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OPTIMISING LEARNING FOR HEARING-IMPAIRED STUDENTS: A COMPARATIVE ANALYSIS OF LET'S WRITE, A MOBILE APPLICATION, AND GOOGLE CLASSROOM LEARNING PLATFORM ON USABILITY, LEARNING MOTIVATION AND ACADEMIC PERFORMANCE

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Abstract:

Hearing-impaired students struggle with writing, frequently make errors, and have limited sentence construction skills. Current learning platforms like Google Classroom do not have sign language support or content specifically designed for students with lower written comprehension, leading to frustration, sentence structure difficulties, and decreased motivation, as their unmet needs affect academic achievement. This study aimed to investigate if Let's Write, a mobile application, could address the essential writing skills needed for simple sentences, specifically focusing on the Preposition of Positions. The goal was to improve handwriting, accuracy, sentence structure, and punctuation by comparing it to the Google Classroom learning platform. The study was conducted using an experimental design, and the participants were chosen from government schools in Perak and Penang using purposive sampling. The study divided 80 hearing-impaired students into control (n=40) and experimental (n=40) groups, each using a different platform. Pre-tests, treatment (platform use), and post-tests were used to measure academic progress, while questionnaires assessed usability and motivation. The results showed that the Let's Write application provided a significantly more user-friendly and interactive learning environment. Students using the Let's Write application displayed higher self-assessment, focused on learning from mistakes, sought independent knowledge, and reported overall satisfaction. Importantly, the Let's Write application group showed greater academic improvement than the Google Classroom learning platform group. This suggests that mobile applications, particularly those incorporating sign language, can greatly enhance learning for hearing-impaired students by improving usability and

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learning motivation. It highlights the importance of tailored educational technologies in bridging the achievement gap. The study provides valuable insights for educators and developers to refine digital learning tools further.

Keywords:

Google Classroom, Mobile Applications, Usability, Learning Motivation, Academic Performance, Hearing Impaired Students

Introduction

Diverse learning approaches are vital to ensure adequate education for hearing-impaired students. Technology, like mobile applications and online platforms such as Google Classroom, plays a pivotal role (Nasir et al., 2021). Mobile applications offer personalized learning with features like captioning and sign language integration (Yeratziotis et al., 2023), enabling students to learn independently (Millett, 2023). Google Classroom provides structure but may pose challenges due to its reliance on auditory and text-based communication (Ashraf et al., 2021). Evaluating their effectiveness is crucial. While mobile applications promise to improve outcomes and motivation (Amnur et al., 2021), there is a gap in comparing them with Google Classroom for hearing-impaired students. This study aims to bridge this gap by examining their impact on academic achievement, usability, and learning motivation, striving to identify the most effective approach for hearing-impaired students.

Problem Statement

Mastering writing skills is crucial to communicative competence in students across educational levels (Almusawi, 2022). However, for hearing-impaired students in secondary schools, acquiring these skills presents a significant challenge (Kumatongo & Muzata, 2021; Nasir et al., 2021). Unfortunately, their English proficiency has consistently declined, reflecting poor overall performance (Khasawneh, 2021). Hearing-impaired students often struggle with writing, as they tend to make high-frequency spelling, punctuation, and grammatical errors (Zia, 2021). Additionally, their writing may be challenging to understand due to a lack of vocabulary and proficiency in sign language (Khasawneh, 2021). These students also face challenges related to letter formation, letter size, and spacing (Barnett et al., 2020). Therefore, this study primarily focuses on improving the writing skills of hearing-impaired students. The researcher has specifically narrowed down the learning content to focus on writing simple sentences, as these students struggle with constructing basic sentences (Mayer & Trezek, 2019; Herrera-Marmolejo et al., 2020). Furthermore, the researcher emphasizes using Preposition of Positions in writing simple sentences, as this can enhance handwriting, spelling accuracy, sentence structure, and punctuation (Kilpatrick & Wolbers, 2020).

Although hearing-impaired students face challenges in learning to read and write, there has been more emphasis on research about reading rather than writing (Wolbers et al., 2022). This lack of research on writing indicates a gap in this field of study. In addition, implementing a digital technology tool, such as a mobile application, in special education classrooms can provide differentiation and create a fun learning environment for students with special needs, increasing their motivation to learn (Siong et al., 2021; Supermaniam & Zaharudin, 2021). Therefore, it is necessary to reform the learning methods for hearing-impaired students by using current learning tools, like mobile applications in sign language, that fulfil the needs of

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these students for self-directed learning, which can have a positive impact on their academic achievements (Nugraha & Hermina, 2023).

Literature Review

Effectiveness of Mobile Application on Usability

Mobile applications offer a potent means to enhance learning achievement and motivation among hearing-impaired students. Features like colourful text, pictures, and videos cater to their needs and boost learning (Hafit et al., 2019). User-friendly and interactive content is an external motivator, fostering learning (Samsudin & Sulaiman, 2022). Moreover, mobile applications facilitate self-directed learning, allowing students to learn at their own pace and beyond school hours, potentially improving skills (Setiawan et al., 2023; Nasir et al., 2021). However, challenges exist, particularly in English language acquisition. Without proper guidance, students may struggle to navigate mobile learning. Guided activities significantly enhance English proficiency, and training in ICT devices is crucial for overcoming difficulties (Fannakhosrow et al., 2022).

Effectiveness of Mobile Application on Learning Motivation

Mobile applications can potentially enhance learning achievement and motivation for hearing-impaired students. Research by (Alias et al., 2023) highlights this potential, showing that applications designed with features like colourful text, pictures, and videos cater to the specific needs of hearing-impaired students and contribute to a more engaging learning process. In addition, well-designed applications with user-friendly and interactive content act as external motivators, facilitating student learning and encouraging academic excellence (Samsudin & Sulaiman, 2022). According to (Setiawan et al., 2023) further support this finding that mobile applications empower students by promoting self-directed learning. These applications allow students to learn at their own pace, even outside of school hours, potentially improving their writing skills, as stated by (Nasir et al., 2021). However, realising the full potential of mobile learning requires addressing potential barriers. One key challenge identified is the need for proper guidance. Their quasi-experimental research revealed that students who received guided activities through mobile technologies improved their English language proficiency more than those without guidance. This finding emphasises the importance of providing support to help hearing-impaired students navigate the learning process effectively. Similarly, (Fannakhosrow et al., 2022) emphasise the importance of assisting and training students using Information and Communications Technology (ICT) devices. Such support can help students overcome initial difficulties and alleviate apprehension about using these technologies for learning purposes.

