

Coping Strategies for Academic Performance as Criterion of Resilience: A Case Study of Chemistry Students in Pakistan



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Abstract: *This study aimed to find the association between resilience and coping strategies in specific context of academic performance and furthermore to find the effect of resilience on coping strategies in specific context of academic performance among 10th-grade chemistry students. Two self-structure questionnaires regarding resilience and coping strategies for academic performance were used to collect data from district Lahore. All the chemistry students of district Lahore were the population of the study. 400 individuals were selected for the data collection on the basis of multistage random sampling technique. This study adopted the positivistic paradigm of the research study directing the quantitative study with ex-post facto design. Independent sample t-test, linear correlation and linear regression were applied by using the SPSS. The results of the study reflected that there was strong positive and significant correlation between the constructs. Furthermore, resilience was predictor of coping strategies for academic performance and there was 55.6 % variance in copings strategies for academic performance. The further research studies may be conducted by adding one or more variable by adopting the quantitative, qualitative or mixed-method research design.*

Keywords: *Resilience, Coping strategies, academic performance, chemistry students*

Introduction

Coping strategies and resilience are the psychological constructs those are concerned with intellectual approach of the individuals (Vescio, 2016). Resilience is specific trait of the students which enables them to come from setback (Mirza & Arif, 2018; Siddique et al., 2023; Muhmmad. Siddique et al., 2021). Qamar and Akhter (2020) stated that resilience is bounce back ability of the individuals from the very tough situation. Resilience is the ability to adapt and recover from adversity, trauma, or significant stress; it involves mental, emotional, and behavioral flexibility, allowing individuals to navigate challenges and emerge stronger

(Godor et al., 2024; Mi et al., 2024; Poulus et al., 2024; Sacgaca et al., 2023; Siddique et al., 2021; Siddique et al., 2021; Sobhani et al., 2024; Vladislav et al., 2024; Wu et al., 2024).

In Chemistry education, resilience plays a critical role in how students cope with the challenges associated with learning complex concepts and solving difficult problems (Kadioglu-Akbulut & Uzuntiryaki-Kondakci, 2021). Chemistry, as a subject, often needs a strong understanding of abstract principles, and logical thinking, that can be overwhelming for many students, especially in high-stakes environments like high school or university (Lawrie, 2021).

Following are the key aspects of resilience in chemistry education.

Overcoming Difficult Concepts: Chemistry involves learning abstract concepts like atomic structure, chemical bonding, thermodynamics, and stoichiometry, which many students find difficult to grasp. Resilient students are better equipped to handle the frustration of not immediately understanding these concepts. Instead of giving up, they persist, seeking alternative explanations, revisiting lessons, or practicing until they master the material (Chikendu et al., 2021).

Persistence in Problem Solving: Chemistry problems often require multiple steps and careful reasoning, which can be mentally taxing. Students with resilience don't easily get discouraged by mistakes or wrong answers. Instead, they view challenges as opportunities to improve and are more likely to try different strategies to solve problems (Siddique, K. H. U. Hassan, et al., 2023).

Handling Failure and Feedback: In Chemistry, like other sciences, students are likely to face failure—whether through low exam scores, failed experiments, or incorrect solutions. Resilience helps students see failure as a temporary setback rather than a reflection of their ability. They use feedback constructively to improve their understanding and performance, demonstrating a growth mindset (Mahaffey, 2022).

Adapting to Different Learning Environments: Chemistry education often takes place in both theoretical and practical settings (labs). Students need to be able to adapt to different modes of learning. Resilience aids in managing the anxiety or frustration that can come with performing lab experiments that might fail or appear confusing (Mehta et al., 2022).

Managing Academic Pressure: Chemistry can be a high-stakes subject in many educational systems, with exams and practicals that significantly influence a student's academic trajectory. Resilient students manage the pressure and stress better by developing coping mechanisms such as time management, self-care, and seeking academic support when

necessary (Bascopé & Reiss, 2021).

