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Climate Change and Educational Resilience: Evidence from Secondary and Higher Education Institutions in Balochistan

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ABSTRACT

Climate change poses significant challenges to educational systems by disrupting institutional operations, infrastructure, and learning continuity, particularly in vulnerable regions. The present study explores the link between climate change challenges, institutional climate change adaptation capacity, and educational resilience in secondary and higher education institutions of Balochistan. The study adopted the quantitative cross sectional survey design with a total sample of 400 teachers and administrators using stratified random sampling technique. SPSS and SmartPLS 4 software were used for data analysis, with measurement model assessment, structural equation modeling, mediation analysis and group comparison analysis. The results showed that climate change has a negative impact on educational resilience, and that institutional adaptive capacity is a key determinant of educational resilience. Moreover, there is a partial mediation between climate challenges and educational resilience, mediated by adaptation capacity. There were significant differences found between secondary and higher education institutions. The study highlights the importance of climate-responsive planning and institutional preparedness for developing resilient education systems.

Introduction

Climate change is one of the most pressing global issues impacting education systems, as it has led to exposure to climate hazards such as floods, heatwaves, droughts, and extreme weather events. These risks hinder the continuity of education by compromising educational facilities, school infrastructure, academic activities, and the learning environment for students and teachers (IPCC, 2022; Khan & Hussain, 2022; Gul et al., 2024). Educational resilience has become more important in this context as a tool to help institutions prepare for, absorb, adapt to and bounce back from climate-related shocks. Climate-resilient education systems need, in addition to climate-resilient infrastructure, effective institutional planning, emergency preparedness, adaptive policies, and capacity-building mechanisms (UNESCO, 2022; Rashid & Qixiang, 2024; Scolobig & Balsiger, 2024).

Climate change impacts on education are especially severe in developing countries due to socio-economic disparities, poor infrastructure, and financial constraints (Adnan et al., 2024; Zulfiqar & Mostafa, 2025). Climate change is affecting South Asia in a manner that is particularly harmful for human development sectors, such as education, due to rising temperatures, water

scarcity, and extreme weather events (Mbah et al., 2022; Hussain et al., 2018). Climate change in Pakistan is a serious threat as the country is at risk from floods, droughts, rising temperature, and other climate stresses (Hussain et al., 2018; Adnan et al., 2024). Balochistan, the largest province of Pakistan in terms of area, is more vulnerable due to its arid climate, water scarcity, scattered population and inadequate institutional resources. The situation poses huge difficulties in sustaining educational continuity and enhancing the resilience of secondary institutions and higher education institutions (Arif et al., 2025; Fatima et al., 2025).

The impact of climate change is posing growing challenges to educational institutions in Balochistan due to its impact on infrastructure, learning environment, and institutional functioning. Climate-related disasters may lead to temporary closures, damage to educational facilities, and decreased school attendance, as well as quality education delivery challenges (IPCC, 2022; Khan & Hussain, 2022). However, many schools do not have a comprehensive climate adaptation strategy, disaster preparedness strategy, or resilience-based planning approach (Rashid & Qixiang, 2024; Scolobig & Balsiger, 2024). Previous studies in Pakistan have been mainly conducted on climate vulnerability, disaster consequences, and environmental awareness (Adnan et al., 2024; Bhatti et al., 2024), with limited studies conducted on the role of educational institutions in the development of climate resilience. Furthermore, the experiences and adaptive capacities of secondary and higher education institutions in Balochistan have not been studied in detail (Arif et al., 2025; Fatima et al., 2025). The absence of evidence makes it challenging to create effective policies and interventions for a climate-resilient educational system in the province.

While the importance of climate adaptation and resilient education systems are increasingly gaining attention in international research, studies on educational resilience in climate-sensitive parts of Pakistan are still scarce. While the importance of climate change education, institutional preparedness and adaptive capacity building have been emphasized in previous studies, there are limited studies that have focused on the practical responses of education institutions to climate change related risks (Mbah et al., 2022). Moreover, there is limited comparative evidence on the difference in climate resilience between secondary schools and universities. The existing literature does not sufficiently account for the relationships between institutional level, resources, governance mechanisms, and preparedness mechanisms and resilience outcomes. Thus, this study aims to fill this research gap by studying the effects of climate change, adaptation measures, and educational resilience in secondary and higher education institutions of Balochistan.

Research Objectives

1. To examine the impact of climate change challenges on educational resilience.
2. To investigate the role of institutional climate adaptation capacity in developing educational resilience.
3. To identify strategies for improving climate resilience among educational institutions.

Research Questions

1. How do climate change challenges affect educational resilience?
2. What role does institutional adaptation capacity play in improving educational resilience?
3. What strategies can enhance climate resilience in educational institutions?