Effectiveness of Mobile Application on Academic Performance

Students with hearing impairments often experience learning disabilities and academic difficulties due to challenges in processing information (Schley & Trussell, 2019). These combined challenges can significantly impact their academic achievement (Davenport et al., 2019). However, emerging assistive technologies offer promising educational opportunities. Mobile devices such as phones, tablets, and iPods can provide alternative learning pathways for students who struggle with traditional methods (Sumitra et al., 2024). Research by (Parvez et al., 2019) highlights the increasing use of mobile phones for individual and collaborative learning among hearing-impaired students.

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Furthermore, studies suggest mobile phones can be valuable tools for independent learning tailored to individual needs (David et al., 2023), and another scholar (Joseph, 2019) found that using mobile phones as educational tools can enhance engagement and improve learning outcomes for hearing-impaired students. The benefits extend beyond the classroom, and the feedback from students and parents indicates that mobile phones facilitate communication with teachers and enable effective learning from home, with indirect guidance outside of school hours (Efrina & Zulmiyetri, 2020). Ismaili (2017) proposed using mobile applications as instructional aids for hearing-impaired students. These applications have the potential to promote self-directed learning and improve academic achievement. Additionally, research by (Jameel et al., 2022) suggests that mobile applications can increase motivation and engagement in learning activities, particularly for learning English as a second language. Xu (2018) further indicates that mobile applications can foster positive attitudes towards learning English among hearing-impaired students.

Purpose of Study and Research Questions

This study aims to design and develop Let's Write, a mobile application. The aim is to evaluate the impact of the Let's Write application on the usability, motivation to learn, and academic performance of hearing-impaired students in special education government schools. They will focus on their ability to construct simple sentences using Preposition of Positions. Therefore, the study carried out three research questions, as stated below.

RQ1 How do hearing-impaired students perceive the usability of the Let's Write application and the Google Classroom learning platform in terms of design, ease of learning, user-friendliness, and interactivity, and what are the comparative differences between the two?

RQ2 What are the differences in learning motivation, specifically in terms of self-assessment, learning from mistakes, seeking knowledge independently, and satisfaction among hearing-impaired students using the Let's Write application compared to those using the Google Classroom learning platform?

RQ3 What is the comparative impact of the Let's Write application and Google Classroom learning platform on hearing-impaired students' academic performance as measured by pre-and post-test scores?

Research Design

An experimental design can be defined as the systematic organization and control of factors and conditions within an experiment. This meticulous approach ensures valid and reliable results (Miller et al., 2020). Therefore, the researcher applied an experimental design to collect data from questionnaires, pre-tests, and post-tests in this study. Figure 1 illustrates the experimental design of data collection used in this study.

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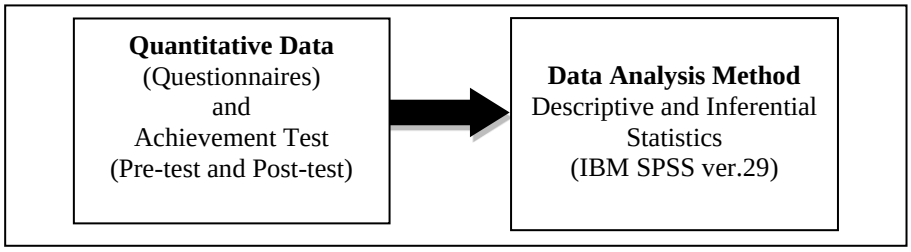

Figure 1 Experimental Data Collection

Population and Participants

The study used a population selection process to identify a representative sample of hearing-impaired students. The targeted population was students enrolled in government schools under the Special Education Program in Penang and Perak, Malaysia. These states were chosen because they have a larger population of hearing-impaired students than other regions. Initially, 130 students between 13 and 18 followed the Standard-based English Language Curriculum (SBELC) syllabus. However, 30 students were excluded from the pool of eligible participants due to medical concerns, based on approval from their class teacher. This resulted in a remaining pool of 100 eligible participants. To ensure that the samples taken in this study are representative of the population, the sample size is determined using the sample size table by (Krejcie & Morgan, 1970). According to the table, for a population of 100, a sample size of 80 is required to obtain a cross-section of the population. The selection of samples is based on the backgrounds, characteristics, and equal levels of academic achievements.

Methods

The investigation employed an experimental research design to assess the effectiveness of the Let's Write application and the Google Classroom learning platform in facilitating learning. A Non-Probability Sampling method, specifically focusing on Purposive Sampling, was implemented in this study. Purposive Sampling is an approach in which specific individuals or events are intentionally selected to gather essential information that other methods cannot obtain (Nyimbili & Nyimbili, 2024). A purposive sampling approach was used to select a representative sample of hearing-impaired students from two government secondary schools in Perak and Penang states. The researcher developed a survey instrument to collect the necessary information according to the study's objectives. The survey comprised multiple-choice and Likert scale items designed to assess participants' experiences in two sections: Section A focused on usability factors such as design, ease of learning, user-friendliness, and interactivity, while Section B addressed learning motivation aspects, including self-assessment, learning from mistakes, seeking knowledge independently, and satisfaction. Furthermore, a pilot test was conducted with a small group of hearing-impaired students to ensure the questionnaire's clarity and validity within the integrated program of Selangor's government secondary school of special education.

The Institutional Review Board granted ethical clearance for the study to safeguard the participants' confidentiality and rights. The study adhered to ethical guidelines by obtaining informed consent from all participants and informing them of their right to withdraw from the study at any time. Participants completed the survey questionnaires during allocated class periods. Comprehensive guidelines were provided to ensure consistency and accuracy in responses. Participants were encouraged to provide honest and thoughtful answers. A specific

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timeframe was allocated for data collection regarding participants' perceptions and experiences with the Let's Write application. Quantitative data from the survey questionnaires were analysed using software tools such as IBM SPSS ver.29. Descriptive statistics summarised participants' responses, including frequencies, means, and standard deviations. Inferential statistics, such as t-tests, include independent and paired sample t-tests.