Collaboration and Peer Learning: Chemistry often involves group work and peer collaboration in lab settings or study groups. Resilient students are able to work effectively in teams, despite personality differences or conflicts, because they are skilled in maintaining a positive attitude, communicating effectively, and handling group dynamics with maturity (Hurst et al., 2019).

Building Confidence in Practical Applications: Conducting experiments and working in the lab are essential components of Chemistry education. Resilience helps students build confidence when they encounter unexpected outcomes or errors in their experiments. They learn to stay calm under pressure and focus on the learning process rather than being discouraged by imperfect results (Borazon & Chuang, 2023).

According to Hurst et al. (2019) and Mehta et al. (2022), resilience may be fostered as:

Encouraging a Growth Mindset: Educators can emphasize the importance of effort over innate ability, helping students understand that they can improve with practice.

Providing Supportive Feedback: Constructive feedback that focuses on progress rather than only on correctness encourages students to keep trying.

Incorporating Real-Life Applications: Showing how Chemistry concepts apply to real-world problems (e.g., environmental science, medicine) can motivate students and make challenges feel more relevant and worth overcoming.

Creating a Safe Learning Environment: Students are more likely to take risks and persevere in a supportive classroom where mistakes are seen as learning opportunities rather than failures.

According to Kadioglu-Akbulut and Uzuntiryaki-Kondakci (2021) resilience in Chemistry education equips students with the emotional and mental tools to navigate the inherent difficulties of the subject, it helps them

not only cope with the stress and challenges but also thrive, enhancing their ability to perform academically and build confidence in their scientific abilities.

Coping strategies in education refer to the methods and techniques that students, teachers, and educational institutions use to manage stress, challenges, and emotional demands (Sagaca et al., 2023; Sobhani et al., 2024). These strategies help individuals navigate the pressures of academic life and maintain mental well-being (Ahuvia et al., 2024; Hamu et al., 2022; Karakuş & Göncü-Köse, 2023; Mi et al., 2024; Rilveria, 2018; Sagaca et al., 2023; Sharma & Gupta, 2023; Sobhani et al., 2024; Takács et al., 2021; Teh et al., 2023; Vladislav et al., 2024; Zarei et al., 2016). Both resilience and coping strategies are the psychological constructs which the used the students to come out the tough situations and using the various strategies to cope up the difficulties (Fukase et al., 2021; Kumar, 2019; Liang et al., 2020; Lucero, 2021; Maiorano et al., 2020; Meneghel et al., 2019; Minshall et al., 2021; van der Merwe et al., 2020; Zhou et al., 2021).

In Chemistry education at the secondary school level, coping strategies refer to the methods and techniques students use to handle stress, challenges, and academic pressures related to learning Chemistry (Ahuvia et al., 2024; Mi et al., 2024; Sagaca et al., 2023; Sobhani et al., 2024; Vladislav et al., 2024). These strategies help students manage difficult concepts, prepare for exams, handle the workload, and navigate the emotional aspects of learning in a potentially high-pressure subject (Fitzgibbon & Murphy, 2023; Viana Machado et al., 2020).

There are generally two types of coping strategies used by students:

Problem-focused Coping Strategies:

Active Learning: Engaging deeply with the subject through additional practice, asking questions in class, or seeking help from teachers and peers (Fitzgibbon & Murphy, 2023).

Time Management: Organizing study schedules effectively to balance Chemistry with other subjects and prevent last-minute cramming

(Fitzgibbon & Murphy, 2023).

Resource Utilization: Using available materials like textbooks, online resources, or extra tutoring sessions to better understand difficult topics (Mishra et al., 2023).

Emotion-focused Coping Strategies:

Relaxation Techniques: Managing stress through mindfulness, meditation, or deep breathing exercises before exams or difficult assignments (Vagni et al., 2022).

Seeking Emotional Support: Reaching out to friends, family, or counselors for support when feeling overwhelmed by the subject (Zhang et al., 2023).

Cognitive Restructuring: Changing negative thoughts about one's ability to succeed in Chemistry, developing a positive mindset, and reducing feelings of frustration or self-doubt (Rilveria, 2018; Takács et al., 2021).

