

# Utilising Diagnostic Assessment of Learner Mentality to Foster Challenge-Readiness in Chemistry Learning

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**Abstract.** The global scientific education community is recognizing that students' success in challenging subjects such as chemistry is contingent not only upon cognitive capabilities but also on psychological readiness to confront academic challenges. This study seeks to implement a diagnostic evaluation of learner mentality to characterize students' readiness to confront challenges in chemistry education and to discern essential psychological factors that facilitate or impede adaptive engagement. The study concentrated on evaluating five aspects of learner mentality: persistence, self-confidence, challenge orientation, feedback responsiveness, and emotional regulation among undergraduate chemistry education students, aiming to yield data-driven instructional implications. The urgency of this research is underscored by the persistent disparity between students' conceptual proficiency and their psychological readiness to navigate complex, abstract, and cognitively demanding chemistry content. If teachers don't know how students are mentally preparing for class, they might only deal with surface-level academic problems and ignore deeper emotional and motivational problems that affect students' ability to stay engaged and bounce back. The results show that most students (69.7%) were either Challenge-Ready or Highly Challenge-Ready. The mean score for Feedback Responsiveness ( $M = 3.90$ ) was the highest, and the mean score for Emotional Regulation ( $M = 3.51$ ) was the lowest. There were strong links found between persistence and challenge orientation ( $r = 0.45$ ) and between self-confidence and emotional management ( $r = 0.38$ ). These findings indicate that enhancing self-confidence and emotional regulation should be prioritized. Subsequent research should investigate intervention-based methodologies to enhance psychological readiness in conjunction with conceptual chemistry education.

**Keywords:** Diagnostic assessment, Learner mentality, Challenge-readiness, Chemistry learning, Psychological resilience.

## 1 Introduction

Education systems worldwide are increasingly tasked with equipping learners not only with conceptual knowledge but also with the mental resilience necessary to navigate complex and uncertain learning environments [1], [2]. The cultivation of adaptive learner dispositions, encompassing persistence, self-regulation, and a growth-oriented mindset, has supplanted mere cognitive performance in international educational discourse [3]. In science education, especially in chemistry, students often face abstract ideas, symbols, and reasoning that require them to think about more than one thing at once. When they run into problems, they might feel anxious, avoid the subject, or lose interest [4], [5]. Even though the focus is on 21st-century skills, many classrooms still care more about how well students do on tests than how well they are mentally ready to handle difficult work.

Similar patterns emerge at the national level across secondary and tertiary chemistry courses. Many students use surface-level learning methods, give up when they run into hard problems, and think that chemistry is hard by nature [6]. High-stakes tests and teacher-centred instruction, which put learning processes ahead of accuracy, often support these ideas [7]. Consequently, students' cognitive readiness to confront challenges such as rectifying errors, engaging in research, or amending misconceptions remains insufficient. This gap indicates that affective and dispositional factors are inadequately addressed in standard teaching and assessment practices.

One major problem with these settings is that diagnostic tools aren't used well enough to find out how students feel about learning at the start of training [8]. Chemistry diagnostic tests often focus on previous knowledge or misunderstandings, but they rarely assess students' psychological dispositions regarding challenges, such as resilience, self-efficacy in problem-solving, or openness to criticism. If teachers don't know this, they might think that a student who isn't engaged isn't skilled when they really are. Consequently, pedagogical methods typically do not tackle the fundamental psychological barriers that inhibit substantial engagement in chemistry education.

The absence of a comprehensive diagnostic assessment of learner mentality in chemistry classes has significant consequences [9], [10]. Students who aren't ready for a challenge are more likely to avoid cognitively challenging tasks, rely on rote memory, and lose interest when they have to do multistep reasoning or abstract representations at the submicroscopic level. This tendency ultimately results in heightened disparities in achievement, reduced motivation, and persistent misconceptions. Furthermore, there is insufficient information to assist educators in developing customised support that addresses students' cognitive and psychological requirements, thereby diminishing the overall effectiveness of chemistry instruction.

