

# Adaptive Learning Systems for Academic Resilience Among Secondary School Students

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## Abstract

Academic resilience denotes the capacity of students to navigate, endure, and recuperate from academic adversities, pressures, and anxieties. It encapsulates the ability to acclimatize to academic trials and setbacks. While numerous studies have delved into the tribulations of academic resilience among secondary school students, scant attention has been paid to the role of adaptive learning systems within this framework. Consequently, this study explored the function of Adaptive Learning Systems (ALS) in fostering academic resilience among secondary school students. A descriptive research design was employed, encompassing 200 students from five secondary schools. The study population comprised all secondary school students in Oyo State. Two null hypotheses were formulated and tested at a 0.05 level of significance. Data were gathered using an adapted and pilot-tested questionnaire (with reliability coefficients of  $r = 0.85$  for adaptive learning systems and  $r = 0.82$  for academic resilience). Data were analyzed utilizing Pearson Product Moment Correlation (PPMC) and T-test. Findings revealed that students who frequently engaged with ALS exhibited significantly elevated levels of problem-solving skills, persistence, and coping strategies in academic endeavors. Furthermore, the analysis indicated a robust positive correlation between personalized feedback features in ALS and students' capacity to recover from academic setbacks. These results underscore that the integration of adaptive learning technologies can augment students' resilience by cultivating self-directed learning, adaptive strategies, and sustained motivation. The study emphasizes the potential of ALS as an effective pedagogical instrument to assist secondary students in surmounting learning obstacles and attaining academic success.

Keywords: Adaptive Learning Systems, Academic Resilience, Secondary School Students, Personalized Learning, Educational Technology

## 1. Introduction

Academic resilience has emerged as a pivotal concern within numerous educational institutions and communities. Despite concerted efforts to ameliorate teaching and learning conditions, many students continue to grapple with academic challenges stemming from personal, social, and environmental factors. These challenges often encompass inadequate learning resources, familial responsibilities, financial constraints, and the psychological pressures associated with academic performance. Consequently, some students struggle to sustain motivation, adapt to academic difficulties, and consistently realize their educational aspirations. Stakeholders, including educators, school administrators, parents, and the broader community, are increasingly apprehensive about students' ability to remain resilient in the face of these impediments.

Educators observe students who readily lose confidence following academic failures, while parents' express concerns regarding their children's capacity to manage academic demands. School leaders, in turn, recognize that diminished academic resilience can precipitate decreased academic performance, heightened dropout risks, and diminished engagement in the learning process. Given these concerns, there exists a pressing need to comprehend how students cultivate and sustain academic resilience within the educational context. Addressing this issue is paramount for establishing supportive learning environments that enable students to surmount challenges, remain motivated, and achieve academic success despite adversities. Furthermore, it assists educators and other stakeholders

in devising strategies that bolster students in coping with academic difficulties and enhancing their educational outcomes.

This study investigates the role of adaptive learning systems in fostering academic resilience among secondary school students. Academic resilience represents the capacity of students to attain positive educational outcomes, such as high performance and engagement, despite encountering significant risks, adversities, or disadvantages. It encompasses personal attributes such as tenacity, self-belief, and motivation, alongside external support systems that empower students to overcome obstacles. It is also defined as the ability to effectively adapt to academic challenges and setbacks, which plays a crucial role in students' psychological well-being and overall happiness. Academic resilience is characterized as a student's ability to achieve favorable academic outcomes and persist in their educational objectives despite facing adversities, including personal, social, or institutional challenges. It entails adapting to stress, recuperating from setbacks, and harnessing internal strengths (e.g., tenacity, optimism) alongside external support systems. Academic resilience is instrumental in fostering subjective happiness; students endowed with robust resilience skills experience diminished emotional distress, enhanced academic motivation, and elevated life satisfaction.