Hypotheses

H1: Climate change challenges significantly affect educational resilience.

H2: Institutional climate adaptation capacity significantly influences educational resilience.

H3: Institutional climate adaptation capacity mediates the relationship between climate change challenges and educational resilience.

Literature Review

Social-Ecological Resilience Theory

Social-ecological resilience theory is a theory that describes how a system reacts to a disturbance and continues to function and adjust to change. Resilience is typically defined as the ability of a system to withstand shocks, reorganise and regain its essential structure and identity (Folke et al., 2010). In the context of climate change, resilience focuses on adaptation, learning, and transformation as key processes of addressing uncertainties in the environment. Education institutions are social systems that are connected with their environmental, social and institutional contexts, and preparedness, flexibility and adaptive capacity are important to withstand the impacts of climate change (Arif et al., 2025; Sujaya et al., 2023).

Climate change brings new disturbances that are complex, such as extreme weather events, resource scarcity, and environmental instability, and institutions need to prepare for adapting to these disturbances, not just responding to them after they occur (IPCC, 2022). In the context of education systems, resilience can be defined as ensuring continuity of learning processes, safeguarding institutional resources, supporting vulnerable students and teachers, and establishing a framework for rapid recovery in case of crises (Khan & Hussain, 2022; Samman et al., 2026). Social-ecological resilience theory, therefore, offers a suitable framework to explore the ability of secondary and higher education institutions (SEIs) in climate-vulnerable areas to build resilience to address climate-related challenges (Nasreen et al., 2025; Fatima et al., 2025).

Institutional Theory

Institutional theory is used to account for the way that organizations react to pressures from the outside world by creating structures, policies and practices that enhance legitimacy and effectiveness. Educational institutions are embedded in a wider social, environmental and policy context, and so may be affected by climate change pressures on institutional decision-making and adaptation. From the institutional point of view, organizations adjust their behaviors when they are pressured by external expectations, regulations, and uncertainties (Scott, 2013; Rashid & Qixiang, 2024).

In the education field, the adaptation to climate change calls for the development of policies on disaster preparation, emergency management, infrastructure planning, and climate awareness. Institutions that incorporate climate in their planning processes are better equipped to take action when climate disrupts the environment (Scolobig & Balsiger, 2024; Adnan et al., 2024). Institutional theory can therefore help to explain the adaptation mechanisms of educational institutions to the pressures arising from climate change.

Climate Change Challenges and Educational Systems

Climate change poses important challenges for education systems around the world. Educational infrastructure can be affected by climate related hazards, including floods, heatwaves, droughts and storms, which can interrupt academic activities and limit access to learning opportunities (IPCC, 2022). Schools and universities are often closed due to extreme weather events and exams are also affected, with reduced attendance or challenges in maintaining the teaching schedule (Khan & Hussain, 2022; Gul et al., 2024).

The weakness of educational infrastructure is especially high in underdeveloped areas where the institutions have limited resources to build climate-resilient infrastructure. UNESCO (2021) emphasized that educational continuity is under threat due to climate related disasters, which impact on educational facilities, learning materials, transportation systems and teacher availability. Moreover, the learners and teachers face extra difficulties such as displacement, health issues, psychological stress, and limited involvement in learning activities (Arif et al., 2025; Samman et al., 2026). The aforementioned challenges highlight the importance of improving the resilience mechanisms of education systems to climate disruptions (Nasreen et al., 2025; Jaelani & Djayaningrat, 2025).

Climate Change Challenges and Institutional Adaptation Capacity

Institutional climate adaptation capacity is the capacity of educational institutions to anticipate and respond to climate risks and adapt their operations during a climate crisis. This capacity encompasses climate awareness, preparedness for disaster, disaster planning, availability of resources, and institutional policies. The importance of going beyond awareness and building systems for climate risk management has been highlighted in research (UNESCO, 2022; Rashid & Qixiang, 2024). As climate-related disasters persist in Pakistan, they have emphasized the need for institutional preparedness, especially in the face of

ongoing disruptions to education and institutional operations due to floods and environmental hazards (Adnan et al., 2024; Arif et al., 2025).

Schools with more adaptive capacity are more likely to have emergency response plans, to include climate considerations in policies, and to provide resources for resilience building activities. However, institutions with limited financial and administrative capacity may not be able to react to climate-related disruptions effectively (Scolobig & Balsiger, 2024; Fatima et al., 2025). Therefore, climate change challenges are expected to influence the level of institutional adaptation capacity.

