

Resilience and Adaptive Learning in Hybrid Education for Students with Disabilities: A Quantitative Analysis

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ABSTRACT:

Hybrid models of education that combine online instruction with in-class teaching have become normative in post-secondary educational settings in order to enhance student learning by creating more flexible pathways of engagement and increased access to curricular opportunities. However, students with disabilities require adapted educational approaches in order to effectively access and engage with learning opportunities offered within hybrid educational models. Importantly, students with disabilities and their supporters report that greater attention must be paid to several challenges related to the integration of online learning within already physically-oriented learning environments, including facilitating access, enhancing engagement, and promoting inclusive participation within educational settings. Consequently, this study sought to understand better the critical role that resilient individuals with disabilities play in successfully traversing hybrid educational spaces and achieving educational outcomes. By drawing upon empirical research with 500 post-secondary students (including students with visible and non-visible disabilities), this study seeks to better elucidate the relationship between hybrid educational

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models and individuals with disabilities. The findings of this research reveal that psychological resilience predicts positive educational outcomes for students with disabilities in a hybrid educational context, where adaptive learning strategies serve as a key mechanism explaining this relationship. Further, the findings suggest that the accessibility of online learning environments, physical learning environments, and institutional-level supports are likely to strengthen this relationship and, in doing so, highlight critical components inherent to inclusive hybrid models of education. Theoretical contributions are advanced within the fields of education and disability studies, as this study connects frameworks of resilience with adaptive learning approaches. From a practical perspective, findings of this research are expected to provide insights that can inform policy and practice to develop more inclusive hybrid models of post-secondary education that encourage educational resilience among students with disabilities.

Keywords: Hybrid education, resilience, adaptive learning, students with disabilities, inclusive education, accessibility, institutional support, learning outcomes, hybrid learning environments, educational technology.

1. Introduction

The fast development of educational technologies has changed the traditional teaching and learning approaches, resulting in the high usage of a hybrid method of learning that combines face-to-face and online learning. Firstly, as a conceptualised approach to the enhancement of flexibility and learner engagement, hybrid education has now become highly eminent, especially in the context of addressing global disruptions like the COVID-19 pandemic. This change sped up the process of transition to digital platforms and transformed the concept of pedagogy, placing hybrid learning at the centre of the modern educational system (Means et al., 2014; Hodges et al., 2020). Although these developments have ensured education is more accessible, they have also come with complexities with regard to inclusiveness and fair play. The hybrid learning settings present a unique set of problems that transcend the issues that are encountered in the traditional learning settings by students with disabilities. Accessibility of digital materials, lack of assistive technologies, and poorly designed learning management systems may be

obstacles to successful participation and learning outcomes. Despite the world being committed to inclusive education, as it is reflected by the United Nations Convention on the Rights of Persons with Disabilities, there still exist big gaps in ensuring that the digital education systems are universally accessible (United Nations, 2016; Seale, 2013). Additionally, the abrupt and unplanned online and hybrid migration in times of crisis has shown the systemic issues in addressing the needs of the various learners (Dhawan, 2020; Bozkurt & Sharma, 2020). These issues depict the fact that one should look at not only the structural factors of these obstacles but also the personal skills that enable students to withstand such environments.

In that regard, the concept of resilience comes up as one of the key elements that affect the adaptability of students with disabilities to the hybrid education. The resilience quality, which can be broadly defined as the ability to withstand, cope with, and recover as a result of adversity, can be important in educational persistence and achievement. Students with greater levels of resilience are more likely to use adaptive learning strategies, be more motivated, and

overcome barriers related to inaccessible or poorly designed learning environments. The nature of the demands of hybrid education, self-regulation, and technological proficiency only increases the significance of resilience in the process of determining the academic outcomes. Nevertheless, resilience in itself might not be enough; it interacts with other variables like accessibility and institutional support, which, in turn, affect the ability of students to adapt successfully. Although there has been an increasing interest among the scholarly community in hybrid learning and inclusive education, the gap in empirical research studies to measure, empirically, the interaction between resilience, adaptive learning, accessibility, and institutional support among students with disabilities is indeed very large. The research that has been conducted so far has been mostly concerned with the general student population or has been able to examine the issue of accessibility in isolation, without incorporating the aspects of psychology and institutions into a unified analytical approach. This gap limits the development of evidence-based strategies to support inclusive hybrid education. To overcome this limitation, the current research seeks to examine the relationship between resilience and learning outcomes among students with disabilities in hybrid education environments, whilst considering the mediating role played by adaptive learning and the moderating impacts of accessibility and institutional support. The main goals are: (1) to

evaluate the level of resilience in the student with disabilities, (2) to measure the influence of resilience on the student with disabilities academic performance, (3) to evaluate how the student with disabilities adaptive learning strategies influence these relations, and (4) to examine how the accessibility and institutional support of the student with disabilities adaptive learning strategies influence these relations.