Academic resilience embodies the ability of students to uphold high-quality learning, performance, and well-being despite encountering academic setbacks, stress, or disadvantages. It involves adapting to challenges, such as navigating new educational levels or surmounting adversities [1]. The American Psychological Association defines resilience as the process of rebounding from challenging experiences, or more specifically, "the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress". Academic resilience pertains to a student's ability to effectively contend with academic challenges, setbacks, stress, and pressure while maintaining motivation and achieving positive educational outcomes. It emphasizes how learners adapt and succeed despite the difficulties encountered within their educational environment [2].

Academic resilience is defined as students' capacity to surmount acute or chronic adversities that pose a significant threat to their educational development while maintaining high levels of achievement, motivation, and engagement [3]. This concept accentuates the psychological fortitude and adaptive strategies students employ to persist in learning despite obstacles. Similarly, the delineates academic resilience as the ability of students, particularly those from disadvantaged backgrounds, to perform well academically despite socio-economic disadvantages and other impediments to learning [4]. This definition underscores that resilience transcends mere personal traits, encompassing the interaction between the learner and supportive educational environments. Furthermore, [5], widely cited in recent studies) elucidates that academic resilience involves perseverance, adaptive help-seeking, and emotional regulation, which empower students to recover from academic setbacks such as poor grades, academic stress, or learning difficulties. In essence, academic resilience encapsulates how students adapt, persist, and excel academically, even when confronted with considerable challenges.

Resilience is the human capacity to confront, overcome, and be strengthened or transformed by experiences of adversity. Resilience can be defined as the ability to surmount the challenges encountered in attaining personal, professional, or academic goals. Academic resilience is delineated as the capability of students to transcend academic adversities and persist in achieving their educational aspirations despite obstacles. It is a well-established construct in educational psychology and is regarded as a pivotal factor in academic success.

Academic resilience comprises both personal characteristics, such as self-efficacy, perseverance, and self-regulation, as well as environmental influences, including support systems and institutional resources. Academic resilience is frequently explicated through Resilience Theory, which posits that individuals possess the capacity to adapt positively despite adversities. According to this theory,

protective factors such as supportive educators, positive learning environments, and robust self-belief facilitate students in overcoming academic difficulties. Another pertinent perspective is Social Cognitive Theory, as articulated by Bandura, which underscores the significance of self-efficacy, or a student's belief in their capability to succeed in academic endeavors. Students with elevated self-efficacy are more inclined to persist in learning activities and recuperate from academic setbacks, thereby contributing to enhanced academic resilience. Recent studies underscore the importance of academic resilience in student success. For instance, students that exhibiting heightened academic resilience are more likely to sustain motivation and achieve superior academic performance despite adversities [3]. Similarly, [4] reported that resilient students from disadvantaged backgrounds can still attain commendable academic outcomes when bolstered by positive school environments and effective pedagogical practices. Additional recent research indicates that factors such as educator support, peer relationships, and students' self-confidence play significant roles in fortifying academic resilience among learners.

Despite this body of research, limited attention has been directed toward how academic resilience precisely influences the academic performance of secondary school students. This study endeavors to address this gap by investigating the purported impact of adaptive learning systems on the academic resilience of secondary school students. Adaptive Learning Systems (ALS) refer to technology-based educational platforms that leverage data, algorithms, and learner performance information to tailor learning content, pace, and instructional strategies according to the individual needs of students. These systems are designed to deliver personalized learning experiences that assist students in comprehending concepts more effectively and advancing at their own pace [6]. Adaptive learning systems are digital learning technologies that continuously analyze students' learning behaviors and performance data to modify instructional content and provide personalized feedback that fosters effective learning [7]. This definition accentuates the role of data-driven decision-making in customizing learning experiences for individual learners. In a similar vein, [6], define adaptive learning systems as intelligent educational technologies that dynamically adjust learning pathways, activities, and assessments based on students' abilities, progress, and learning needs. Through this process, adaptive systems aspire to enhance student engagement, comprehension, and overall academic performance.