H2: *Climate change challenges significantly influence institutional climate adaptation capacity.*

Institutional Climate Adaptation Capacity and Educational Resilience

The capacity of the institutions is important in enhancing educational resilience. Institutions with good preparedness plans, continuity plans and flexible teaching methods are better able to continue educational services in times of crisis. Adaptive institutions can employ other learning approaches, emergency communication systems, and support for students to reduce disruption (Nasreen et al., 2025; Samman et al., 2026).

COVID-19 pandemic has highlighted the need for institutional flexibility and readiness to ensure continuity of education during the unexpected crisis (Pokhrel & Chhetri, 2021). The same adaptive mechanisms are applicable for climate-related emergencies, where institutions need to quickly adapt their operational and teaching practices (Khan & Hussain, 2022; Arif et al., 2025). Thus, there is expected to be a positive relationship between the institutional climate adaptation capacity and educational resilience.

H3: *Institutional climate adaptation capacity significantly influences educational resilience.*

Climate Change Challenges and Educational Resilience

The direct impacts of climate change on educational resilience are significant, as they create obstacles for uninterrupted learning and functioning of educational institutions. Climate related events may compromise institutional stability by damaging infrastructure, disrupting academic activities, and causing added operational challenges. Educational institutions' capacity to keep education going in the face of environmental shocks relies heavily on their resilience features, such as flexibility, preparedness and recovery capability (IPCC, 2022; Sujaya et al., 2023).

Climate change can exacerbate inequalities in vulnerable areas, through the disproportionate impact on students and institutions with fewer resources. The impact of floods and climate related disasters on the education access of students, especially the vulnerable and marginalized groups, has been observed in Pakistan (Khan & Hussain, 2022; Gul et al., 2024). As a result, it is vital to build resilient education systems to guarantee access to quality education in the face of changing environmental conditions (Nasreen et al., 2025).

H1: *Climate change challenges significantly influence educational resilience.*

Mediating Role of Institutional Climate Adaptation Capacity

The institutional climate adaptation capacity can act as a pathway by which climate issues impact educational resilience. Climate hazards pose risks to the continuity of education, but with good adaptation strategies, negative impacts can be minimized and recovery outcomes can be enhanced. Institutions can mitigate climate risks by transforming them into manageable challenges through preparedness planning, climate policies, emergency management and resource allocation (Rashid & Qixiang, 2024; Scolobig & Balsiger, 2024).

Therefore, capacities for adaptation could be one reason why some schools continue to operate during climate events while others experience extended educational disruptions. This suggests that institutional adaptation capacity mediates the relationship between climate change challenges and educational resilience. Research on climate education and climate preparedness of institutions also shows that improving adaptive capacities can support educational sustainability and resilience in climate vulnerable contexts (Sujaya et al., 2023; Fatima et al., 2025).

H4: *Institutional climate adaptation capacity mediates the relationship between climate change challenges and educational resilience.*

Research Framework

The study conceptualizes a framework based on the literature to examine the link between the challenges of climate change, institutional climate adaptation capability and educational resilience in secondary and higher education institutions in Balochistan. According to the framework, climate-related challenges place significant pressures on the educational systems, including through the disruption of institutional functioning, the disruption of learning continuity, and vulnerability (IPCC, 2022; Khan & Hussain, 2022). In this model, Climate Change Challenges are seen as the independent variable, which includes climate-induced disruptions, environmental risks and infrastructure vulnerabilities that can impact institutional stability and educational delivery.

Institutional Climate Adaptation Capacity is seen as a mediating variable that encompasses institutions' capacity to prepare for, respond to and recover from climate-related threats through disaster preparedness, climate-responsive policies, emergency planning, and effective resource management. The importance of systematic adaptation mechanisms, policy integration and organizational preparedness in educational institutions to effectively respond to climate-related uncertainties has been highlighted in previous research (Adnan et al., 2024; Rashid & Qixiang, 2024).

The framework makes the assumption that institutions with a higher capacity to adapt are more capable of reducing the negative effects of climate change and continuing educational services in times of crisis. Educational Resilience (dependent variable) is defined as the ability of educational institutions to continue educational processes, show adaptability of the organization and support learners in the learning process in the face of climate changes (Arif et al., 2025; Nasreen et al., 2025). Thus, the framework proposes that the capacity of institutions to adapt is a mediating factor between climate challenges and educational resilience, because it helps to move from vulnerability to adaptability. The proposed research framework is presented in Figure 1, showing direct and indirect relationships between climate change challenges, institutional climate adaptation capacity and educational resilience.

