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EFFECT OF ASSISTIVE TECHNOLOGY AND TRAINING ON ACADEMIC PERFORMANCE AMONG COLLEGE STUDENTS WITH PHYSICAL DISABILITIES AT PRESBYTERIAN COLLEGE OF EDUCATION, AKROPONG-AKUAPEM, GHANA

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Abstract:
The study examined how assistive technology type and training affected physical disability students' academic performance at the Presbyterian College of Education in Akropong-Akuapem. The study found that screen readers, braille displays, and speech-to-text improved academic achievement. Participants employing these technologies had significantly higher post-test results than pre-test scores. The study also found that assistive technology training improved academic achievement. The trained experimental group had higher mean pre- and post-test scores than the control group. This emphasises the need for extensive training to maximise assistive technology benefits for students with physical disabilities. Voice recognition technology improved academic performance slightly, but not significantly. This technology may need more research and development to promote academic performance in this environment. This study adds to the evidence that assistive technology and training improve college students' academic performance with physical limitations. To develop inclusive learning environments and promote equitable opportunities for students with disabilities, teachers and institutions must carefully choose and implement assistive technology and training initiatives. The report recommends integrating assistive technology into schools to help students succeed. Future studies should examine the efficacy of diverse assistive technologies and training methods and solve implementation issues.

Keywords: academic performance, assistive technology, physical disability, teacher training

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1. Introduction

Higher education is becoming increasingly in demand in Africa. However, many individuals with disabilities face significant challenges in accessing and completing their education (Tudzi *et al*., 2020). The United Nations Educational, Scientific and Cultural Organisation (UNESCO) reports that only 5% of Africans with disabilities have access to postsecondary education. The inadequate infrastructure and resources in most African nations make it difficult for persons with disabilities to obtain the assistive technology (AT) they need to fulfill their educational aspirations.

In Ghana, there is a lack of comprehensive data on people with disabilities, particularly those with physical impairments (Owusu-Fordjour *et al*., 2020). According to the World Health Organization (WHO), fifteen percent of people worldwide have some form of disability. Inaccessibility to education for people with disabilities is a significant global issue, and Ghana is no exception. Assistive technology is viewed as a critical tool to ensure inclusive and equitable education for people with disabilities (Acheampong & Agyemang, 2021).

The WHO defines assistive technology (AT) as "*any item, piece of equipment or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities*" (WHO, 2011). At Presbyterian College of Education in Akropong-Akuapem, physically challenged students face various obstacles in accessing academic material. Assistive technology can help overcome some of these barriers, facilitating access to and engagement with educational resources, communication with peers and teachers, and completion of assignments and exams. The effectiveness of AT interventions, however, depends on the type of technology used, the level of training received, and the specific needs of the user.

Studies have shown that assistive technology can significantly benefit individuals with physical impairments. For instance, a meta-analysis by De Witte *et al*. reported that AT usage improved the independence, mobility, and quality of life of people with physical impairments. Similarly, research by Ackah-Jnr and Danso (2019) found that AT enhanced the capacity of individuals with physical impairments to engage in meaningful work and social activities. Nonetheless, the success of AT interventions is influenced by factors such as the type of technology, the specific needs and skills of the individual, and the level of training and support provided (Lyner-Cleophas, 2019).

Despite the increasing focus on the efficacy of AT interventions in high-income countries, there is a scarcity of research in low- and middle-income countries (LMICs), including Ghana (Lawson *et al*., 2019; Odame *et al*., 2021). This gap is concerning, given that most people with disabilities live in LMICs (WHO, 2021). Therefore, research in these settings is crucial to ensure that individuals with disabilities have access to effective AT interventions.

While the use of assistive technology is becoming more common in Ghana, there is limited knowledge about its effectiveness in aiding individuals with disabilities. This study aims to contribute to the existing knowledge by examining the effectiveness of AT interventions for physically disabled students at Presbyterian College of Education, Akropong-Akuapem.

2. Statement of the Problem

The global disability community comprises more than one billion people, accounting for approximately 15% of the global population. According to the WHO, physical disabilities, such as mobility impairments, hearing or visual impairments, and speech disabilities, are among the most prevalent types of disabilities worldwide (WHO, 2021). These disabilities often limit individuals' ability to perform daily tasks, including accessing education and employment opportunities, participating in social and cultural events, and engaging in leisure activities (WHO, 2021). Consequently, individuals with physical disabilities frequently face social exclusion, discrimination, and unequal access to resources and services (UN, 2020).