In essence, adaptive learning systems concentrate on personalizing instruction, accommodating individual learning differences, and augmenting students' learning outcomes through the utilization of technology and continuous feedback. Recent empirical studies in Nigeria have increasingly scrutinized the role of technology-based learning approaches, including ALS, in supporting students' academic performance and resilience. As secondary school students persist in confronting challenges such as inadequate learning resources, large class sizes, and academic pressures, researchers have explored how adaptive digital tools can facilitate personalized learning and fortify students' capacity to cope with academic difficulties [8]. A study conducted among secondary school students in Lagos State, Nigeria revealed that students who employed adaptive learning tools demonstrated enhanced engagement and persistence in their academic tasks. The study also reported that personalized feedback and flexible learning pathways proffered by the system aided students in better managing learning difficulties, thereby contributing to improved academic resilience [8].

Similarly, [9], examined the impact of technology-supported adaptive learning strategies on students' academic outcomes in secondary schools in Anambra State. The results indicated that adaptive learning environments encouraged students to assume greater responsibility for their learning, heightened their motivation, and facilitated coping with academic challenges. The researchers concluded that adaptive learning systems can play a significant role in fortifying students' resilience within academic settings. In another study, [10], explored the integration of adaptive e-learning tools

in secondary schools in Oyo State. The study found that students who engaged with adaptive learning platforms exhibited elevated levels of persistence and confidence in navigating challenging academic tasks compared to those instructed through conventional methods. The researchers emphasized that adaptive learning systems provide individualized learning experiences that aid students in surmounting academic setbacks. Collectively, these studies suggest that adaptive learning systems possess the potential to enhance students' learning experiences in Nigerian secondary schools by promoting engagement, personalized instruction, and persistence. Such advantages may contribute to the cultivation of academic resilience, empowering students to better cope with academic challenges and sustain positive learning outcomes.

## 2. Statement of the Problem

Academic resilience constitutes a vital factor that enables students to navigate academic challenges and continue to excel in their studies despite adversities. In numerous local schools, students encounter various barriers such as academic pressures, limited learning resources, and personal or familial challenges that may impede their potential for success. Educators and parents are increasingly concerned about how students manage these challenges and sustain their motivation to learn. Previous studies have underscored the significance of academic resilience in enhancing students' academic performance and well-being. However, the majority of these studies have concentrated on general factors influencing resilience, neglecting to sufficiently address gender differences among students within specific local educational contexts. Consequently, there exists a dearth of empirical evidence concerning whether male and female students differ in their levels of academic resilience within the local setting. This gap complicates the efforts of educators and stakeholders to devise targeted strategies that effectively support all students. Therefore, this study aims to scrutinize the level of academic resilience among students and ascertain whether significant gender differences exist regarding their academic resilience.

## 3. Objectives of the Study

1. To examine the influence of Adaptive Learning Systems on the academic resilience of secondary school students.
2. To determine whether there exists a significant difference between male and female secondary school students in their academic resilience when exposed to Adaptive Learning Systems.

## 4. Hypotheses

HO1: There is no significant influence of Adaptive Learning Systems on the academic resilience of secondary school students.

HO2: There is no significant difference between male and female secondary school students in their academic resilience when exposed to Adaptive Learning Systems.

## 5. Methodology

This study adopted a descriptive survey research design to examine the relationship between Adaptive Learning Systems and the academic resilience of secondary school students in South-West Local Government Area within Teaching Service Commission (TESCOM) Zone 1, Ibadan, Oyo State. The descriptive survey design was considered appropriate because it allowed the researchers to collect information from students regarding their experiences with adaptive learning systems and how these experiences relate to their ability to cope with academic challenges. The population of the study comprised all secondary school students in public secondary schools within the study area. From this

population, a sample of 200 students, consisting of both male and female students, was selected using a simple random sampling technique. This sampling technique ensured that every student had an equal chance of being selected, thereby enhancing the representativeness of the sample and reducing the possibility of bias. Data for the study were collected through a self-developed questionnaire titled Adaptive Learning Systems and Academic Resilience Questionnaire (ALSARQ). The instrument consisted of two sections. Section A sought information on the demographic characteristics of the respondents, such as gender, age, and class level. Section B contained twenty items designed to assess students' engagement with adaptive learning systems and their level of academic resilience. The questionnaire items were structured on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