In this study, the concept of learner mentality denotes a multifaceted psychological disposition indicative of students' preparedness to confront cognitively challenging learning environments. The learner mentality encompasses motivational, affective, and behavioral inclinations that affect learners' responses to academic problems, especially in intricate fields like chemistry. In this research, learner mentality is characterized as a composite construct of five interconnected dimensions: learning persistence, academic self-confidence, challenge orientation, feedback responsiveness, and emotional regulation. These qualities collectively signify learners' readiness to persist in effort, uphold confidence in their capabilities, confront tough tasks, leverage feedback for enhancement, and manage emotional responses in the face of academic challenges.

While learner mentality exhibits conceptual similarities with various known dimensions in educational psychology, it does not correspond to any singular paradigm. Persistence and challenge orientation are conceptually related to Dweck's growth mindset theory, academic self-confidence aligns with Bandura's self-efficacy construct, feedback responsiveness reflects elements of self-regulated learning, and emotional regulation relates to academic resilience frameworks. Nonetheless, the current study conceptualizes learner mentality as a comprehensive diagnostic construct that amalgamates these characteristics into a singular psychological ready profile specifically designed for the setting of chemistry education. So, learner mentality is a combination of many ideas that tries to show how ready students are to handle cognitive obstacles in science education.

In light of these concerns, this study seeks to implement diagnostic assessment of learner mentality as a basis for enhancing students' preparedness to confront challenges in chemistry education [11], [12]. The study seeks to identify fundamental components of learner mentality, delineate their correlation with students' reactions to learning challenges, and formulate pedagogical implications derived from diagnostic results [13, 14]. This research is urgent due to the necessity of shifting from content-centred remediation to a more holistic approach that integrates psychosocial and cognitive preparedness as interconnected components of effective chemistry learning.

This research is essential as it positions diagnostic assessment not merely as a means to identify knowledge deficiencies, but as a tool for understanding learners as holistic entities. By documenting students' mental attitudes toward challenges, educators can create more adaptive learning environments that foster perseverance, reflective thinking, and flexible coping strategies. This approach aligns with modern educational paradigms that prioritise social-emotional learning, self-regulated learning, and a growth mindset as essential adjuncts to academic achievement.

Even though more and more people are realizing how important non-cognitive aspects are in scientific learning, most chemistry education diagnostic tests still mostly test for conceptual comprehension and finding misconceptions. Standard chemistry diagnostic examinations usually check for past knowledge, conceptual accuracy, or representational comprehension. They don't often check to see if students are mentally ready to deal with difficult learning situations. Consequently, educators frequently possess little information regarding pupils' motivational perseverance, emotional resilience, or self-assurance in managing abstract chemical concepts.

This study mitigates this restriction by creating and administering a diagnostic examination explicitly aimed at evaluating learners' psychological preparedness for challenge-oriented chemistry education. The study seeks to furnish educators with a more thorough profile of students' preparedness to tackle cognitively challenging scientific activities by including many psychological variables into a structured diagnostic tool.

This research has the potential to significantly influence the transformation of chemistry education in the long term. Incorporating diagnostic assessment of learner mindset into teaching can help students become more resilient and independent, which will help them deal with difficult scientific problems outside of school. In a time when scientific literacy, the ability to solve problems quickly, and the ability to learn new things throughout your life are all necessary, this kind of readiness is very important. Consequently, the study provides both immediate pedagogical benefits and strategic ramifications for the reform of future-oriented scientific education.

Chemistry learning requires distinct cognitive skills since it uses different levels of representations, such as macroscopic phenomena, submicroscopic particle models, and chemical symbols. Students must consistently translate among various representational levels while also engaged in abstract reasoning and problem-solving. This kind of cognitive complexity can make people feel frustrated, unsure, and mentally overloaded, especially when they are just starting to learn.

In this scenario, the learner mentality is very important in deciding how pupils deal with these problems. Students who are more persistent and willing to take on challenges are more likely to work on difficult representational tasks. On the other hand, students who are more self-confident and able to control their emotions are better equipped to handle academic stress and conceptual difficulties. Thus, comprehending the learner's mentality is crucial for discerning the psychological aspects that affect students' capacity to manage the cognitive challenges of chemistry education.

## 2 Methods

This study's diagnostic assessment breaks down learner mentality into five observable psychological aspects that are supposedly linked to challenge-oriented learning. These qualities encompass learning persistence, academic self-efficacy, challenge orientation, receptiveness to feedback, and emotional regulation. Each level signifies a unique yet interrelated facet of learners' psychological preparedness to tackle intricate academic challenges.