Design and Development of the Let's Write Application

The researcher has designed and developed the Let's Write application, which is available on Android and IOS platforms. This application caters to the needs of hearing-impaired students who commonly use these platforms. It boasts a user-friendly design, with menu buttons presented in English for easy navigation. To access learning materials, students must touch the corresponding tab to explore various topics of interest. These topics include a Sign language dictionary, tutorials, exercises, and quizzes (see Figure 2-14). Educational content was carefully curated during the design phase to facilitate effective learning for hearing-impaired students. To ensure a robust pedagogical framework, the Let's Write application incorporates two prominent theories - Constructivism Theory (Vygotsky, 1978) and Mayer's Cognitive Theory of Multimedia (Mayer, 2001; Clark & Mayer, 2023; Mayer, 2017).

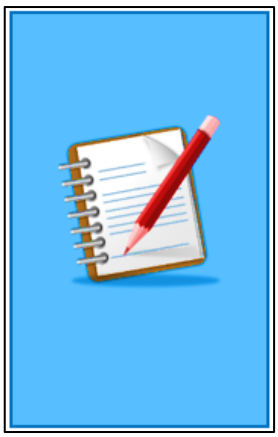


Figure 2: Let's Write Logo

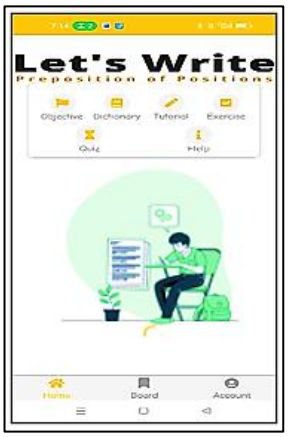


Figure 3: Homepage

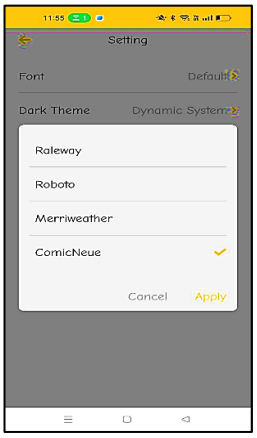
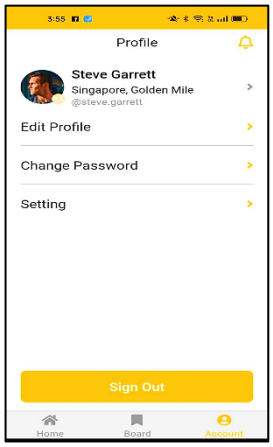


Figure 4: Settings



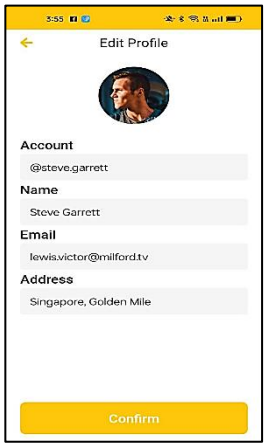


Figure 5: Profile Editing

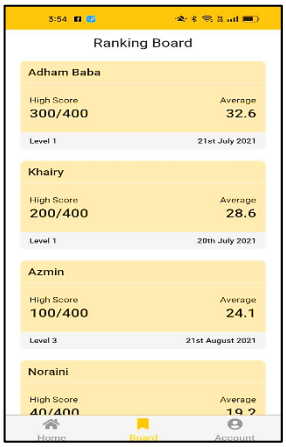


Figure 6: Ranking Board

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Figure 7: Learning Objectives and Success Criteria