Assistive technology has emerged as a solution to these challenges, enabling individuals with impairments to participate more fully in society and improving their quality of life (UN, 2020). AT includes devices and systems designed to assist people with disabilities in performing daily tasks, such as mobility aids, communication devices, and software applications (WHO, 2021). AT can enhance individuals' independence, social participation, and economic productivity (UN, 2020).

Despite the potential benefits of AT, individuals with physical impairments continue to face significant barriers to using these technologies globally. Financial, infrastructural, and policy-related obstacles often hinder access to AT in low- and middle-income countries (WHO, 2021). Even in high-income countries, there is often a lack of awareness among employers, educators, and medical professionals about the benefits of AT (WHO, 2021). Additionally, the effectiveness of AT interventions remains uncertain, even when AT is accessible.

Several studies have called for more comprehensive research on the impact of AT on the daily lives of individuals with physical impairments (Acheampong & Agyemang, 2021; Owusu-Fordjour *et al*., 2020). While some studies have shown positive outcomes of AT interventions on individuals' productivity, independence, and quality of life (Banahene *et al*., 2018; Tetteh & Attiogbe, 2019), others have reported mixed results, with some individuals experiencing difficulties using the technology or finding it ineffective in improving their daily lives (Ahmed, 2018; Syriopoulou-Delli & Gkiolnta, 2022).

Given these mixed findings, there is a pressing need for research examining the effectiveness of AT interventions for individuals with physical disabilities at the Presbyterian College of Education in Akropong-Akuapem, Ghana. This study aims to fill this gap by evaluating how AT and training impact the academic performance of these

students, thereby contributing to the development of more effective strategies for inclusive education.

2.1 Research Questions

The study was guided by the following research questions:

1. How does the type of assistive technology used to impact the academic performance of college students with physical disabilities at the Presbyterian College of Education in Akropong-Akuapem?
2. To what extent does training in the use of assistive technology affect the academic performance of college students with physical disabilities at the Presbyterian College of Education in Akropong-Akuapem?

3. Literature Review

3.1 Theoretical Framework

The theoretical foundation of this research is the Social Model of Disability, which holds that people with disabilities are mainly disadvantaged by social barriers that prevent them from participating fully in various spheres of life, including education (Kazou, 2017). This perspective holds that a person's impairments interact with their environment to create disability. By removing barriers from the surroundings, people with disabilities may be more involved in life in general and in school (Woods, 2017). The Technology Adoption Model (TAM), a commonly used theoretical framework that clarifies the factors influencing the adoption and usage of technology, further directs the study. According to the Technology Acceptance Model (TAM), how useful and easy-to-use technology is to a person determines how much they want to use it (Gupta *et al*., 2021). In the context of assistive technology for people with impairments, perceived usefulness describes how much the technology enhances their capacity to finish jobs or activities. Conversely, simplicity of usage refers to how easy the technology is to understand and utilise (Siti *et al*., 2021). The study also takes into account the Ecological Systems Theory, which contends that the microsystem, mesosystem, exosystem, and macrosystem—among other interrelated systems—shape an individual's development (Yang & Sanborn, 2021). The physically disabled person is referred to as the microsystem in this study; their immediate environment, such as family and friends, is referred to as the mesosystem; the external environment, including educational policies and disability services, is referred to as the exosystem; and the larger society and cultural norms and values are referred to as the macrosystem (Noursi *et al*., 2021). Furthermore used in the study is the Self-Efficacy Theory, which holds that a person's motivation and conduct are influenced by their beliefs about their abilities to do a task. Within this study, self-efficacy refers to a person's belief in their ability to employ assistive technology to improve their academic performance. The theoretical framework of this study provides a comprehensive understanding of the factors influencing college students with physical disabilities'

acceptance and usage of assistive technology as well as the interactions between these aspects and the larger social and cultural context.

3.2 Assistive Technology and Its Types

Software and hardware intended to help people with disabilities execute tasks that would be difficult or impossible; otherwise, they are referred to as assistive technology (De Witte *et al*., 2018). Within the field of education, assistive technology may help students with disabilities overcome barriers to learning and improve their academic performance.