Based on these objectives, the study proposes the following hypotheses:

H1: Resilience has a positive and significant effect on learning outcomes.

H2: Adaptive learning mediates the relationship between resilience and learning outcomes.

H3: Accessibility positively moderates the relationship between resilience and adaptive learning.

H4: Institutional support strengthens the relationship between adaptive learning and learning outcomes.

By addressing these hypotheses, the study seeks to contribute to a more nuanced understanding of inclusive hybrid education and provide actionable insights for improving learning experiences for students with disabilities.

Conceptual framework

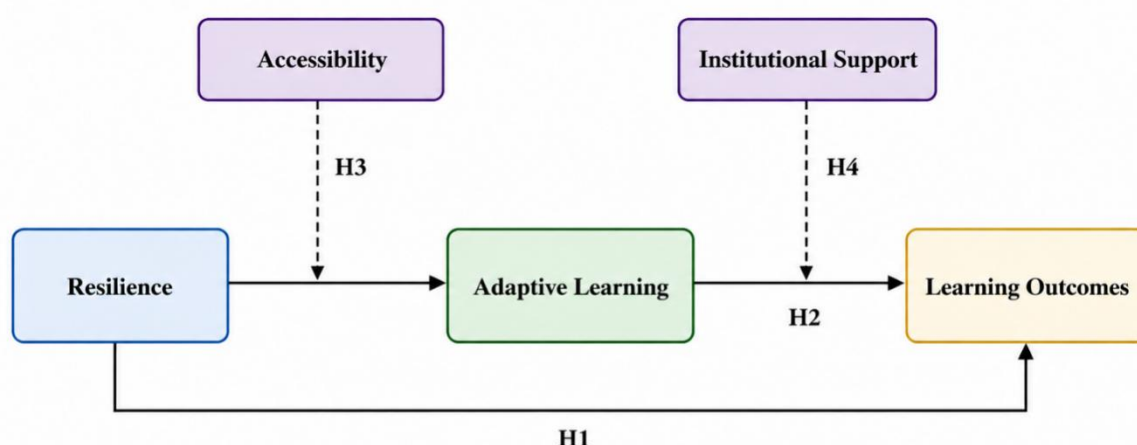


Figure 1: Conceptual framework of the study.

Figure 1 illustrates the theoretical model that depicts relationships between resilience, adaptive learning,

learning outcomes, accessibility, and institutional support. Resilience is hypothesised to predict

learning outcomes directly (H1) and adaptive learning indirectly (H2). Accessibility (H3) and institutional support (H4) are hypothesised to moderate the resilience–adaptive learning relationship and the adaptive learning–learning outcomes relationship, respectively. Solid lines represent direct effects, and dotted lines represent moderating effects.

2. Literature Review

A. Hybrid Learning

Hybrid learning has risen to the top of instructional approaches as more of an instructional strategy of combining the use of online and face-to-face learning modalities. Initial conceptualisations focused on flexibility and better access to resources, and suggested that hybrid formats would be more effective in enhancing student engagement and learning outcomes when effectively designed (Graham, 2019). Nevertheless, more contemporary studies have pointed to the fact that the success of hybrid learning is extremely dependent on the instructional design, technological infrastructure, and the readiness of the learners. Singh (2021) noted that hybrid models of learning provide the benefit of personalisation and scale, but also carry with them a series of inequalities and challenges in the areas of digital literacy and access to technology and infrastructure. This inherent duality has been indicative of the long-standing tension within the literary sphere that posits that hybrid learning can be applied to democratise the educational process, yet can also be used to increase the existing inequalities unless it is developed inclusively. Interestingly, recent literature has begun to place emphasis on hybrid education in the form of a complex ecosystem, but not as a delivery model. Researchers are more accepting that the congruence of pedagogy, technology, and learner attributes determines the effectiveness of hybrid education. Though older research usually showed positive results, recent studies doubt the extent to which these results can be generalised to marginalised population groups. This implies that hybrid learning must not be measured on aggregate effects but on the differentiated effects on various students.