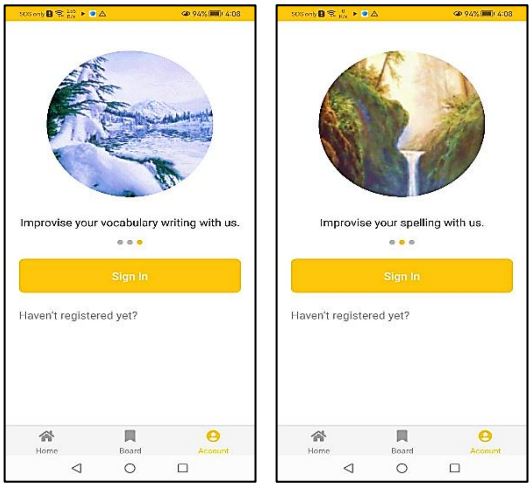

Figure 8: Log-In Process

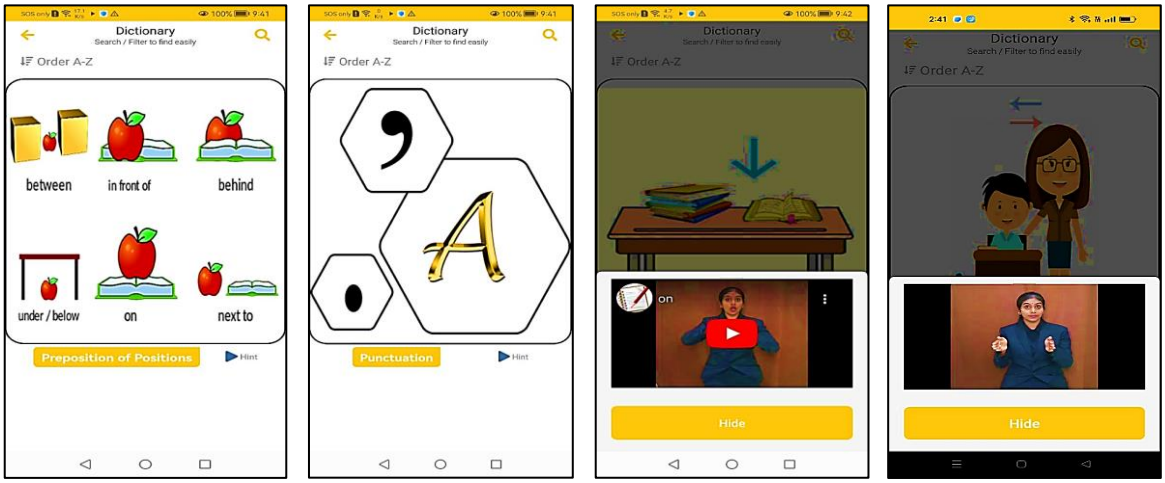

Figure 9: Sign Language Dictionary

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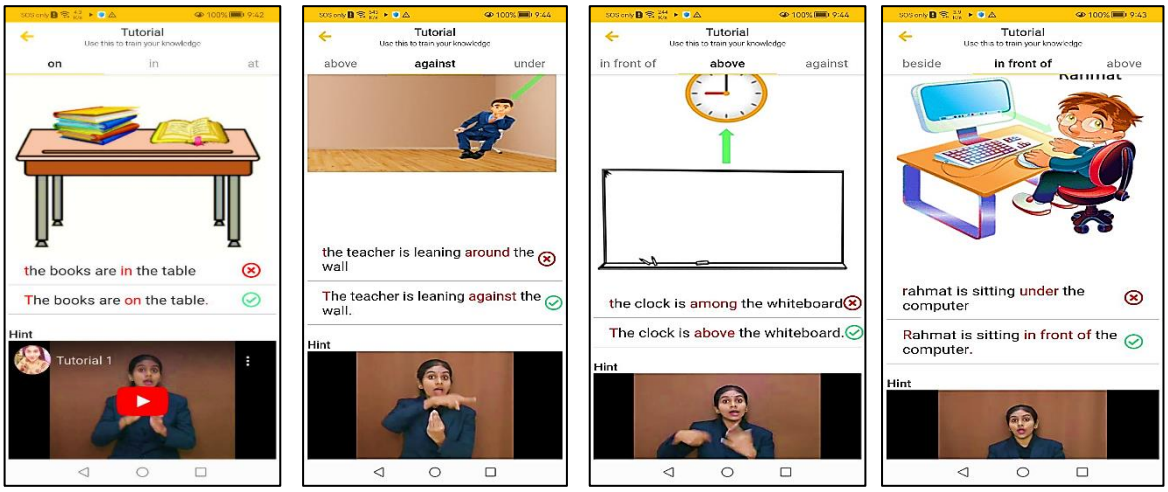

Figure 10: Tutorials

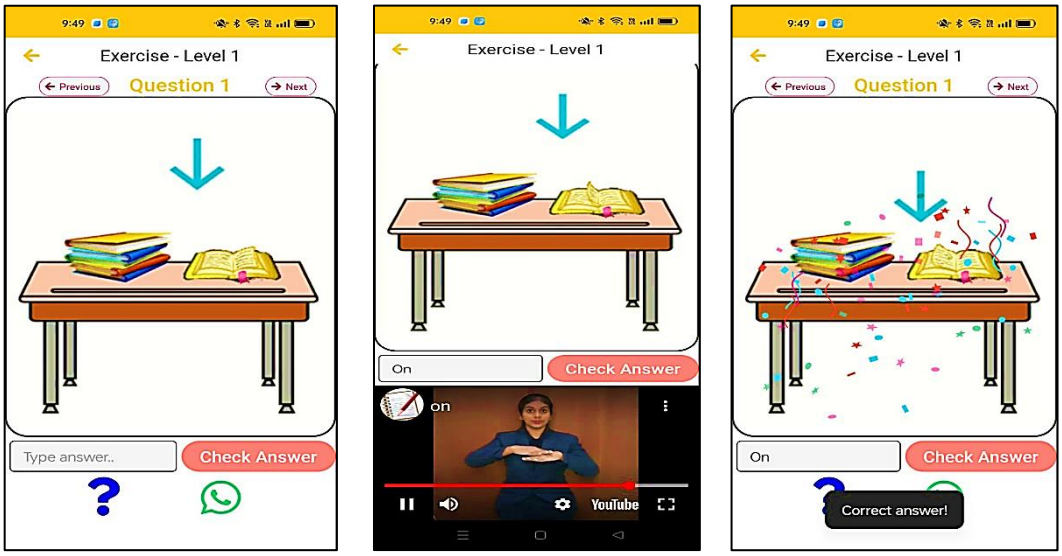

Figure 11: Level 1 of Spelling Assessments

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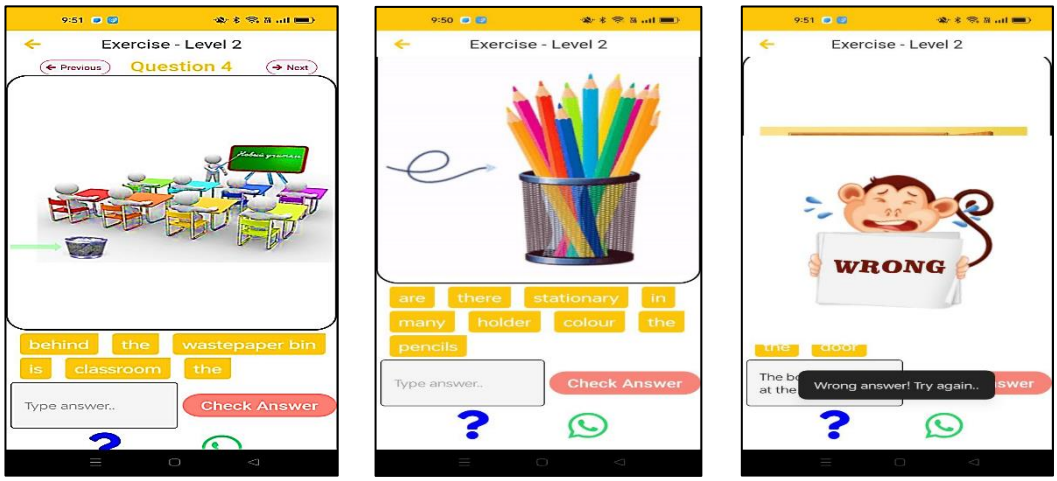