A research study was conducted in china on the constructs of resilience, coping strategies and techno-stress, the sample of the study was 280 university level students; for resilience CD-RISC with α value .90, for coping strategies SCSQ with α value .74, and for techno-stress Techno Stress Scale with α value 0.91, were used. The results of the study revealed that resilience has strong positive and significant relationship with coping strategies furthermore resilience has significant and positive effect on copings strategies (Mi et al., 2024). A research was formulated on resilience and coping strategies on the chinse high school students with sample of 1488, resilience scale for adolescent was used to measure the resilience with α value 0.92 on five-point Likert scale and Simple Coping Style Questionnaire on five point with α value 0.94. The results of the study reflected the resilience had strong, significant and positive association with coping strategies, and further to resilience was predictor of coping strategies (Wu et al., 2024). Another study was conducted on resilience and copings strategies on the 900 participants, to measure the resilience RSCA was used, and to measure the copings strategies, the Brief-CPE was used. The results of the study showcased that resilience and

coping strategies were closely associated with one another and resilience was positive predictor of copings strategies (Godor et al., 2024). Another study was conducted on resilience and coping strategies in Saudi Arabia was *ex-post facto* design, the sample of the study was 763 individuals, CD-RISC was used to measure the resilience and CSI-SF was used to measure the copings strategies, the results of the study demonstrated that resilience and coping strategies have strong and significant correlation and furthermore resilience was strong predictor of coping strategies (Sagaca et al., 2023).

According to Poulus et al. (2024), research was formulated on resilience and coping strategies with the sample of 453 individuals with correlational research design by using CD-RISC-10 to measure the resilience and CFQ to measure the coping strategies, the results of the study reflected that resilience was negatively correlated with coping strategies. Another research study was conducted in Romania with 1010 individuals with correlational quantitative research design, Cognitive Emotional Response Questionnaire was used to measure the coping strategies on five-point Likert scale with α value 0.92 and Family Resilience Assessment Scale was used to measure the resilience on five-point Likert scale with α value 0.82. The results revealed that there was negative correlation between resilience and coping strategies (Vladislav et al., 2024). According to Sobhani et al. (2024) study was formulated on resilience and coping strategies in Iran with 347

individuals having correlational quantitative design, Billings and Moss Coping Strategies Questionnaire with 19-items was used to measure the copings strategies on four-point Likert scale with α value .94 and CD-RISC with 25-items on five-point Likert scale with α value .85 was used to measure the resilience. The results of the study demonstrated that there was negative and significant association between resilience and coping strategies.

All the previous research studies were discussed the various fields of the study medical and general education etc. but very less focused on the chemistry study and chemistry education. They have adopted the various research design and methodology but *ex-post facto* research design was very less focused. Similarly, population and sample were selected from the difference context and fields but chemistry education was very less focused. The research studies highlighted the research gap in the context of chemistry education which is need to fill up and bridge up the knowledge gap in this field. Furthermore, chemistry students faced the difficulties in learning and less aware of the technique and strategies to cope up and come back from the setbacks. They do not know how to use the strategies and which strategy to come out the tough situation in learning chemistry. Therefore, research focused on the construct of resilience and coping strategies and framed the research to find the effect of resilience on coping strategies in the specific of chemistry at secondary level.

Conceptual Framework



Objective of the Study

As the objective of the study set the comprehensive direction for the research to continue the smooth flow of the study. The researcher constructs the following objective of

the study after the careful insight.