As Satsangi and Miller (2017) have shown, educational settings often use a variety of assistive technologies. Among them are programmes that help kids with dyslexia, reading difficulties, or visual impairments by turning written material into audio words. Students with physical disabilities may now use speech recognition software to operate their computers by speaking commands. Software called screen readers reads text shown on a computer screen aloud so that students with visual impairments may access it. Electronics called braille displays convert text on a screen to Braille. They let kids who are blind or visually impaired read and interact with digital content. Students with physical restrictions may use computers or mobile devices with the assistance of alternative input devices like joysticks or touchscreens. Electronic magnifiers may also help visually challenged pupils view printed items like handouts or textbooks. With the use of assistive technology, students with disabilities may easily access learning resources and participate fully in class. By doing this, one may feel more autonomous and self-worthy as well as perform academically more effectively (WHO, 2022).

3.3 Academic Performance and Physical Disabilities

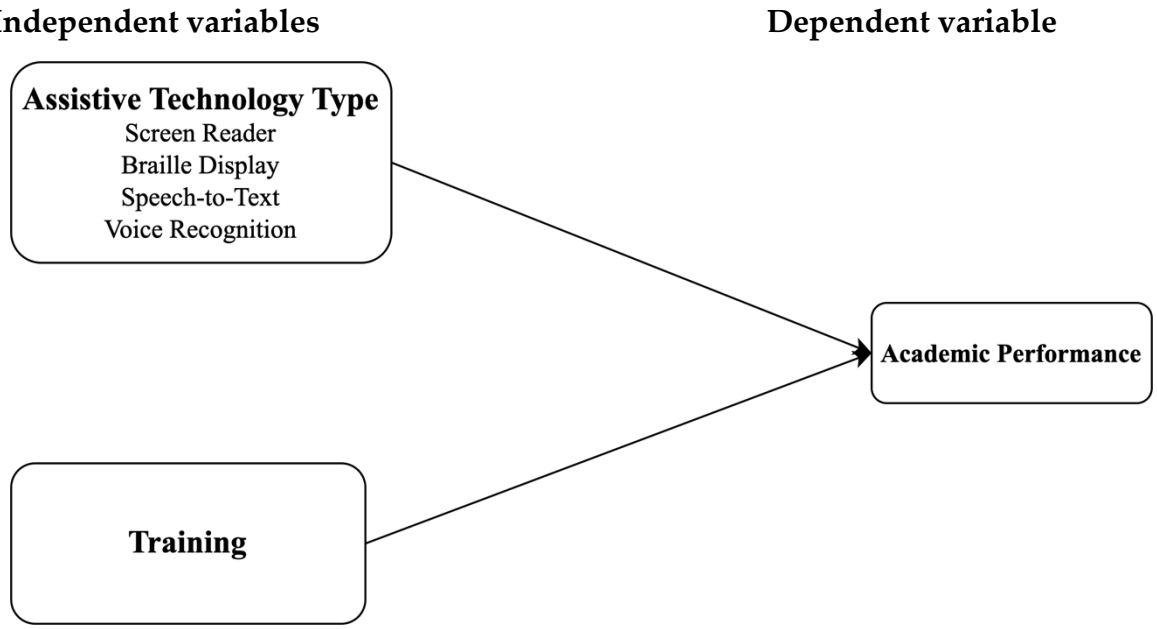
One of the most important measures of success in higher education is academic performance. Still, physically challenged college students might run into unique challenges that could affect their academic performance (Onivehu Adams *et al*., 2017). These problems might be anything from physical barriers on campus to difficulties getting course materials or the need for extra support services. Physical impairments may be any number of illnesses, including chronic health problems, visual or hearing problems, or mobility restrictions. Physically challenged students might run across challenges that could affect their academic performance, like taking notes, participating in class discussions, or getting course materials (Syriopoulou-Delli & Gkiolnta, 2022). Research has shown that, in comparison to their peers without disabilities, kids with physical disabilities often do lower academically and are more likely to drop out of classes (Svensson *et al*., 2021). Still, kids with physical constraints may benefit academically and have these issues successfully eased with the use of assistive technology and other support services. By meeting the particular needs of students with physical disabilities, colleges and universities may encourage inclusion and accessibility in the learning environment. This phenomenon could improve academic performance

and increase opportunities for success within this particular group (Rodríguez & Cumming, 2017).