An integrative examination of educational psychology literature, including ideas of growth mindset, self-efficacy, self-regulated learning, and academic resilience, helped us choose these variables. Persistence and challenge orientation signify behavioural engagement with difficulty; self-confidence denotes cognitive belief in capability; feedback responsiveness embodies reflective learning processes; and emotional regulation illustrates learners' capacity to manage affective responses in challenging learning contexts. These factors collectively yield a thorough diagnostic picture of pupils' preparedness to tackle cognitively challenging chemical learning assignments.

### 2.1 Research Design

This study employed a quantitative descriptive research design aimed at utilising a structured diagnostic evaluation to assess students' mental readiness to confront challenges in chemistry learning. The study aimed to conduct a comprehensive analysis of students' psychological learning dispositions as a preliminary step for future instructional interventions, rather than to modify instructional variables. The study concentrated on assessing learner mindset attributes, including resilience, tenacity, confidence in problem-solving, receptiveness to feedback, and adaptive coping, in the context of academic challenges encountered in chemistry courses. The study utilized a diagnostic survey methodology to establish learner mindset as a quantifiable psychological attribute that could inform pedagogical decision-making.

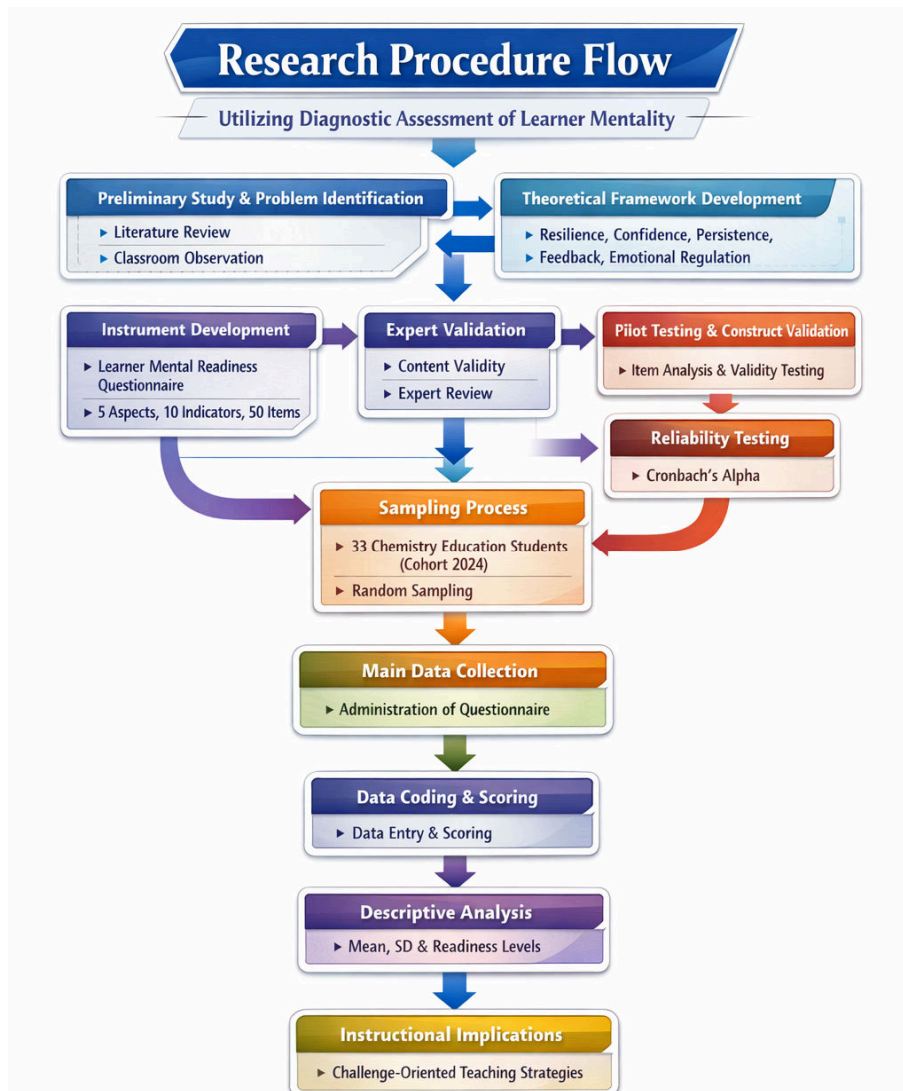


Figure 1. Flowchart of the Research Procedure

## 2.2 Population and Sample

The participants in this study consisted of all undergraduate students enrolled in the Chemistry Education Study Program, cohort 2024. These students were chosen as the target audience because they were just starting their academic careers and were actively learning how to deal with the cognitive and emotional challenges of university-level chemistry. A simple random selection process was used to choose a sample of 33 students to make sure that everyone in the population had an equal chance of being included. This method got rid of sampling bias and made the data more representative. The sample size was deemed adequate for descriptive statistical profiling and psychometric evaluation of the instrument, facilitating a reliable assessment of item validity and internal consistency reliability.

## 2.3 Data Collection Techniques

The data for this study were obtained using the Learner Mental Readiness Questionnaire for Facing Challenges in Chemistry Learning, designed as a diagnostic tool to assess students' psychological readiness to confront academic challenges. The questionnaire was developed based on a solid theoretical framework of learner mentality, guaranteeing that each element represented significant psychological aspects pertinent to chemistry education. Structurally, the instrument comprised five core aspects of learner mentality, operationalized into ten measurable indicators, and represented through fifty Likert-scale statements employing a five-point response range from strongly disagree to strongly agree. This method makes it possible to look at students' mental states in a complicated but measurable way.