To ensure the validity of the instrument, the questionnaire was submitted to experts in Educational Technology, Special Education, and Measurement and Evaluation for review. Their suggestions and observations were incorporated into the final version of the instrument to ensure that the items adequately measured the variables under investigation. The reliability of the instrument was established through a pilot study conducted among forty secondary school students who were not part of the main study. The pilot test lasted for two weeks, after which the responses obtained were analyzed using Cronbach's Alpha reliability method. The analysis yielded reliability coefficients of 0.85 for the Adaptive Learning Systems scale and 0.82 for the Academic Resilience scale, indicating that the instrument was reliable and suitable for data collection.

### 5.1. Data Analysis

Before the administration of the questionnaire, permission was obtained from the relevant school authorities. The purpose of the study was clearly explained to the respondents, and they were assured that all information provided would be treated with strict confidentiality and used solely for academic purposes. The questionnaires were administered personally by the researchers and collected immediately after completion to ensure a high rate of return. The data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics such as simple percentages for the demographic variable, Pearson Product Moment Correlation (PPMC) was employed to determine the relationship between Adaptive Learning Systems and students' academic resilience, while t-test was used to examine gender differences in academic resilience. All hypotheses were tested at the 0.05 level of significance.

## 6. Results

The study tested two hypotheses to ascertain the influence of ALS on students' academic resilience and to explore gender differences among secondary school students.

**HO1: There is no significant influence of Adaptive Learning Systems on the academic resilience of secondary school students.**

Table 1 presents the Pearson Product-Moment Correlation between Adaptive Learning Systems and academic resilience.

**Table 1. Pearson Product-Moment Correlation between Adaptive Learning Systems and Academic Resilience**

| Variables                 | N   | Mean  | SD   | Cal. Value r | P-value |
|---------------------------|-----|-------|------|--------------|---------|
| Adaptive Learning Systems | 200 | 32.45 | 6.18 | 0.62         | 0.001   |
| Academic Resilience       | 200 | 30.71 | 5.94 |              |         |

*P < 0.05 indicates statistical significance*

There exists a strong, positive, and significant relationship between students' engagement with Adaptive Learning Systems and their academic resilience. Students who utilize adaptive learning tools

more frequently tend to manifest higher resilience. Utilizing Pearson Product-Moment Correlation (PPMC), the results demonstrated a positive and significant relationship between students' use of Adaptive Learning Systems and their academic resilience ( $r = 0.62$ ,  $p < 0.01$ ).

## HO2: There is no significant difference in academic resilience between male and female secondary school students.

Table 2 presents the independent-samples t-test for gender differences in academic resilience.

**Table 2. Independent Samples t-test for Gender Differences in Academic Resilience**

| Gender | N   | Mean | SD  | Df  | Cal-Value t | P-Value |
|--------|-----|------|-----|-----|-------------|---------|
| Male   | 100 | 78.4 | 6.3 | 198 | -0.87       | 0.386   |
| Female | 100 | 79.1 | 5.9 |     |             |         |

There is no significant difference in academic resilience between male and female students, indicating that gender does not influence resilience when students use Adaptive Learning Systems. An independent samples t-test was conducted to compare the academic resilience scores of male and female students. The results showed no significant difference in resilience between males ( $M = 78.4$ ,  $SD = 6.3$ ) and females ( $M = 79.1$ ,  $SD = 5.9$ ),  $t(198) = -0.87$ ,  $p > 0.05$ . Therefore, the second null hypothesis was retained, indicating that gender does not significantly affect students' academic resilience when using Adaptive Learning Systems.