The literature research indicates that college students with physical disabilities may accomplish academically far better when they employ assistive technologies. Moreover, how well the intervention works depends critically on the particular assistive technology and the level of training. Mobility aids, computer-based courses, and communication devices are just a few examples of the many assistive technologies that have been shown to improve this group's academic performance. The recommended study emphasises how important it is to provide college students with physical limitations enough instruction and to choose appropriate assistive equipment. The requirement of creating an inclusive and easily accessible learning environment may also be the main topic of the study. This may be accomplished by spreading knowledge of the challenges this specific group faces and by advocating for laws that will ensure their academic success. With the use of the data gathered from the literature review, the suggested study may improve the body of knowledge on the best ways to help college students with physical disabilities succeed academically.

4. Conceptual Framework

Figure 3.1: Conceptual framework



Source: Author's own creation

5. Methodology

The study used a quantitative approach and a quasi-experimental research design. It included two separate student groups, the control group and the experimental group. The main goal was to find out how training and the kind of assistive technology affect academic achievement. Whereas the control group received no instruction at all, the experimental group received training in the use of assistive technology. The academic performance of both groups was evaluated using a pre- and post-test. Historical events, participants' natural changes with time, and the impact of repeated testing are some possible sources of bias that might impact the accuracy of the findings. Blinding procedures, thorough control group selection, and random participant assignment were all part of the research to lessen these influences. The Hawthorne effect, which is typified by people changing their conduct when they realise they are being observed, was controlled by either deception or naturalistic observation.

Students with disabilities enrolled at the Presbyterian College of Education in Akropong-Akuapem were part of the study. Students from the roster of registered students with disabilities were selected using a random sampling method. Students who had received a disability diagnosis and had registered formally with the disability services office qualified. The selection of participants for the research was done via a combination of convenience and selective sampling. Participants were sourced from disability NGOs or from the disability service providers at the Presbyterian College of Education in Akropong-Akuapem. Having a physical limitation that requires the use of assistive technology equipment and being a registered college student at Presbyterian College of Education were two of the prerequisites needed to be eligible for the study. Random allocation of the participants was made to either the control group, which received no intervention, or the intervention group, which received a specific kind of assistive technology equipment and training on its usage. The individual needs and preferences of the volunteers, as determined by preliminary assessments and discussions with assistive technology experts, guided the choice of assistive technology devices used in the study. Selection bias was reduced by closely matching members of both groups according to significant demographic variables like age, gender, and academic major. Furthermore, steps were done to confirm that, as determined by standardised disability measurement tools, the degrees of impairment severity in the two groups were similar. The study gathered data quantitatively. In order to measure academic performance, pre- and post-tests were given. Several accessible and in-use assistive technologies, including Screen Reader, Braille Display, Speech-to-Text, and Voice Recognition, were included in the data gathered. To get demographic data from the participants such as their age, gender, and kind of disability—a survey was designed. The significance of the results was determined by examining the quantitative data using inferential statistics like the t-test and ANOVA in addition to descriptive statistics like the mean and standard deviation.

6. Results

Table 1: Demographic Results

Demographic	Number of Participants
Age	
18-24 years	6
25-34 years	7
35-44 years	4
45 and above	0
Sex	
Male	10
Female	7
Disability Type	
Hearing Impaired	9
Visually Impaired	8

Table 1 shows that the study comprised 6 individuals aged 18–24, 7 aged 25–34, 4 aged 35–44, and no aged 45 or beyond. The gender split was 10 men and 7 women. According to the data, many research participants are 25–34 years old. Male participants outnumbered females.

Table 2: Impact of Assistive Technology Type on Academic Performance

Assistive Technology Type	Number of Participants	Mean Pre-Test Score	Mean Post-Test Score	Mean Difference	T-Value	P-Value
Screen Reader	3	70.5	83.2	12.7	4.59	<0.001
Braille Display	3	69.8	81.4	11.6	3.83	0.001
Speech-to-Text	3	72.3	82.1	9.8	2.96	0.006
Voice Recognition	2	71.1	78.6	7.5	1.94	0.075
Control Group	6	68.9	71.5	2.6	-	-

Table 2 presents the impact of different assistive technology types on academic performance. The participants using screen readers had a mean pre-test score of 70.5, which significantly increased to 83.2 in the post-test ($p < 0.001$). Similarly, participants using braille displays showed a significant improvement from a mean pre-test score of 69.8 to 81.4 in the post-test ($p = 0.001$). Those utilizing speech-to-text technology also experienced a significant improvement, with their mean pre-test score of 72.3 increasing to 82.1 in the post-test ($p = 0.006$). However, participants using voice recognition technology demonstrated a slight improvement, but it did not reach statistical significance ($p = 0.075$). The study's findings, which support previous research by Onivehu Adams *et al*. (2017), which emphasised the role of speech recognition software in helping students with physical disabilities navigate computer-based tasks, show that a variety of assistive technologies, such as screen readers and braille displays, greatly improved academic performance among these pupils. While speech-to-text technology

assisted students in completing computer-based assignments, screen readers and braille displays raised post-test results. But speech recognition technology improved somewhat, suggesting that not all assistive technologies work for everyone in the same way. This result supports the recognition that, as Syriopoulou-Delli and Gkiolnta (2022) noted, not all assistive technology may be equally useful for all people.