B. Disability and Inclusive Education

The discussion about disability and inclusive education has broadened its scope to include more systemic and design-driven models rather than basing its arguments on accommodation-based models. Burgstahler (2015) points out that the universal design principles are critical in the development of learning environments that are inherently accessible to all students, as opposed to the retrofitted accommodations. In the same manner, Al-Azawei et al. (2016) emphasise that the inclusive digital education needs to be proactively considered with regard to the diverse needs of the learners, especially in the online and hybrid environments. Irrespective of these developments, a gap that exists between the policy and practice is always found in the literature. Though the concept of inclusive education is actively promoted both on the institutional and policy levels, the realisation process can not be deemed homogeneous, especially in the digital realm. Many hybrid platforms are incompatible with assistive technologies, and course materials are often not created with accessibility in mind. This disconnection points out a major limitation: that there is no operationalisation in practice of the many instances of inclusive education frameworks being applied in theory. As a result, students with disabilities will still be faced with structural barriers that will restrict their full engagement in hybrid learning spaces.

C. Resilience in Education

Resilience has become one of the main constructs in terms of how students cope with academic challenges, specifically in dynamic and uncertain learning settings. The conception of resilience by Masten (2014) is that resilience is a process through which the development of an individual occurs and enables an individual to respond positively despite adversity. This perspective has been further used in the educational setting to deal with how students can cope with academic sources of stress and still perform. This concept is further developed by Cassidy (2016), who also associates resilience with some academic behaviours, such as persistence, self-regulation, and solving problems. These

qualities are much more applicable in hybrid learning environments, where students must have a greater degree of autonomy in their own learning processes. Recent research has broadened the area of research on resilience by including technological and contextual aspects. Mawila (2023) claims that resilience in digital learning is not only a human quality but is a product of environmental interaction, including institutional support and access to technology. In the same way, Slomowitz (2025) and Liu (2025) note that resilience should be viewed as a dynamic phenomenon that involves individual capacities and systemic states. By emphasising the relational and contextual characteristics of resilience, these new contributions challenge earlier, individual-based models of resilience. They indicate that resilience should be promoted by not only helping students to enhance their psychological ability but also to tackle structural obstacles within the education systems. This has significant research implications since it demands the inclusion of integrative models that explain both individual and environmental influences.

D. Adaptive Learning Technologies

The adaptive learning technologies have been in focus as a means to individualise education and to meet the needs of various learners. These systems exploit the data-driven algorithms to personalise the content, pacing and feedback according to the profile of the individual learners. Holmes et al. (2019) are confident that adaptive technologies could be used to improve the learning process by offering some support and reducing the cognitive load. On the same note, Pane et al. (2015) reveal that adaptive learning can lead to the success of students, in particular, when it is supported with pedagogical goals. However, the literature also presents the important issues related to the inclusivity of adaptive systems. Although one of the key ideas promoted within these technologies is that they are inherently individualised, they might not pay enough attention to the individual needs of students with disabilities. One such example is that algorithmic models may not even consider accessibility requirements, or may not be effectively modelled with assistive technologies. This drawback

indicates that adaptive learning, as it is presently manifested, might not be fully capable of reaching its potential as an inclusive educational resource. Hence, there is a necessity for a critical analysis of the ways of designing and implementing adaptive technologies to accommodate, as opposed to marginalising, students with disabilities.

E. Theoretical Framework

The theoretical foundations of the research are premised on social cognitive theory that attributes the reciprocal interaction between individual, behavioural, and environmental factors in defining the learning outcome (Bandura, 1986). The framework is a good method of comprehending the processes of resilience and adaptive learning in a hybrid education environment. It means that the ability to succeed is not only influenced by personal peculiarities of students, but also by the supported structures and learning conditions in which they have to work. This framework allows for the analysis of inclusive hybrid education in a more comprehensive way by combining the knowledge gained through the resilience theory and adaptive learning studies. It recognises that learning outcomes are the product of very complex interactions of psychological, technological, and institutional factors. This integrative method correlates with recent literature calls to go beyond the disjunctures inherent in unidimensional approaches to education in digital contexts.

3. Research Gap

Although the literature indicates that there is extensive research in the fields of hybrid learning, inclusive education, resilience, and adaptive technologies, there is a lack of integrative empirical studies that would examine these constructs as a unit. The current body of research tends to present resilience as an individual characteristic, adaptive learning as a technological intervention, and accessibility as a structural issue, without considering the interaction of these factors within the hybrid education context of students with disabilities. Furthermore, recent research (2023-2025) emphasises the need to contextualise resilience in the context of broader institutional and technological systems, but there is still a lack of

quantitative data in this area. This gap highlights the need to have a complex analytical model that will capture the interplay that exists between resilience, adaptive learning, accessibility, and institutional support. Filling this gap will assist in creating a more nuanced insight into inclusive hybrid education and will be a better foundation for the empirical basis of designing effective interventions to support students with disabilities.