Figure 12: Level 2 of Word Arrangement Assessments

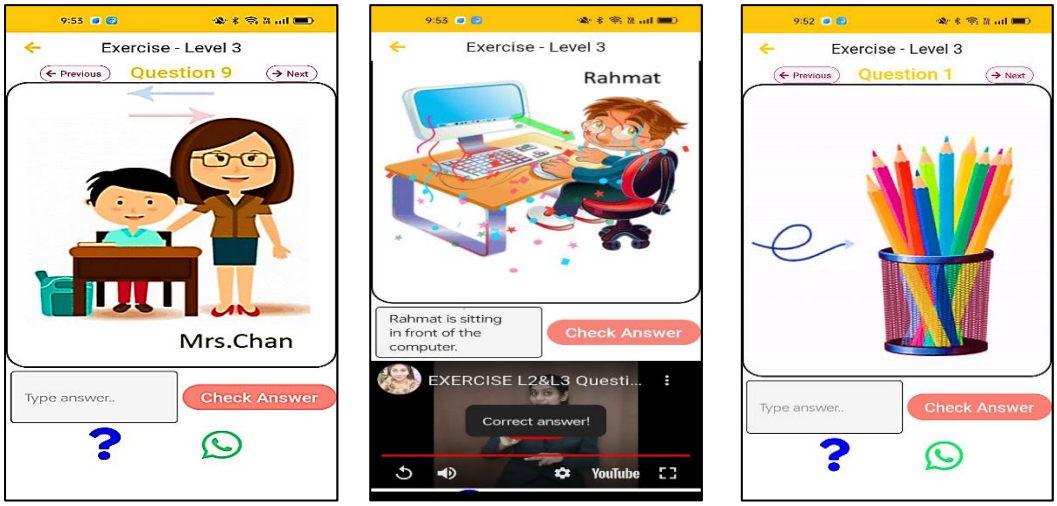

Figure 13: Level 3 of Writing Sentence Assessments

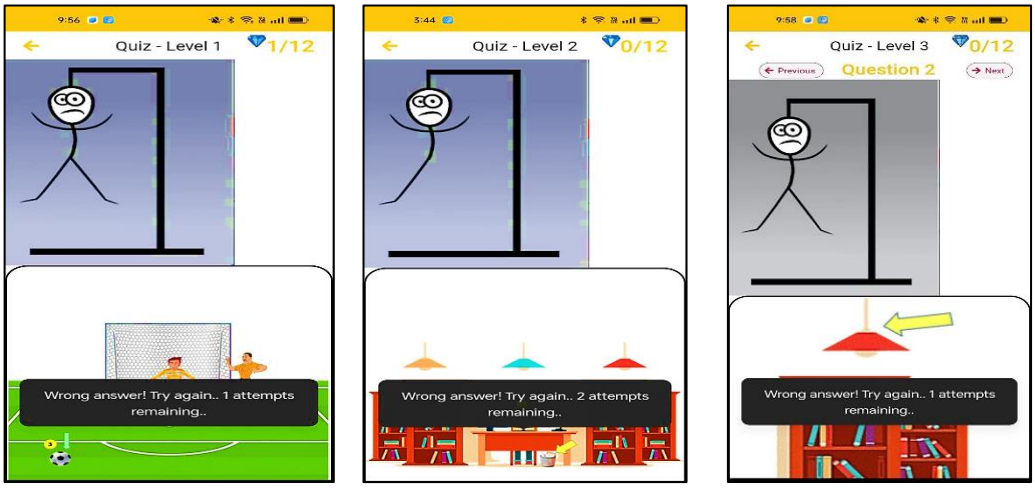

Figure 14: Three levels of Game-Based Quizzes

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Data Analysis And Results

Quantitative Data Analysis

The study used a parametric test to consider the normal distribution and homogeneity (Fraenkel & Wallen, 2006). Two questionnaires were employed to assess the usability of the Google Classroom Learning Platform (control group) and the Let's Write application (experimental group) within Section A and to evaluate the learning motivation within Section B. Subject matter experts validated these questionnaires. The data collected from the participants were analysed using IBM SPSS ver.29 software.

Effectiveness of the Let's Write application compared with the Google Classroom learning platform on Usability

RQ1 How do hearing-impaired students perceive the usability of the Let's Write application and the Google Classroom learning platform in terms of design, ease of learning, user-friendliness, and interactivity, and what are the comparative differences between the two?

This assessment aimed to measure user perceptions of usability, focusing on four fundamental constructs: perceived design, perceived interactivity, perceived user-friendliness, and perceived ease of learning. The questionnaire's user assessment section employed a five-point Likert scale to measure participants' agreement or disagreement with predetermined statements. Table 1 presents the exact statements and corresponding Likert scale anchors, such as "Strongly Disagree" to "Strongly Agree," and their specific details and wording.

Table 1 The Level of Likert-Scale

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5	4	3	2	1

Table 2 Descriptive Statistics of Experimental Group and Control Group (Perceived Design)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
B1	*The colors used in the Google Classroom learning platform are attractive.*	2.20	.687	*The colors used in the Let's Write application are attractive.*	4.47	.506
B2	*The audio used is clear.*	2.45	.504	*The audio used is clear.*	3.90	.841
B3	*The graphics used make the Google Classroom learning platform look attractive.*	2.17	.675	*The graphics used make the Let's Write application look attractive.*	4.47	.506
B4	*The size of the text used makes the Google Classroom learning platform easy to read.*	2.53	.506	*The size of the text used makes the Let's Write application easy to read.*	4.50	.506
B5	*The quiz activities in the form of a games are exciting.*	2.20	.687	*The quiz activities in the form of games are exciting.*	4.58	.501
Composite Mean of Design		**2.31 (Disagree)**		**Composite Mean of Design**	**4.38 (Strongly Agree)**	

Table 2 explains that hearing-impaired students have a negative opinion of the text size used in the Google Classroom Learning Platform (M=2.53, SD=0.506). They also strongly dislike its sound and graphical system (M=2.17, SD=0.675), leading to an overall mean of 2.31, indicating dissatisfaction with the platform's design. On the other hand, the Experimental Group, which used the Let's Write application, strongly agrees that the quiz activities are very appealing (M=4.58, SD=0.501). They also agree that the audio is clear and easy to understand

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(M=3.90, SD=0.841), resulting in an overall mean of 4.38, suggesting high satisfaction with the application's design.