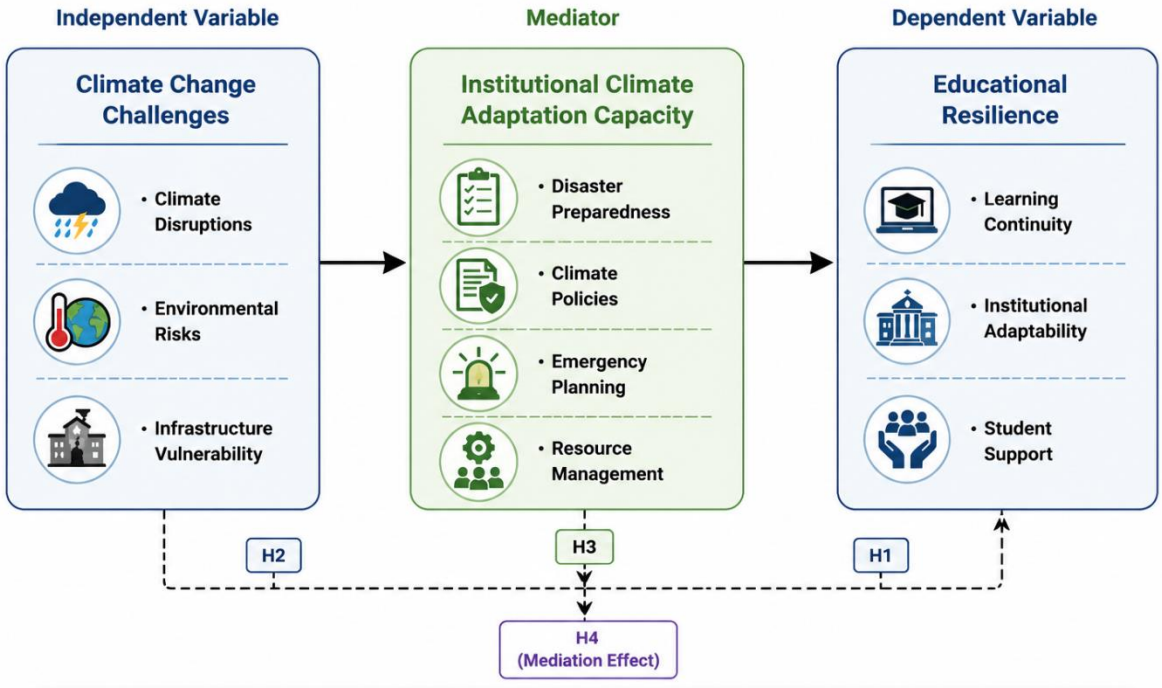

Figure 1. Conceptual framework showing the relationship between climate change challenges, institutional climate adaptation capacity, and educational resilience.

Methodology

The quantitative research methodology was used in this study to explore the linkages between climate change challenges, institutional climate adaptation capacity, and educational resilience of secondary and higher education institutions in Balochistan. The methodological decisions were guided by the research objectives and theoretical foundations of social-ecological resilience theory and institutional theory. The study focused on the impact of climate change-related challenges on educational institutions and the contribution of institutional adaptation capacity to enhance educational resilience.

Research Philosophy

The study was conducted using positivist approach since it was intended to measure and analyze the relationships between the variables proposed in the study numerically. According to positivism, social phenomena can be systematically studied by observable and measurable indicators (Saunders et al., 2011). Thus, this philosophy was deemed suitable for testing the hypothesized relationships between climate change challenges, institutional climate adaptation capacity, and educational resilience using statistical methods.

Research Approach

A deductive research approach was employed in this study. The deductive method was chosen since hypotheses were generated based upon current theoretical frameworks and previous empirical studies, and tested with quantitative data. The study used social-ecological resilience theory and institutional theory to formulate hypotheses for the relationships between climate change challenges, institutional adaptation capacity and educational resilience. This strategy allowed the researcher to assess the validity of the theoretical assumptions (Creswell & Creswell, 2017).

Research Design

The research design of the study was quantitative cross sectional survey. The respondents were surveyed at one time to understand their perception on the challenges of climate change, institutional adaptation, and education's resilience. A quantitative design was appropriate since the study was trying to measure relationships between variables and test hypotheses with statistical analysis. The cross-sectional method enabled the data to be gathered from a wide range of education professionals across various institutional contexts.

Population of the Study

The study was based on teachers and administrators of secondary and higher education institutions of Balochistan. The study involved respondents from secondary schools, colleges and public and private universities. The teachers and administrators were chosen due to their first-hand experiences and understanding of the operations of the institutions, the challenges of the climate, disaster preparedness, and practices of educational continuity.

Sample Size and Sampling Technique

The study was conducted using 400 respondents, which was obtained by stratified random sampling. The population was segmented into different strata to obtain proper representation of different educational sectors in accordance with the level of the institution and the location. Stratified sampling was deemed appropriate as there were different groups of people in the population with potentially different experiences related to climate challenges and institutional adaptation practices (Taherdoost, 2021).