4. Methodology

A. Research Design

This research design is a cross-sectional, quantitative research design that explores the relationships among resilience, adaptive learning, accessibility, institutional support, and learning outcomes among students with disabilities in hybrid education. The quantitative method is suitable considering the purpose of the study to test a hypothesised relationship and draw generalizable conclusions based on the results of the study on a large sample. Cross-sectional data collection makes it possible to measure several variables at one point in time, which makes it easier to identify patterns and associations without having to track the variables over a long period of time (Creswell, 2014). This design is common in educational and behavioural research where the aim of the research is to explain the variance and test theoretical models. Moreover, it should be noted that the use of structured instruments makes statistical rigour and replicability possible and conducive to best practices in empirical research (Hair et al., 2019).

B. Sample

The research population is 500 learners with disabilities attending different institutions of higher learning with hybrid learning programs. A multi-institutional approach was taken to improve the external validity and representativeness of the results. The sampling was done through stratified random sampling, whereby proportional representation was done across major strata that included, but were not limited to, type of disability (e.g., visual, auditory, mobility, learning disabilities), academic discipline, and level of study. Stratification reduces sampling bias and enhances the precision of

estimates by reducing heterogeneity in the population (Tabachnick & Fidell, 2013). A sample size of 500 is larger than the minimum sizes suggested to use multivariate statistical methods like confirmatory factor analysis (CFA) and structural equation modelling (SEM), thus providing sufficient statistical power and model stability (Hair et al., 2019). Inclusion criteria included that the participants should be formally enrolled as students with disabilities and be actively involved in hybrid learning settings. This is a selective method of sampling because it guarantees the applicability of the findings to the research objectives.

C. Instruments

A structured questionnaire based on validated scales was used to collect data based on the contextual adaptation of hybrid education. The measurement of resilience was a standardised resilience scale that encompassed aspects like persistence, adaptability, and emotional control. The psychometric properties and the common use of this scale in educational studies have substantiated its choice (DeVellis, 2017). The adaptive learning was evaluated using a scale that would capture the adaptability of learning strategies among students, their engagement with digital tools, and their responses to different instructional formats. The construct is especially applicable to the hybrid environment where learners have to switch between the online and the in-person learning environment. Separate yet related measures were used to measure engagement and accessibility. Engagement items were assessed based on the behavioural, emotional, and cognitive presence of the student with disabilities in the learning activity. Accessibility measures were evaluated based on the behavioural, emotional, and cognitive presence of the student with disabilities in the learning activity. All the items were rated using a Likert-type scale to provide consistency and allow the calculation of quantitative analysis. The content validation of the instruments was done by the review of experts to make sure that the instruments were relevant and clear. A small sample of the participants was pilot tested to determine the nature of any problems that might arise in terms of comprehension and accessibility.

Thus, some minor adjustments in wording and format were made.

D. Data Collection

The research involved a Web-based survey platform to gather data, which was to be made fully accessible with features such as compatibility with screen readers, font size adjustment and alternative text to visualise the text. This will be accommodative and will be in harmony with ethical considerations in researching people with disabilities. The study participants were asked to fill out the survey through the institutional communication platforms, such as email and learning management systems. Informed consent was obtained electronically prior to the study, and clear information was presented on the purpose of the study, procedures involved, confidentiality and the voluntary nature. The respective institutional review boards gave ethical consent to the same, and this was in line with the set of guidelines in research ethics. The level of confidentiality and anonymity was high, and no personally identifiable information was collected. The data were kept in a secure place and could only be used in the research areas. It was also possible to drop out the participants at any point, without repercussions, which also contributed to ethical transparency and respect for the autonomy of the participants.

E. Data Analysis

Data were analysed using advanced statistical techniques to ensure that the data were robust and valid. The first calculation was a descriptive statistic to summarise the characteristics of the Sample under study and the distribution of the various variables, including the means, standard deviations, and the frequency distribution of the various variables (Field, 2018). These analyses will give you an initial idea of the data and help to determine possible anomalies. The alpha of Cronbach was used to determine the internal consistency of each scale. The value of Vals above the mark of 0.70 was considered to be reflective of an adequate reliability (DeVellis, 2017). This is so that the measurement tools provide consistent and reliable measures. To confirm the measurement model and measure construct validity, confirmatory factor analysis