Table 3 Descriptive Statistics of Experimental Group and Control Group (Perceived Interactivity)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
B6	The search tool in the Google Classroom learning platform works well.	1.13	.335	The search tool in the Let's Write app works well.	4.88	.335
B7	The instructions in the Google Classroom learning platform make it easy to find learning activities.	1.18	.385	The instructions in the Let's Write app make it easy to find learning activities.	4.83	.385
B8	Most buttons and links in the Google Classroom learning platform work when you click them.	2.23	.698	Most buttons and links in the Let's Write app work when you click them.	3.78	.698
B9	The icon buttons on the Google Classroom learning platform are self-explanatory.	1.20	.405	The icon buttons on the Let's Write app are self-explanatory.	4.78	.423
B10	Each interface of the Google Classroom learning platform is systematically linked.	1.12	.335	Each interface of the Let's Write app is systematically linked.	4.88	.335
Composite Mean of Interactivity		**1.37 (Strongly disagree)**		**Composite Mean of Interactivity**	**4.63 (Strongly Agree)**	

Table 3 shows that hearing-impaired students disagree with the Google Classroom Learning Platform's icon button, stating that it does not work well with links (M=2.23, SD=0.698). Furthermore, they strongly disagree with its interface functionality (M=1.12, SD=0.335), leading to an overall mean of 1.37. This clearly indicates their strong dissatisfaction with the platform's interactive features. In contrast, the Experimental Group, which uses the Let's Write application, strongly agrees that the search engine works well and that the interfaces are systematically linked (M=4.88, SD=0.335). Additionally, they agree that the application helps them easily access learning content (M=3.78, SD=0.698). Consequently, the overall means for satisfaction with the application's interactive features is 4.63.

Table 4 Descriptive Statistics of Experimental Group and Control Group (Perceived User-Friendliness)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
B11	Signing in to the Google Classroom learning platform is easy.	1.33	.474	Signing in to the Let's Write app is easy.	4.68	.474
B12	The Google Classroom learning platform lets me access learning content easily.	1.60	.496	The Let's Write app lets me access learning content easily.	4.40	.496
B13	The full-screen mode in the Google Classroom learning platform lets me see the content clearly.	1.50	.506	The full-screen mode in the Let's Write app lets me see the content clearly.	4.50	.506
B14	Learning content is easy to find in the Google Classroom learning platform	1.60	.496	Learning content is easy to find in the Let's Write app.	4.33	.616
B15	The navigation menu helps me use the Google Classroom learning platform	1.55	.504	The navigation menu helps me use the Let's Write app easily.	4.45	.504
Composite Mean of User-Friendliness		**1.52 (Strongly Disagree)**		**Composite Mean of User-Friendliness**	**4.45 (Strongly Agree)**	

Table 4 declared that hearing-impaired students strongly disagree that the Google Classroom Learning Platform meets their needs to access learning content (M=1.60, SD=0.496). They also strongly disagree that its log-in system is confusing (M=1.33, SD=0.474). This results in an overall mean of 1.52, indicating strong disagreement with the platform's user-friendliness. In contrast, the Experimental Group using the Let's Write application finds it easy to log-in and access learning content (M=4.68, SD=0.474). They agree that the application helps them achieve learning content easily (M=4.33, SD=0.616). This results in an overall mean of 4.45, indicating agreement with the application's helpfulness in fulfilling their learning needs.

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Table 5 Descriptive Statistics of Experimental Group and Control Group (Perceived Ease of Learning)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
B16	The Sign Language Dictionary facilitates the learning process.	2.10	.672	The Sign Language Dictionary facilitates the learning process.	4.85	.362
B17	I can answer spelling exercises easily.	2.48	.506	I can answer spelling exercises easily.	4.48	.506
B18	I can write simple sentences with correct grammar.	1.92	.730	I can write simple sentences with correct grammar.	4.45	.504
B19	Quizzes with hints are easy to understand.	2.03	.768	Quizzes with hints are easy to understand.	4.80	.405
B20	I understand the learning of Preposition of Positions.	2.28	.452	I understand the learning of Preposition of Positions.	4.40	.496
Composite Mean of Ease of Learning		**2.16 (Disagree)**		**Composite Mean of Ease of Learning**	**4.60 (Strongly Agree)**	

Table 5 reveals that hearing-impaired students disagree with the spelling activities on the Google Classroom Learning Platform, stating that they are not guided and easy to follow (M=2.48, SD=0.506). Additionally, these students struggle with writing simple sentences with correct grammar (M=1.92, SD=0.730), contributing to an overall mean of 2.16. This suggests that they are dissatisfied with the platform's ease of learning. On the other hand, the Experimental Group, which uses the Let's Write application, has reported strong agreement regarding the effectiveness of the sign language dictionary for comprehending vocabulary (M=4.85, SD=0.362). They also strongly agree that they can understand the learning of Preposition of Positions (M=4.40, SD=0.496). As a result, the overall mean for this group is 4.60, indicating a high level of satisfaction with the application's usability in facilitating their learning process.

Effectiveness of the Let's Write application compared with the Google Classroom learning platform on Learning Motivation

RQ2 What are the differences in learning motivation, specifically in terms of self-assessment, learning from mistakes, seeking knowledge independently, and satisfaction among hearing-impaired students using the Let's Write application compared to those using the Google Classroom learning platform?

This section utilized a four-part questionnaire. The first part assessed participants' self-efficacy in self-assessment, while the second part evaluated their perception of the value of learning from mistakes. The third part measured their perceived ability to engage in independent knowledge acquisition. The final part measured their overall satisfaction levels. The questionnaire's user assessment section employed a five-point Likert scale to measure participants' agreement or disagreement with predetermined statements. Table 1 displays the exact statements and corresponding Likert scale anchors, such as "Strongly Disagree" to "Strongly Agree," and their specific details and wording.