The sample distribution was as follows:

- Secondary school teachers: 150 respondents
- Secondary school administrators: 50 respondents
- Higher education faculty members: 150 respondents
- Higher education leaders: 50 respondents

This distribution provided a balance between secondary and higher education institutions, and allowed a comparison between the two levels of education.

Research Instrument

The data were gathered using a structured questionnaire that was adapted from previously validated measurement scales found in literature. The questionnaire was divided into four parts. The first part gathered data on demographic factors such as institutional characteristics and professional background of respondents. The second section assessed the challenges associated

with climate change such as climate disruption, environmental risks and vulnerability of infrastructure. In the third section, institutional climate adaptation capacity was evaluated, covering aspects such as disaster preparedness, disaster policies, emergency planning and resource management. The fourth part was focused on educational resilience, learning continuity, institutional adaptability, and student support mechanisms.

All items were measured using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. Construct reliability and construct validity were ensured as validated measurement scales were used (Sarstedt & Liu, 2023).

Data Collection Procedure

Data collection was done after formal permission from the respective educational institutions. Selected teachers and administrators were provided with questionnaires using physical and online survey methods. The participants were briefed on the purpose of the study and given instructions on how to complete the questionnaire.

The researcher made sure that the respondents were free to withdraw from the study at any time and that participation was voluntary. Questionnaires that were completed were retrieved, sifted and processed for statistical analysis. Care was taken to ensure the accuracy, confidentiality and integrity of the information collected.

Ethical Considerations

The research process was carried out with respect to ethical standards and safeguarding the rights and privacy of the research participants. Prior formal approval and permission was sought from the relevant authorities of selected educational institutions before conducting the survey. The participants were informed about the purpose and goals of the research, and they consented to participate in the study.

It was emphasized that participation in this study was voluntary and that respondents had the right to drop out of the study at any time without any consequence. Confidentiality and anonymity of participants was ensured by not collecting personally identifiable information and by not sharing individual responses. Collected data were only used for academic purposes and kept securely.

In addition, there were no physical, psychological or professional risks for the participants in the study. The results of the research were presented in an objective manner, without changing or misrepresenting the answers of the participants. Throughout the data collection, analysis and reporting process, ethical standards were adhered to, including transparency, confidentiality, honesty and responsible research conduct.

Data Analysis Techniques

The collected data were analyzed with SPSS and SmartPLS 4. Descriptive analysis was conducted first to describe the demographic characteristics of the respondents and their responses in terms of frequencies, mean and standard deviations.

The measurement model was evaluated to determine the reliability and validity. Cronbach's alpha and Composite Reliability (CR) were used to evaluate reliability and Average Variance Extracted (AVE) was used to evaluate convergent validity. Heterotrait-Monotrait (HTMT) ratio was used to check the discriminant validity.

The analysis of the structural model was carried out using PLS-SEM (Partial Least Squares Structural Equation Modeling) software with the SmartPLS 4 program. Path analysis and bootstrapping were used to test the hypotheses. The explanatory power of the model was measured using the coefficient of determination (R^2), whereas effect size (f^2) and predictive relevance (Q^2) were applied to gauge the strength and predictive power of the model (Sarstedt & Liu, 2023).

Mediation analysis was used to explore the mediation effect of institutional climate adaptation capacity between climate change challenges and educational resilience. Moreover, independent sample t-test and Multi-Group Analysis (MGA) were conducted to determine the differences between secondary and higher education institutions.

Results

Demographic Characteristics

The demographic characteristics of the respondents were analyzed to gain insight into the composition of the respondents. The study was conducted on 400 respondents who were working in secondary and higher education institutions of Balochistan. Teachers and administrators from various levels of education participated in the sample. The demographic analysis showed that there were 238 (59.5%) males and 162 (40.5%) females. In terms of institutional representation, 200 respondents (50%) were from secondary education institutions while 200 respondents (50%) were from higher education institutions. Professional position of the respondents was mostly teachers (n = 300, 75%) and administrators (n = 100, 25%). Demographic distribution shows that the sample was well balanced by secondary and higher education, and that it was possible to examine the challenges of climate change, the capacity of institutions to adapt to it and educational resilience.

Table 1. Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	238	59.5
	Female	162	40.5
Institution Level	Secondary Schools	200	50.0
	Higher Education	200	50.0
Position	Teachers	300	75.0
	Administrators	100	25.0

Measurement Model Assessment

The measurement model was validated using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test indicator reliability, construct reliability and validity of the proposed constructs. The assessment consisted of factor loading, composite reliability, average variance extracted (AVE) and discriminant validity. The results indicated that all the measurement items had factor loadings of more than 0.70 which was the minimum acceptable value, thus confirming the reliability of measurement items.