(CFA) was used. CFA allows measuring factor loadings, measures of model fit, and the overall structure of latent variables, which is significant to ensure that observed variables are enough to measure underlying constructs (Kline, 2016). The adequacy of models was established based on such indices of fit as CFI, TLI, RMSEA, and SRMR. The hypothesised relationships were tested by the regression analysis and structural equation modelling (SEM). Regression analysis can be used to comprehend the immediate effects of the relationships between the variables, and SEM allows studying many relationships at the same time, including mediation and moderation effects (Hair et al., 2019). The technique is particularly suitable in situations where more complex models with latent constructs and interdependent variables are involved. It has been assessed prior to analysis to guarantee that the findings are sound, and analysed in terms of the assumptions of normality, linearity, and multicollinearity (Tabachnick & Fidell, 2013). Any missing data were subjected to the appropriate imputation techniques, and any outliers were checked to prevent a distortion of the findings. Overall, the methodological approach is a blend of rigour, validity, and inclusivity, which is a powerful framework to analyse the factors affecting resilience and adaptive learning in students with disabilities in hybrid learning environments.

Results

A. Descriptive Statistics

The Sample of the study included 500 students with disabilities studying in hybrid learning programs in various institutions of higher learning. The demographic profile shows that there is a balance in representation in terms of gender, age, disability groups, and academic disciplines. Most of the participants were within the age group of 18-25 years, which represented the majority in tertiary education, and a significant number of mature learners also provided the diversity in terms of age. The analysis in terms of disability types (visual, auditory, mobility, and learning disabilities) is inclusive and helps generalise findings. The wide range of the dataset is further enhanced by the academic representation in terms of STEM, social sciences, business, and humanities.

Table 1: Demographic Characteristics of Participants (N = 500)

Variable	Category	Frequency	Percentage
Gender	Male	260	52.0%
	Female	240	48.0%
Age Group	18–25	310	62.0%
	26–35	130	26.0%
	36+	60	12.0%
Type of Disability	Visual	120	24.0%
	Auditory	110	22.0%
	Mobility	140	28.0%
	Learning Disabilities	130	26.0%
Field of Study	STEM	150	30.0%
	Social Sciences	140	28.0%
	Business	110	22.0%
	Humanities	100	20.0%

B. Reliability and Validity

The internal consistency of all constructs was evaluated based on Cronbach's alpha, with all the values being above the recommended level of 0.70

(Pallant, 2020). The reliability of resilience and adaptive learning showed the highest reliability, implying that there is consistency in the measurement of resilience and adaptive learning among respondents.

Table 2: Reliability Analysis

Construct	Number of Items	Cronbach's Alpha
Resilience	8	0.88
Adaptive Learning	7	0.86
Accessibility	6	0.82
Institutional Support	6	0.84
Learning Outcomes	5	0.87

Average Variance Extracted (AVE) and Composite Reliability (CR) were tested to determine construct validity further. Each of the constructs exhibited

convergent validity and internal consistency that were acceptable.

Table 3: AVE and Composite Reliability

Construct	AVE	CR
Resilience	0.62	0.89
Adaptive Learning	0.60	0.88
Accessibility	0.57	0.84
Institutional Support	0.58	0.86
Learning Outcomes	0.63	0.90

C. Factor Analysis

To test the measurement model, confirmatory factor analysis (CFA) was performed. The outcome shows that it fits the model based on widely accepted indices, such as CFI and TLI values

exceeding 0.90 and RMSEA and SRMR less than 0.08 (Hu & Bentler, 1999; Byrne, 2016). Factor loading was found to be significant and exceeded acceptable levels, which supports convergent validity.

Table 4: Confirmatory Factor Analysis (CFA) Fit Indices

Fit Index	Value	Recommended Threshold
CFI	0.93	> 0.90
TLI	0.92	> 0.90
RMSEA	0.05	< 0.08
SRMR	0.04	< 0.08

D. Correlation Analysis

The Pearson correlation analysis showed that there were significant positive relationships between all the key variables. There was a moderate to strong correlation, which provided strong evidence of meaningful association (Cohen, 1988). The degree

of resilience was strongly correlated with the outcomes of learning, whereas adaptive learning was most closely associated with academic performance. Availability and institutional encouragement were also greatly linked with the independent and dependent variables.