Table 3: Effect of Training in the Use of Assistive Technology on Academic Performance

Group	Pre-test Mean Score	Pre-test SD	Post-test Mean Score	Post-test SD
Experimental	70.9	3.2	81.3	4.1
Control	68.9	3.4	70.2	0.8

In Table 3, the effect of training in the use of assistive technology on academic performance is examined. The experimental group, which received training, had a higher mean pre-test score of 70.9 compared to the control group's mean pre-test score of 68.9. In the post-test, the experimental group achieved a mean score of 81.3, while the control group scored 70. Both groups showed improvement from the pre-test to the post-test, with the experimental group displaying a more substantial increase.

Table 4: Descriptive Statistics

	Mean	SD	N
Pre-Test Score			
Experimental	70.9	3.2	11
Control	68.9	3.4	6
Post-Test Score			
Experimental	81.3	4.1	11
Control	70.2	3.8	6

In the study, descriptive statistics and ANOVA were used to analyze the pre-test and post-test scores of the experimental and control groups. Table 4 presents the descriptive statistics for both sets of scores. The experimental group had a mean pre-test score of 78.9 with a standard deviation of 3.2, based on 11 participants. In comparison, the control group had a slightly lower mean pre-test score of 68.9 with a standard deviation of 3.4, based on 6 participants. For the post-test scores, the experimental group had a higher mean score of 81.3 with a standard deviation of 4.1, while the control group had a mean score of 70.2 with a standard deviation of 3.8. These results indicate that the experimental group had higher scores both before and after the intervention.

Table 5: ANOVA

	Sum of Squares	df	Mean Square	F-Value	p-value
Pre-Test Score	Between groups	1	32.46	21.78	0.000
	Within groups	15	81.54		
Post-Test Score	Between groups	1	501.78	89.29	0.000
	Within groups	15	47.22		

Effect size: Cohen's d = 1.34.

The ANOVA computations on the pre- and post-test scores are shown in Table 5. Significant differences in the pre-test performance between the experimental and control groups were shown by the ANOVA for the pre-test scores, which had an F-value of 21.78 ($p < 0.001$). Comparably, a very significant F-value of 89.29 ($p < 0.001$) from the ANOVA for the post-test scores indicated a notable difference in the post-test performance of the experimental and control groups. These results confirm the idea that the type of assistive technology and training taken together improve academic achievement. Cohen's d, which gauges effect size, gives a reported 1.34. This significant effect size suggests that the intervention has had a significant influence on academic achievement. It confirms even further the data showing that college students with physical impairments do better academically when they utilise assistive technology and receive training. The data taken together show that the experimental group—which had training in assistive technology—performed better than the control group on the pre- and post-tests. These results emphasise the value and efficiency of using assistive technology and receiving training to help students with impairments succeed academically.

7. Conclusion

The study found that academic performance improved noticeably when various assistive technology types—such as screen readers, braille displays, and speech-to-text—were used. Participants who used these technologies had far higher post-test results than they had before. Furthermore, the study showed that instruction in the use of assistive technology improved academic performance even further. Comparing the experimental group to the control group, the former showed higher mean pre- and post-test scores. This emphasises the need to give pupils with physical limitations thorough training in order to get the most out of assistive technology. It is noteworthy, therefore, that the academic achievement of individuals utilising speech recognition technology improved just a little and was not statistically significant. It might take further research and development of this technology to fully appreciate its potential to help academic performance in this situation. All things considered, the results of this study add to the body of information on the beneficial effects of training and assistive technology on the academic achievement of college students with physical impairments. They stress that to build inclusive learning environments and advance equitable chances for students with disabilities, educators and institutions must take into account the proper choice and use

of assistive technology in addition to efficient training techniques. The report promotes the incorporation of assistive technology into educational environments and emphasises its potential to help academic progress. Future study should keep looking at how well various assistive technologies and training methods work, as well as possible implementation obstacles and difficulties.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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