- To find the association between resilience and coping strategies for

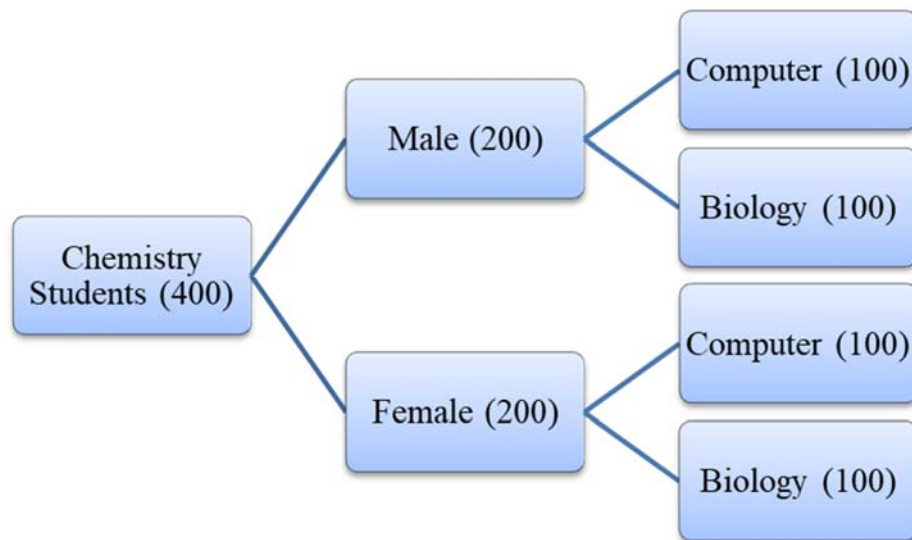
academic performance of 10th-grade chemistry students.

- To find the effect of resilience on coping strategies for academic performance of 10th-grade chemistry students.

Methodology

Methodology provide the framework for the study in the context of population, sampling and procedure to select the sample. This research study adopted the quantitative nature with *ex-post facto* research design possessing the positivistic paradigm. Total number of the individuals from which sample are selected is called population of the study (Shahzad et al., 2023a, 2023b; Siddique et al., 2021; Siddique, Siddique, et al., 2023; Siddique et al., 2021; Vosniadou, 2008). All the chemistry students of the Lahore district were the target population of

the study and 10th-grade chemistry students (62005) were the accessible population of the study. The number of individuals under study used for collection of data by passing through the specific criteria and process are called sample (Ali et al., 2021; Sajjad et al., 2022; Siddique et al., 2022; Vosniadou, 2008). The research adopted the multi-stage random sampling technique to select the sample of the study. 400 individuals (including male and female and further biology and computer) were selected as sample of study. The researcher used the two self-structured questionnaires regarding resilience with 7 factors and 42 items and coping strategies for academic performance with 6 factors and 40 items. The researcher personally visited the school and collected the data after the permission of the principal. The researcher provides the proper time to fill the questionnaires and collected back.



Data Analysis

Table 1.1 Linear Correlation between Resilience and CS for AP

Variables Name	N	r-value	Sig.
Resilience and CS for AP	400	.746**	0.01

** . Correlation is significant at the 0.01 level (2-tailed).

The table 1.1 revealed the linear correlation between resilience and CS for AP. Linear correlation was used to find the relationship as the data meet the term and condition of parametric tests (Hair Jr et al., 2010; Pallant,

2020). The value of $r = .746^{**}$ indicated that there is strong and significant correlation between resilience and CS for AP ($r = .746^{**}$, $N = 400$, $p < .01$).

Table 1.2 Regression Analysis Predicting Coping Strategies from Resilience

<i>Variables</i>	<i>B</i>	<i>t-value</i>	<i>Sig</i>	<i>Model R square</i>
Resilience & CS for AP	.797	22.34	.001	.556

The table 1.2 revealed the regression analysis and predict the effect of resilience (independent variable) on the dependent variable (CS for AP) with variance as 55.6% which demonstrated that

resilience has 55.6% effect on CS for AP. The value of β (.979) is significant at $p = .001$. It is reflected that resilience having the strong and significant effect on CS for AP.