The factor loadings for all the items corresponding to the three dimensions (climate change challenges, institutional capacity to adapt to climate change, educational resilience) were acceptable as shown in Table 2. The results showed that the indicators used were sufficient to represent the latent constructs.

Table 2. Factor Loadings of Measurement Items

Construct	Item	Loading
Climate Change Challenges	CCC1	.781
	CCC2	.823
	CCC3	.796
Institutional Adaptation Capacity	AC1	.812
	AC2	.845

Educational Resilience	ER1	.834
	ER2	.876

Reliability and Validity Results

Cronbach's alpha, composite reliability (CR) and average variance extracted (AVE) were used to test the reliability and convergent validity of the constructs. As presented in Table 3, all constructs had Cronbach's alpha greater than the suggested value of 0.70, which is a high level of internal consistency among the measurement items. Likewise, composite reliability values were over 0.70, indicating construct reliability.

Moreover, the AVE values for all constructs exceeded the minimum acceptable level of 0.50, indicating acceptable convergent validity. The results of this study indicate that the measurement model had good reliability and validity.

Table 3. Reliability and Convergent Validity

Construct	Cronbach Alpha	Composite Reliability	AVE
Climate Change Challenges	.891	.914	.642
Adaptation Capacity	.903	.925	.673
Educational Resilience	.887	.910	.631

The Heterotrait-Monotrait (HTMT) ratio was used to determine discriminant validity. As seen in the results in Table 4, all the HTMT values were below the recommended threshold of 0.85, which shows that all constructs were empirically different from one another.

Table 4. Discriminant Validity (HTMT Criterion)

Constructs	Climate Change Challenges	Adaptation Capacity	Educational Resilience
Climate Change Challenges	—	.71	.68
Adaptation Capacity		—	.76
Educational Resilience			—

Descriptive Statistics

Descriptive statistics were computed to analyze the perceptions of the respondents on the issues of climate change challenges, institutional adaptation capacity, and educational resilience. The results are presented in Table 5.

The results indicated that the respondents had relatively high levels of climate change challenges (M = 3.84, SD = .71), meaning that there is a high degree of awareness of climate change challenges in educational institutions. The results of the institutional adaptation capacity showed a mean score of 3.62 (SD = .76), which means that the institutional capacity and adaptation mechanisms were moderate. The mean value for educational resilience was 3.75 (SD = .68), indicating the perceived capacity of the educational institution to keep education going in the face of climate-related disruption.

Table 5. Descriptive Statistics of Study Variables

Variable	Mean	SD
Climate Change Challenges	3.84	.71
Adaptation Capacity	3.62	.76
Educational Resilience	3.75	.68

Correlation Analysis

Pearson correlation analysis was performed to investigate the relationships between the climate change challenges, institutional adaptation capacity, and educational resilience. The results shown in Table 6 reveal that there are significant relationships among all of the study variables.

The challenges of climate change were highly correlated with the capacity to adapt ($r = .54$, $p < .01$) and educational resilience ($r = .61$, $p < .01$). Furthermore, the best positive correlation was found between institutional adaptation capacity and educational resilience ($r = .67$, $p < .01$). The results of this study offer preliminary evidence for the proposed relationships between the study variables.

Table 6. Pearson Correlation Matrix

Variables	1	2	3
Climate Change Challenges	1		
Adaptation Capacity	.54**	1	
Educational Resilience	.61**	.67**	1

Note: p < .01

Structural Model Results

Structural model assessment was carried out with path coefficients, t values and significance values using bootstrapping procedures in SmartPLS 4. Table 7 shows the results.

The results showed that challenges due to climate change were significant factors affecting educational resilience ($\beta = -.42$, $t = 8.35$, $p < .001$). Likewise, the challenges posed by climate change had a significant impact on institutional adaptation capacity ($\beta = -.55$, $t = 10.21$, $p < .001$). In addition, the educational resilience was significantly positively related to the institutional adaptation capacity ($\beta = .63$, $t = 12.45$, $p < .001$).

The findings suggest that the climate-related challenges have a negative impact on institutional resilience, and that institutional resilience is enhanced by greater adaptation capacity.

Table 7. Structural Model Assessment

Relationship	β	t-value	p-value	Decision
CCC → ER	-.42	8.35	<.001	Supported
CCC → AC	-.55	10.21	<.001	Supported
AC → ER	.63	12.45	<.001	Supported

R^2 values were used to test the explanatory power of the structural model. The results indicated that 30% of the variance in institutional adaptation capacity can be explained by climate change challenges and 52% by climate change challenges and adaptation capacity together, while educational resilience was explained by 52% by the same factors.