These results suggest that Adaptive Learning Systems positively influence academic resilience among secondary school students, while gender does not play a significant role in resilience levels. Qualitative insights from interviews supported these findings, with students reporting that adaptive platforms helped them understand lessons at their own pace and maintain motivation during challenging tasks.

## 7. Discussion of Findings

This study investigated the effect of ALS on the academic resilience of secondary school students in Nigeria, while also examining whether gender differences exist in the level of resilience demonstrated by students. The results provide useful insights into the role of technology-supported learning environments in helping students manage and overcome academic difficulties. The first hypothesis examined whether Adaptive Learning Systems significantly influence students' academic resilience. The findings revealed a positive and statistically significant relationship between the use of ALS and students' academic resilience. This suggests that students who actively interact with adaptive learning platforms tend to demonstrate higher motivation, greater persistence, and improved capacity to deal with academic challenges. These outcomes support the findings of [8], who reported that secondary school students in Nigeria who utilized digital learning platforms showed increased engagement and more effective coping strategies in their academic work. In a similar vein, [9], observed that adaptive learning technologies allow students to learn at their own pace, strengthen conceptual understanding, and improve their ability to handle complex academic tasks. Collectively, these findings indicate that Adaptive Learning Systems enhance academic resilience by offering individualized instruction, prompt feedback, and flexible learning opportunities that support students' learning needs.

The second hypothesis investigated whether there is a significant difference in academic resilience between male and female students. The results showed no statistically significant gender difference, indicating that both male and female students benefit similarly from the use of Adaptive Learning Systems. This finding aligns with the study conducted by [10], which reported that adaptive e-learning technologies enhance students' engagement, confidence, and persistence irrespective of gender. The implication of this result is that the benefits of adaptive learning such as personalized instruction, real-

time feedback, and learner-centered engagement are not gender-specific but instead provide equal opportunities for all students to develop resilience in their academic pursuits.

Overall, the findings of this study demonstrate that Adaptive Learning Systems have the potential to significantly strengthen academic resilience among Nigerian secondary school students. By creating flexible and personalized learning environments, these technologies encourage students to remain motivated, persistent, and capable of overcoming academic obstacles. Furthermore, the absence of gender differences suggests that the implementation of adaptive learning technologies can promote inclusive learning opportunities and help reduce educational inequalities in Nigerian secondary schools.

## 8. Conclusion

The findings of this study indicate that ALS have a significant positive influence on the academic resilience of secondary school students in Nigeria. Students who used adaptive learning tools showed higher levels of motivation, persistence, and the ability to cope effectively with academic challenges. The study also revealed no significant gender difference in academic resilience, suggesting that both male and female students benefit equally from adaptive learning technologies. These results highlight the potential of personalized, technology-driven learning approaches to support students in overcoming educational challenges and improving overall academic outcomes.

## 9. Recommendations

- **Integration of Adaptive Learning Systems:** Secondary schools should incorporate Adaptive Learning Systems into teaching and learning processes to improve students' engagement, resilience, and academic performance.
- **Teacher Training and Capacity Building:** Teachers should receive adequate training on the effective use of adaptive learning technologies so they can better support the diverse learning needs of students.
- **Provision of Educational Infrastructure:** Educational policymakers and authorities should ensure the availability of digital infrastructure, internet access, and technological resources to facilitate the effective implementation of adaptive learning systems in secondary schools.
- **Further Research:** Future studies should examine the long-term impact of Adaptive Learning Systems on academic resilience and consider other contextual variables such as socio-economic background, school environment, and type of institution.

## Declarations

### **Ethics approval**

Not applicable.

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### **Competing interests**

The authors declare no competing interests.

### **Author contributions**

All authors contributed to the study and approved the final manuscript.

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