Table 1.3 Independent Sample t-test Regarding Gender

Resilience & CS for AP	Gender	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t-value</i>	<i>df</i>	<i>p-value</i>
Resilience	Male	200	4.38	.27	-.834	398	0.41
	Female	200	4.39	.23			
CS for AP	Male	200	4.34	.27	-2.287	398	0.03
	Female	200	4.40	.25			

The table 1.3 revealed that independent sample t-test was applied on the gender for resilience and coping strategies. The independent sample t-test is used to compare the means of the two groups whose data were collected at the same time (Hagen et al., 2013; Harlow, 2002; Lipovetsky, 2007; Tabachnick et al., 2019; Tabachnick & Fidell, 1983). The table reflected that resilience for male ($M = 4.38$, $SD = .27$) and

for female ($M = 4.39$, $SD = .23$); $t (-.834 = 398)$, $p = 0.05$. and CS for AP of male ($M = 4.34$, $SD = .27$) and female ($M = 4.40$, $SD = .25$); $t (-2.287) = 398$, $p = 0.03$. It was concluded that there was no significant difference in resilience between male and female as $p > 0.05$. But there exists a significant difference between male and female in CS for AP as the $p < 0.05$.

Table 1.4 Independent Sample t-test Regarding Subjects

Resilience & CS for AP	Subject	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t-value</i>	<i>Df</i>	<i>p-value</i>
Resilience	Biology	200	4.40	.21	1.41	398	0.16
	Computer	200	4.36	.28			
CS for AP	Biology	200	4.38	.24	1.17	398	0.24
	Computer	200	4.35	.23			

The table 1.3 revealed that independent sample t-test was applied on the subject for resilience and CS for AP. In resilience for Biology ($M = 4.40$, $SD = .21$) and for Computer ($M = 4.36$, $SD = .28$); $t (1.41) = 398$, $p = 0.16$. and CS for AP of Biology ($M = 4.38$, $SD = .24$) and Computer ($M = 4.35$, $SD = .23$); $t (1.17) = 398$, $p = 0.24$. It was concluded that there was no significant difference in resilience and CS for Ap between Biology and Computer students as $p > 0.05$.

Conclusion and Discussion

The aim of this research stud was to find the relationship between resilience and copings strategies for the academic performance and to find the effect of resilience on coping strategies for academic performance among chemistry students in Pakistan. It was concluded that there was strong and significant correlation between resilience and CS for AP. Further, it was reflected that resilience having the strong and

significant effect on CS for AP. It was further concluded that there was no significant difference in resilience between male and female. But there exists a significant difference between male and female in CS for AP. Furthermore, it was concluded that there was no significant difference in resilience and CS for Ap between Biology and Computer students.

The results of the current study revealed that there was positive and significant correlation between resilience and coping strategies ($r = .746^{**}$, $N = 400$, $p < .01$); furthermore, resilience was predictor of copings strategies with the variance 55.6% at $p = 0.001$. The findings of the current study support the results of the past study conducted by Mi et al. (2024) that there was strong, positive and significant relationship between resilience and copings strategies and resilience was predictor of coping strategies. Similarly, the findings of this study also aligned with the results of Wu et al. (2024) that resilience had strong positive and significant correlation with copings strategies and further resilience was predictor of coping strategies. Likewise, the results the current study also congruent with the findings of Godor et al. (2024) that both resilience and copings strategies were significantly and positively correlated with one another and resilience was the predictor of coping strategies. The results of this study also aligned with the results of the study of Sacgaca et al. (2023) that resilience had strong positive and significant association with coping strategies and further resilience was strong predictor of coping strategies.

The findings of the current study contradicted with the findings of (Poulus et al., 2024) that resilience was negatively correlated with coping strategies of the chemistry study. Likewise, the findings of this study also contradicted with the results of Vladislav et al. (2024) that resilience was negative association with coping strategies. In the same way, the findings of this study negate the results of the past study that resilience was negatively and significantly associated with copings strategies (Sobhani et al., 2024).

Limitation and Future Directions

This research study was limited to the district

Lahore, Punjab, Pakistan. Further, this study was also limited to the chemistry students only. Furthermore, this study was also limited to the 10th-grade chemistry students only. On the basis of limitations, further research studies may be conducted on the same constructs by adding one or more available. It is further suggested that further research studies may be conducted by adopting the experimental research design or mixed-method research design or varying the population or sample at the various level like elementary, intermediate or at university level.

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