Table 8. Coefficient of Determination

Endogenous Construct	R^2	Interpretation
Adaptation Capacity	.30	Moderate
Educational Resilience	.52	Moderate

Hypothesis Testing

Path coefficient, significance level, mediation analysis, and group comparison analysis were used to test the hypotheses. The results are presented in Table 9.

All hypotheses were accepted from the results. The results of H1 showed that there was a significant influence of challenges from climate change on educational resilience. H2 was also supported, reinforcing the fact that the capacity of institutions to adapt to challenges related to climate change is significantly affected. For H3, this was the case and institutional adaptation capacity was found to significantly improve educational resilience.

Moreover, H4 was confirmed, institutional adaptation capacity was found to mediate between the two variables. The mediation analysis showed an indirect effect of -.35 with a variance accounted for (VAF) value of 45.4%, indicating partial mediation. Finally, H5 was supported, with substantial differences between secondary and higher education institutions.

Table 9. Hypothesis Testing Results

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	Climate Change → Educational Resilience	-.42	8.35	.000	Supported
H2	Climate Change → Adaptation Capacity	-.55	10.21	.000	Supported
H3	Adaptation Capacity → Educational Resilience	.63	12.45	.000	Supported
H4	Mediation Effect	.35	7.18	.000	Supported
H5	Institutional Differences	—	3.42	.001	Supported

Mediation Analysis

The mediation analysis was conducted to determine whether institutional climate adaptation capacity mediated the relationship between climate change challenges and educational resilience. The results indicated that this relationship was partially mediated by adaptation capacity, as the indirect effect was significant. The result indicates that climate change-related pressures negatively impact the educational resilience, but that greater capacity to adapt to climate change, such as through preparedness planning, emergency management, and resource allocation, can reduce these impacts.

Table 10. Mediating Effect of Adaptation Capacity

Path	Direct Effect	Indirect Effect	Total Effect	VAF
CCC → ER	-.42	-.35	-.77	45.4%

Institutional Differences Analysis

The differences between secondary and higher education institutions were tested using an independent sample t-test. The outcomes showed that there were significant differences in adaptation capacity and educational resilience.

The higher education institutions had a significantly higher adaptation capacity (M = 3.79) than the secondary institutions (M = 3.45). Similarly, higher education institutions reported higher educational resilience (M = 3.92) than secondary institutions (M = 3.58).

Table 11. Institutional Differences

Variable	Secondary Mean	Higher Education Mean	t-value	p-value
Adaptation Capacity	3.45	3.79	4.21	.000
Educational Resilience	3.58	3.92	3.87	.000

The results as a whole support the conclusion that the capacity of institutions to adapt is a key element to enhance educational resilience in the context of climate-related stressors. The findings lend empirical support to the proposed framework and highlight the need for creating policy and adaptive measures in educational institutions in Balochistan that are responsive to climate change.

Discussion

Climate Change Challenges and Educational Resilience

This study's results support H1 as climate change challenges have a significant impact on educational resilience ($\beta = -0.42$, $p < .001$). The negative correlation means that as climate risks and pressures, such as extreme weather events, vulnerabilities to infrastructure, and disruptions to academic operations, increase, the capacity of education institutions to continue and recover from a crisis declines. The results align with earlier research that has identified the significant challenges climate change poses to education, including school closures, damage to infrastructure, lower attendance, and heightened vulnerability of students and teachers (IPCC, 2022; Khan & Hussain, 2022). Climate-related risks pose further challenges to educational sustainability in the context of Balochistan, where institutions have to deal with environmental uncertainties, limited resources and geographical challenges (Arif et al., 2025; Fatima et al., 2025). Therefore, strengthening educational resilience is essential for ensuring continuous learning opportunities in climate-vulnerable regions.

Role of Institutional Adaptation Capacity

The results confirmed that the challenges of climate change have a significant effect on institutional adaptation capacity ($\beta = -0.55$, $p < .001$) and that institutional adaptation capacity has a positive influence on educational resilience ($\beta = 0.63$, $p < .001$) thus affirming H2 and H3. The findings indicate that institutions under climate pressures are encouraged to build up their adaptive capacity by creating emergency plans, climate responsive policies, and resource management plans. The positive correlation between adaptation capacity and resilience indicates that institutions with resilient preparedness systems are more likely to continue educational activities in the event of disruption. This is consistent with the institutional theory that states that organizations adjust to external pressures by changing structures and practices (Scott, 2013). The same results show that climate adaptation planning and disaster preparedness can improve the capacity of institutions to deal with environmental uncertainties (Rashid & Qixiang, 2024; Scolobig & Balsiger, 2024).

