscedasticity. There is no clear pattern or funnel shape, which suggests that the model is well-specified. This is a positive indication that the linear regression results are reliable.

ANOVA Test

The p-value for Overall Average Use of Assistive Technology is 0.001, which is below the 0.05 threshold, indicating that it has a statistically significant impact on academic achievement. Similarly, Overall, Teacher Training has a p-value of 0.001, also below the threshold, confirming its significant effect on the dependent variable. The residuals reflect unexplained variability, with a sum of squares of 9.33 and 59 degrees of freedom. Overall, both independent variables (Assistive Technology Use and Teacher Training) contribute significantly to explaining the variance in academic success, with Teacher Training having a somewhat larger effect than Assistive Technology Use. The low p-values indicate strong statistical evidence for these effects.

Conclusions

The study highlights the importance of a supportive educational environment, which aligns well with Lev Vygotsky's Social Interactionist theory. According to Vygotsky (1978), social interactions play a fundamental role in the development of cognitive abilities. While he did not specifically focus on assistive technology, his ideas on scaffolding and the role of social interaction in learning have been applied to modern educational practices, including the use of assistive technologies. Learning, in his view, is a social process, where knowledge is constructed through collaboration and interaction with others, especially more knowledgeable peers or mentors. In this context, the study's finding that "engaged teachers and adequate resources" enhance motivation and performance for hearing-impaired learners resonates with Vygotsky's concept of the "More Knowledgeable Other" (MKO). Teachers and mentors provide guidance, support, and scaffolding, enabling students to succeed. On inclusive teaching practices and teacher education, highlighting the importance of training teachers to use assistive technology to support students with disabilities is to be practiced. (William B. P. McKinney (1990s–2000s)

To further enhance the academic success of hearing-impaired learners, the educational environment should prioritize a comprehensive support system. Schools should prioritize providing access to a range of assistive technologies tailored to the specific needs of hearing-impaired students. Professional development for teachers should emphasize inclusive strategies, encourage the facilitation of social interaction, and provide resources specifically designed to address the unique needs of hearing-impaired students. Educational institutions should implement continuous professional development programs for teachers focused on the latest tools, strategies, and best practices for teaching hearing-impaired students. Schools should involve parents and communities in supporting hearing-impaired students' academic progress. Providing resources, workshops, and forums for families can strengthen the overall support system around the student. Further research should explore how these factors, alongside tailored interventions, impact long-term student success and well-being.

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