Table 6 Descriptive Statistics of Experimental Group and Control Group (Perceived Self-Assessment)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
C01	I can easily find out my achievement scores.	2.40	.496	I can easily find out my achievement scores.	4.50	.506
C02	I am more focused on learning using the Google Classroom learning platform.	1.48	.599	I am more focused on learning using the Let's Write application	4.50	.506

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C03	The marks given after answering questions in the Google Classroom learning platform boost my interest to continue learning	1.77	.620	The marks given after answering questions in the Let's Write application boost my interest to continue learning	4.45	.504
C04	I am excited when doing activities in the Google Classroom learning platform	1.80	.687	I am excited when doing activities in the Let's Write application	4.68	.474
Composite Mean of Self-Assessment		**1.86 (Disagree)**		**Composite Mean of Self-Assessment**	**4.53 (Strongly Agree)**	

Table 6 indicates that hearing-impaired students disagree with the ease of finding their achievement score after completing exercises (M=2.40, SD=0.496). Furthermore, they strongly disagree that they can stay more focused on learning using the Google Classroom Learning Platform (M=1.48, SD=0.599). These findings suggest an overall mean of 1.86, indicating disagreement with the platform's self-assessment features. In contrast, the Experimental Group, which utilized the Let's Write application, showed strong agreement that they are excited when engaging in activities (M=4.68, SD=0.474). They also strongly agreed that checking their achievement marks increases their motivation to continue learning (M=4.45, SD=0.504). This resulted in an overall mean of 4.53, indicating strong agreement with the application's effectiveness in self-assessment and boosting motivation.

Table 7 Descriptive Statistics of Experimental Group and Control Group (Perceived Learning from Mistakes)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
C5	I can learn from mistakes and correct quiz answers with hint buttons.	2.03	.733	I can learn from mistakes and correct quiz answers with hint buttons.	4.70	.464
C6	I can correct punctuation errors in sentences.	2.32	.656	I can correct punctuation errors in sentences.	4.53	.506
C7	I can fix incorrect capitalization in the sentence.	2.00	.679	I can fix incorrect capitalization in the sentence.	4.68	.474
C8	I can correct wrong exercise answers with hint buttons.	1.65	.622	I can correct wrong exercise answers with hint buttons.	4.53	.506
C9	I can correct wrong quiz answers with the help of hint buttons.	2.28	.640	I can correct wrong quiz answers with the help of hint buttons.	4.53	.506
Composite Mean of Learning from Mistakes		**2.06 (Disagree)**		**Composite Mean of Learning from Mistakes**	**4.59 (Strongly Agree)**	

Table 7 indicates that hearing-impaired students disagree that learning through the Google Classroom Learning Platform enables them to correct mistakes in their writing (M=2.32, SD=0.656). They also strongly disagree that they could reverse mistakes using the hint button (M=1.65, SD=0.622). These results suggest an overall mean of 2.06, indicating disagreement with the platform's ability to facilitate learning from mistakes. Conversely, for the Experimental Group using the Let's Write application, students strongly agree that the application provides better instructions and guidance for learning from mistakes (M=4.70, SD=0.464). They also strongly agree that they can correct mistakes using the hint button, which includes sign language videos and guidance on writing sentences with correct grammar (M=4.53, SD=0.506). These results yield an overall mean of 4.59, indicating strong agreement that the Let's Write application helps learn from mistakes by providing comprehensive support through the hint button.

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Table 8 Descriptive Statistics of Experimental Group and Control Group (Perceived Seeking Knowledge Independently)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
C10	Using the Google Classroom learning platform, I can learn independently without assistance from others.	2.13	.757	Using the Let's Write application, I can learn independently without assistance from others.	4.53	.506
C11	Using the Google Classroom learning platform, I do not need guidance from teachers.	2.00	.987	Using the Let's Write application, I do not need guidance from teachers.	4.45	.504
C12	Using the Google Classroom learning platform, I strive to answer all exercises correctly.	1.95	.749	Using the Let's Write application, I strive to answer all exercises correctly.	4.58	.501
C13	Using the Google Classroom learning platform, I feel happy when I get high scores.	2.20	.608	Using the Let's Write application, I feel happy when I get high scores.	4.73	.452
C14	Using the Google Classroom learning platform, I easily understand the Sign Language Communication Dictionary.	1.43	. 501	Using the Let's Write application, I easily understand the Sign Language Communication Dictionary.	4.68	.474
Composite Mean of Seeking Knowledge Independently		**1.94 (Disagree)**		**Composite Mean of Seeking Knowledge Independently**	**4.59 (Strongly Agree)**	

Table 8 shows that hearing-impaired students disagree that the Google Classroom Learning Platform boosts their motivation in learning due to lack of appreciable marks for achievements (M=2.20, SD=0.608), and they strongly disagree that it provides no sign language dictionary for better understanding (M=1.43, SD=0.501), resulting in an overall mean of 1.94, suggesting disagreement with the platform's support for self-centered learning. Conversely, for the Experimental Group using the Let's Write application, students strongly agree that it motivates them for self-centered learning through self-assessment (M=4.73, SD=0.452), and they strongly agree that it helps them learn independently (M=4.53, SD=0.506), resulting in an overall mean of 4.59, indicating strong agreement that the Let's Write application is helpful and encourages independent learning.

Table 9 Descriptive Statistics of Experimental Group and Control Group (Perceived Satisfaction)

No	Statement (Control Group)	Mean	Std. Deviation	Statement (Experimental Group)	Mean	Std. Deviation
C15	I enjoy using the Google Classroom learning platform.	2.25	.670	I enjoy using the Let's Write application.	4.48	.506
C16	I can make references anywhere using the Google Classroom learning platform.	2.00	.641	I can make references anywhere using the Let's Write application	4.47	.506
C17	Learning on the Google Classroom learning platform greatly assists me.	2.18	.712	Learning on the Let's Write application learning platform greatly assists me.	4.48	.506
C18	I feel happy answering questions based on games.	2.33	.616	I feel happy answering questions based on games.	4.48	.506
C19	I find it easy to learn to write simple sentences using Preposition of Positions.	2.15	.700	I find it easy to learn to write simple sentences using Preposition of Positions.	4.43	.501
C20	I want to learn using the Google Classroom learning platform.	1.45	.504	I want to learn using the Let's Write application	4.42	.501
Composite Mean of Satisfaction		**2.06 (Disagree)**		**Composite Mean of Satisfaction**	**4.46 (Strongly Agree)**	

Table 9 reveals that hearing-impaired students do not find answering exercises based on gameplay in the Google Classroom Learning Platform enjoyable (M=2.33, SD=0.616). Furthermore, they strongly disagree that they want to use the platform as their learning medium (M=1.45, SD=0.504). This overall mean of 2.06 indicates dissatisfaction with the platform due to unmet requirements and needs. Conversely, for the Experimental Group using the Let's Write application, students strongly agree that it is enjoyable with games and helpful as a self-

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centered learning tool (M=4.48, SD=0.506). They also strongly agree that they want to use it as a learning tool (M=4.42, SD=0.501). This results in an overall mean of 4.46, indicating strong satisfaction with using the Let's Write application.