Mediating Mechanism of Adaptation Capacity

The results of mediation analysis showed that institutional adaptation capacity partially mediates the relationship between climate change challenges and educational resilience (VAF = 45.4%), supporting the hypothesis H4. This discovery implies that while climate challenges have a negative impact on resilience, there is a way to mitigate this impact through good adaptation. Educational institutions can turn the challenge of climate risks into manageable ones by adopting preparedness frameworks, flexible learning approaches and institutional planning mechanisms (Folke et al., 2010; UNESCO, 2022). Therefore, adaptation capacity is a pivotal pathway on which the resilience of climate vulnerable institutions is built.

Differences Between Secondary and Higher Education Institutions

The results confirmed H5 as significant differences were found between secondary and higher education institutions. Higher education institutions had a higher adaptation capacity and resilience than secondary schools. This difference can be explained by the higher level of autonomy, financial means, technological resources, and administrative skills of universities. Previous studies also indicate that the availability of resources and institutional governance can affect the capacity of institutions to effectively address climate-related disruptions (UNESCO, 2021; Nasreen et al., 2025). The results indicate the need for specific adaptation interventions, especially in secondary schools of vulnerable areas like Balochistan.

Conclusion

The current study aimed to analyze the impact of climate change challenges on educational resilience and to understand the institutional climate adaptation capacity in secondary and higher education institutions in Balochistan. The results showed that climate change poses major challenges to educational systems due to its impacts on the functioning of institutions, the security of infrastructure, and continuity of learning and the capacity of institutions to respond to climate events. The findings indicated that the greater the climate-related pressures, the less resilient the education, emphasizing the need for enhanced preparedness and adaption strategies.

The study also showed that the capacity of institutions to adapt is a key factor in enhancing educational resilience. Climate-related challenges have adverse impacts on school operations and continuity, which can be reduced through effective planning processes, emergency preparedness, adaptive policies, and resource management at institutions. The mediating effect of adaptation capacity suggests that institutional preparedness can shift the climate vulnerability to an opportunity for adaptation.

The results highlight the need for climate-responsive educational planning in Balochistan because of its environmental susceptibility and institutional issues. Building resilient education systems will require incorporating climate into educational policies and planning for educational infrastructure, institutional management and teaching. Multi-level strengthening of adaptation capacity can help promote sustainable and resilient education in climate-sensitive areas.

Theoretical Implications

This study makes a theoretical contribution by taking the concept of resilience beyond the classroom. The results show that the school can be seen as an adaptive system that can adjust to the external environment, recover from the shock, and continue to carry out its educational functions. The study also emphasizes the importance of the ability of the educational system to prepare, adapt, and respond to climate challenges, as well as the influence of such challenges on the educational system.

Moreover, the study is significant for climate education research because of its focus on institutional mechanisms in the management of climate risks. It offers a more nuanced understanding of the role of adaptation capacity as a linkage between climate risks and climate resilience outcomes. The results indicate that institutional structures, preparedness strategies and adaptive capacities are key elements of resilient education systems. This theoretical approach contributes to the knowledge of how educational institutions build resilience to complex environmental challenges.

Practical Implications

The findings have significant implications for practice for government, schools, and teachers. The policy level, the government should develop educational policies which are resilient to climate risks that impact on education systems. There should be sufficient investment in disaster preparedness programmes, climate adaptation and infrastructure development for continuity of education in the event of a disaster related to climate change.

Institutional-wise, educational institutions should create comprehensive climate adaptation plans, establish emergency response mechanisms and encourage sustainable practices on the campus. Institutions need to enhance their resilience by carrying out a risk assessment, contingency planning, flexible learning arrangements and effective communication systems.

Professional development should be targeted to developing crisis-responsive teaching strategies and increasing awareness of climate change at the teacher level. Teachers need to be prepared with the knowledge and skills needed to assist students through climate disruptions and ensure continuity of learning. These measures can be combined to improve the capacity of educational institutions to address and adapt to climate change and to be more resilient in the long term.

Limitations

There are some limitations to this study that need to be taken into consideration when interpreting the results. First, the cross-sectional research design provides evidence based on a specific point in time and does not capture changes in institutional adaptation capacity and educational resilience over longer periods. Second, the study was conducted in educational institutions of Balochistan, so the results might not be applicable to those institutions that are found in other geographical and environmental settings. Third, the study was based on teacher and administrator self-report responses, which could be influenced by individual perceptions and possible response bias.

Future Research Directions

Longitudinal research designs should be used in future studies to explore institutional adaptation strategies as they evolve over time and affect educational resilience. Mixed-method approaches that incorporate both quantitative and qualitative evidence are advised to provide a more comprehensive understanding of institutional experiences, challenges and coping mechanisms. Furthermore, comparative analysis at the provincial and regional level can give a wider picture of the differences in climate vulnerability, adaptation capacity and climate-resilient practices in education systems.

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