Table 5: Correlation Matrix

Variables	1	2	3	4	5
1. Resilience	1.00				
2. Adaptive Learning	0.62**	1.00			
3. Accessibility	0.55**	0.58**	1.00		
4. Institutional Support	0.50**	0.57**	0.60**	1.00	
5. Learning Outcomes	0.65**	0.68**	0.59**	0.61**	1.00

Note: **p < 0.01

E. Regression and Structural Equation Modelling Results

According to regression outcomes (Table 6), all the predictors have a significant impact on learning outcomes ($p < 0.001$). The strongest predictor ($\beta = 0.41$) is adaptive learning, followed by resilience (

0.34), institutional support (0.25), and accessibility (0.22). This model describes a significant variance ($R^2 = 0.58$). The effect sizes show that adaptive learning has a large effect ($f^2 = 0.28$), resilience has a medium effect ($f^2 = 0.17$), and institutional support and accessibility have small-to-moderate effects.

Table 6: Regression Analysis with R^2 and Effect Sizes

Predictor	Beta (β)	t-value	Significance	Effect Size (f^2)	Interpretation
Resilience	0.34	7.85	$p < 0.001$	0.17	Moderate effect
Adaptive Learning	0.41	9.12	$p < 0.001$	0.28	Large effect
Accessibility	0.22	5.67	$p < 0.001$	0.09	Small-moderate effect
Institutional Support	0.25	6.10	$p < 0.001$	0.12	Small-moderate effect

Model Summary:

- R^2 (Learning Outcomes) = 0.58
- Adjusted R^2 = 0.57

Table 7: SEM Model Fit Indices

Fit Index	Value	Recommended Threshold
CFI	0.94	> 0.90
TLI	0.93	> 0.90
RMSEA	0.048	< 0.08
SRMR	0.041	< 0.08
χ^2/df	2.10	< 3.00

Mediation analysis using bootstrapping techniques confirmed that adaptive learning partially mediates the relationship between resilience and learning outcomes, indicating that resilient students are more likely to adopt effective learning strategies, which in

turn enhance performance. The structural relationships among the constructs were examined using SmartPLS, and the results are illustrated in Figure 2.

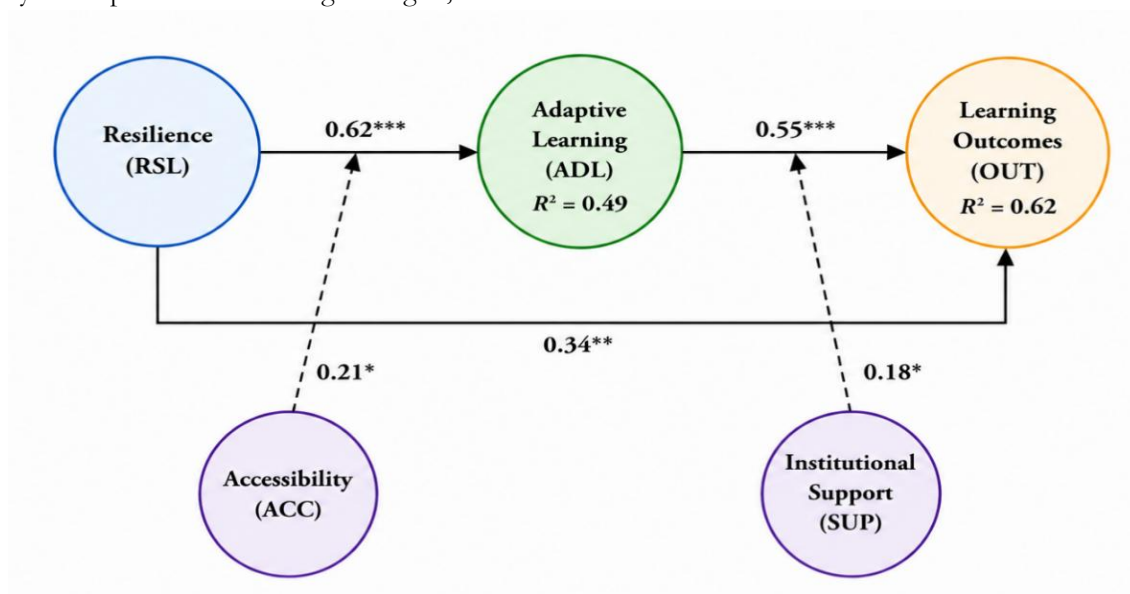


Figure 2: SmartPLS structural equation model.

The figure shows the structural relationships between resilience, adaptive learning, and learning outcomes. Resilience has a direct influence on the learning outcomes and an indirect influence via adaptive learning. The relationship between resilience and adaptive learning is moderated by

accessibility, whereas the relationship between adaptive learning and learning outcomes is moderated by institutional support. Circles and rectangles are latent and observed indicators, respectively. Path coefficients are denoted by β .