Effectiveness of the Let's Write application compared with the Google Classroom learning platform on Academic Performance

RQ3 What is the comparative impact of the Let's Write application and Google Classroom learning platform on hearing-impaired students' academic performance as measured by pre- and post-test scores?

Independent Sample T-Test

In inferential statistics, an independent sample T-test was performed to compare the academic performance scores of both groups (see Table 10). There was no significant difference between the academic performance of both groups before research (p>.05). The paired sample t-test was performed to compare the academic performance scores of both groups. In contrast, a significant difference was found in favor of the experiment group after research (p<.05). By these results, it can be concluded that the Let's Write application poses a better effect on academic performance. Below are the results.

Table 10 Independent Sample T-Test for Pre-Test between the Experimental and Control Group

		Levene's Test for Equality of Variances		T-test for Equality of Means							
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Pre-test Score	Equal variances assumed	.095	.759	.174	78	.431	.863	.250	1.439	-2.615	3.115
	Equal variances not assumed			.174	77.972	.431	.863	.250	1.439	-2.615	3.115

Table 10 explains Levene's Test for Equality of variances, which was conducted and yielded a p-value of 0.759, signifying that the assumption of equality of the two variances is met. The tcalc = 0.174 with sig = 0.863 > 0.05. The outcome of the pre-test session calculation accepts the Null Hypothesis, suggesting no significant difference between the Google Classroom learning platform (control group) and the Let's Write application (experimental group) during the pre-test session. A similar independent samples t-test will be conducted on the post-tests. Table 11 displays the Independent sample T-test for the post-test between the Experimental and Control groups to identify significant differences after the treatment.

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Table 11 Independent sample T-test for Post-test between the Experimental and Control group

		Levene's Test for Equality of Variances		T-test for Equality of Means							
										95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Std. Error Difference	Lower	Upper
Post-test Score	Equal variances assumed	.102	.750	33.096	78	<.001	<.001	52.600	1.589	49.858	55.764
	Equal variances not assumed.			33.096	77.835	<.001	<.001	52.600	1.589	49.858	55.764

Table 11 shows that Levene's Test for Equality of variances has been conducted, and the p-value is 0.750, indicating that the assumption of equality of the two variances is fulfilled. The t_{calc} = 33.096 with sig =.001< 0.05. The consequence of calculation at the post-test session rejects the Null Hypothesis. It proves a statistically significant difference between the Google Classroom learning platform (control group) and the *Let's Write* application (experimental group) at the post-test session. Both independent sample t-tests do not measure the effectiveness of the *Let's Write* application. A paired sample t-test will measure the effectiveness of the *Let's Write* application relative to the hearing-impaired students' achievement.

Paired Sample T-Test for the Control Group and Experimental Group

Table 12 Paired Sample T-Test for Control Group

		Levene's Test for Equality of Variances		Paired Differences					
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig (2 tailed)
Pair 1	Pre-test_ Score – Post-test_ Score	.250	10.729	1.696	-3.181	3.681	.147	39	.884

Table 12 shows the sample mean of the differences between pre-and post-test scores, Mean = 0.250, and the standard deviation of 10.729 measures the variation obtained from the paired scores. The 95% confidence interval indicates that the mean of the differences ranges from -3.181 to 3.681, suggesting that the post-test score is higher than the pre-test score. With a p-value of 0.884, exceeding the SPSS default significance level of 0.05 (p = 0.884 > 0.05), we fail to reject the null hypothesis, leading to the conclusion of "There is no significant difference in the academic performance of hearing-impaired students who use the Google Classroom learning platform, as measured by pre-and post-test scores."

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Table 13 Paired Sample T-Test for Experimental Group (Let's Write Application)

		Levene's Test for Equality of Variances							
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig (2 tailed)
Pair 1	Pre-test_Score – Post-test_Score	-62.625	5.616	.888	-64.521	-60.929	-70.641	39	. <0.001

Table 13 shows the differences between pre and post-test scores, Mean = -62.625, and the standard deviation of 5.616 measures the variation obtained from the paired scores. The 95% confidence interval indicates that the mean of the differences ranges from -64.521 to -60.929, suggesting that the post-test score is higher than the pre-test score. With a p-value of 0.001, below the SPSS default significance level of 0.05 (p= 0.001 < 0.05), we reject the null hypothesis, leading to the conclusion that "There is a significant difference in the academic performance of hearing-impaired students who use the Let's Write application, as measured by pre-and post-test scores.

Conclusions

The current study adds to the existing research on the potential of mobile applications to improve academic performance and motivation among hearing-impaired students. The findings reveal a clear preference for the Let's Write application over the Google Classroom Learning Platform. This suggests that applications specifically designed to meet the needs of this population, incorporating engaging elements and promoting independent learning, are more likely to be well-received and potentially result in better learning outcomes. Additionally, the research highlights the importance of user-centered design principles in developing educational mobile applications for hearing-impaired students. Future versions of these applications should prioritize features that directly address the unique challenges faced by this population, creating a more inclusive and engaging learning environment.

Furthermore, the study emphasizes the significance of learning Preposition of Positions in writing. This knowledge is vital for developing good handwriting, correct spelling, sentence structure, and punctuation skills (Kilpatrick & Wolbers, 2020). Additionally, the Let's Write application can help promote inclusion education. The Let's Write application includes images relevant to the classroom setting, making it an excellent resource for mainstream students and teachers. It facilitates successful communication in sign language and fosters confidence, creating a positive learning environment. As stated by (Srivastava et al., 2021), a smart learning assistance tool may remove barriers to participation, foster smooth communication with both instructors and fellow students and empower special needs students to fully engage with educational opportunities, resulting in a more effective and inclusive learning environment.

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