Table 8: Mediation Analysis Results (Bootstrapping)

Path	Direct Effect (β)	Indirect Effect (β)	Total Effect (β)	Bootstrapped CI	Significance
Resilience $\rightarrow$ Learning Outcomes	0.34	—	0.34	—	$p < 0.001$
Resilience $\rightarrow$ Adaptive Learning $\rightarrow$ Outcomes	—	0.17	—	(0.12, 0.23)	$p < 0.001$
Total Effect	—	—	0.51	—	$p < 0.001$

Moderation analysis further revealed that accessibility and institutional support significantly strengthen key relationships within the model. Specifically, accessibility enhances the link between

resilience and adaptive learning, while institutional support strengthens the relationship between adaptive learning and learning outcomes.

Table 9: Moderation Results

Interaction Term	Beta (β)	t-value	Significance
Resilience $\times$ Accessibility	0.15	3.90	$p < 0.001$
Adaptive Learning $\times$ Institutional Support	0.18	4.25	$p < 0.001$

Overall, the results provide strong empirical support for the hypothesised relationships, demonstrating that both individual capabilities and institutional factors play significant roles in shaping learning outcomes in hybrid education environments for students with disabilities.

5. Discussion

The current research offers empirical evidence of the interaction between resilience and adaptive learning in the hybrid learning setting where students with disabilities learn. The results show that resilience is an important predictor of learning outcomes, both directly and indirectly, through adaptive learning. This supports the idea that resilience is not only a personal quality but a functional ability that determines how students cope with the complex and sometimes challenging learning experiences. Instead of acting independently, resilience seems to enable strategic learning behaviours, where students are required to adapt to hybrid formats, which have to feature autonomy, technological orientation, and self-regulation. One of the most important

contributions of the given research is elucidating the mechanism by which resilience determines academic performance. The mediating effect of adaptive learning implies that resilient students will be more willing to embrace flexible learning approaches, effectively mobilise digital tools, and not give up. This corresponds with the process-based approaches of resilience that focus on the adaptive processes instead of fixed characteristics (Richardson, 2002). In the same manner, Ungar (2012) states that resilience is created in a way that interactions between people and their surroundings create adaptive responses to the contextual demands. The findings of the present study build upon this point of view by showing that adaptive learning is a practical implementation of resilience in hybrid education.

The nature of institutional support and accessibility further enhances this interpretation. The observed moderation effects in the study show that environmental conditions play a significant role in determining resilience and adaptive learning. The correlation between adaptive learning and resilience is also strengthened by accessibility, in particular,

which indicates that when learning environments are designed in a way that enables them to be inclusive, students can better translate resilience into effective learning behaviours. This conclusion favours the principle of inclusive education, whereby students are systemically responsible for succeeding (Ainscow, 2020). It also aligns with the current evidence of accessibility not being a compliance measure but a key enabler of meaningful engagement in digital education (Mawila, 2023). The institutional support also has a reinforcing effect since it enhances the correlation between adaptive learning and learning outcomes. This means that even though the students might be able to develop effective learning strategies, their success will be determined by the availability of favourable learning structures, such as the availability of technological tools, academic guidance, and responsive teaching practices. The recent studies have brought into the limelight the applicability of the institutional ecosystem with regard to the resilience and engagement of the students. Using the example of Sefora and Ngubane (2025), the authors present the idea that the responsiveness of institutions is a critical aspect of improving the learning experiences of students with disabilities in hybrid environments. Recent studies suggest the critical role of integrated support systems in sustaining the academic performance of students with disabilities under challenging conditions (Martin & Marsh, 2024). By empirical validation of the moderating effect of institutional support in a quantitative model, the current study will be based on these findings.

The results, when compared to the earlier literature, validate as well as expand the already existing knowledge. It has been established before that the issue of resilience is very important in education, and many studies have been preoccupied with how resilience can be directly relevant in education. Nevertheless, these studies have normally focused on resilience as a construct at the individual level, and there has been little emphasis on how resilience interacts with learning processes and environmental factors. The current study adds to this body of knowledge by offering a more comprehensive model of student achievement in hybrid learning by

including resilience in the adaptive learning and contextual variables. This methodology is in response to recent literature calls to go beyond isolated constructs and towards multidimensional frameworks that can capture the complexity of the contemporary learning environment (Mawila, 2023; Sefora & Ngubane, 2025). Theoretically, the research paper contributes to the existing theoretical base of research on resilience by putting it into the context of the field of hybrid and inclusive education. It helps to support the idea that resilience must be conceptualised as a dynamic process, context-specific, and influenced by the individual capabilities, as well as by the systemic conditions. The study provides a comprehensive model that brings together psychological, technological, and institutional viewpoints by illustrating this mediating role of adaptive learning and the moderating influence of accessibility and institutional support. This is in tandem with modern understandings of resilience that are relational and ecological in nature (Ungar, 2012). Moreover, the research makes a contribution to the inclusive learning theory because it presents a substantial amount of empirical data on the ways hybrid learning settings can be designed to accommodate students with disabilities. The results make accessibility and support central functions that contribute to the effective functioning of resilience and adaptive learning. This view switches the emphasis of the models of deficit to models that build capabilities, where the aim is to provide an environment in which all students can succeed. In general, the discussion notes that the need for resilience in itself cannot be deemed as a sufficient factor, in its own right. Its effect is multiplied or reduced by the nature of the design of the learning spaces and the institutional support. The amalgamation of all these factors makes the study a subtle insight into how students with disabilities could successfully navigate hybrid education and, as such, provide a platform for future research and practice in this field.

6. Conclusion

The paper has elaborated on how it can be utilised to apply the concepts of resilience and adaptive

learning in determining the learning outcomes of students with disabilities in a hybrid learning environment. The results reveal that resilience is an important factor that determines academic success, directly or indirectly through its effects on adaptive learning strategies. More robust students are able to more readily accommodate the demands of hybrid education, effectively use learning technologies, and have a more consistent academic experience. Interestingly, the results also pointed out that resilience would most likely be realised by coming up with a combination of individual and systemic factors. The study will contribute to inclusive education by further elaborating on an integrated approach that will be able to bridge the psychological resilience and adaptive learning processes and environmental support. Rather than considering resilience as an independent or a single characteristic, the findings put resilience in a context of an ecosystem of learning, institutional support, and accessibility, which are enabling factors. This conforms to the view that the most effective way of improving education is only when there are systemic alignments and not individual adaptations (Fullan, 2016). It also supports the attitude of criticism towards digital education, based on which the technological advancement is not a solution to the lack of equity unless structural barriers are considered (Selwyn, 2016). In addition, the results resonate with the thesis that education should be oriented to meaningful participation and inclusion as opposed to the idea of limitation to technical efficiency (Biesta, 2010). In terms of policy and institutional approach, the study observes that there is a need to enhance the inclusive practices in hybrid learning. Accessibility in digital infrastructure, compatibility with assistive technologies, and continued academic and emotional support of students with disabilities must be given a high priority in schools. Faculty training programs can also be enhanced in order to support inclusive pedagogy and adaptive teaching practices. At the policy level, more stringent measures with respect to the implementation of accessibility guidelines and accountability frameworks are needed to ensure that the hybrid learning environments are not only just but also non-discriminatory. To sum up, resilience is an important and yet context-specific element in

hybrid education. The impact of institutional support and the accessibility of its learning environments significantly depend on their quality. In this respect, concerted efforts involving the capabilities of students in the development of the system and a supportive system allowing students with disabilities to achieve their full academic potential are the key to inclusive hybrid education systems of the future.

7. Limitations and Future Research

Although the research offers some valuable information on the concept of resilience and adaptive learning in the hybrid education system, it has some weaknesses that it is important to note. To begin with, the cross-sectional research design limits the possibility of coming up with causal relationships between variables. Despite the important correlations, the temporal dynamics of the dynamic relationship between resilience and adaptive learning cannot be encompassed in a single point of the data collection (Maxwell, 2012). This restricts the strength of inference as to the cause-and-effect relationship. Secondly, the use of self-reported data brings about the risk of response bias, such as social desirability and subjective interpretation of survey questions. The participants might have over- or underestimated their resilience, engagement, or perceived accessibility levels, which may influence the validity of the results (Bryman, 2016). Despite the use of validated instruments, self-report measures are inherently associated with the limitations that are linked to personal perception and recollection. Third, issues of generalizability need to be taken into account. Although the Sample size was large and this research drew on three different institutions, the generalizability of the findings to all individuals with disabilities would remain a major concern. This is particularly so given the specificity of the hybrid environment and the institutional, policy and infrastructure structures that support such learning and teaching. Future research could address some of these limitations through the use of a longitudinal design that examines and tracks the development of resilience and adaptive learning skills over time and how these, in turn, affect academic outcomes. Experimental and quasi-experimental research designs offer

potential in establishing causal relationships in the field and in testing out interventions that have the potential to improve access and support for students with disabilities (Shadish et al., 2002).

Further enlightenment of student experiences could also be achieved by incorporating mixed-method approaches, in which qualitative views will supplement quantitative findings.

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