The five dimensions of the questionnaire represented important parts of getting ready for learning challenges. Learning persistence is linked to students' resilience and sustained effort when confronting difficult chemistry problems. Academic self-confidence measured how much students believed they could understand and solve chemistry problems. Challenge orientation was the willingness to do mentally difficult tasks instead of avoiding them. Feedback responsiveness meant being willing to be corrected, think about what went wrong, and make things better. Finally, emotional regulation looked at how well students could deal with stress, anxiety, or anger while they were learning something hard. These elements, when viewed as a whole, gave a full picture of the mental readiness needed for successful chemical learning engagement.

Before being used on a large scale, the instrument went through a lot of psychometric testing to make sure it was accurate and of high quality. The content validity was determined by expert evaluation from specialists in chemistry education and educational psychology, who evaluated the coherence among the theoretical frameworks, indicators, and item designs. This process made sure that every comment was both theoretically sound and appropriate for the situation.

Additional statistical analyses were performed to confirm construct validity and reliability. Item-total correlation analysis was used to test construct validity, and all 50 items passed the minimum validity threshold ( $r_{\text{calculated}} > r_{\text{table}}$  at  $\alpha = 0.05$ ), which means that each statement was very helpful in describing learner attitude. The overall coefficient from reliability analysis using Cronbach's Alpha was over 0.90, which is considered excellent internal consistency. Also, the reliability coefficients for each of the five traits were between 0.82 and 0.88, showing that the measurements were strong and consistent across subscales. After going through these steps to make sure it was valid and reliable, the finished instrument was given to the research participants in a controlled academic setting. This made sure that the data collection conditions were the same for everyone and made the diagnostic results about students' ability to solve chemistry problems more reliable.

## 2.4 Data Analysis Techniques

This study utilized a blend of descriptive and inferential statistical methods to develop a comprehensive diagnostic profile of students' learning mentality in overcoming challenges in chemistry education. The research sought not only to delineate numerical trends but also to formulate significant interpretations that could guide instructional decisions.

The first step was to use descriptive statistics to get a general idea of how mentally prepared the students were. The mean score, standard deviation, minimum and maximum values, and other statistical measures were used to show how answers were spread out and where they tended to be. Also, the percentage of students at each readiness level was figured out to show how many students were in different groups of psychological preparedness. To make it easier to understand, the overall scores were turned into five levels of mental readiness using an interval classification system: very high (very challenge-ready), high (challenge-ready), moderate (developing readiness), low (at risk), and very low (extremely at risk) [15]. This classification provided a more lucid comprehension of students' overall readiness to participate in challenging chemistry tasks.

In addition to looking at the overall score, a more detailed evaluation was done at the aspect and indication level. We got mean scores for each of the five parts of learner mentality and the ten traits that make up those parts. This step made it possible to find out what psychological strengths and weaknesses each student had, like whether they were very persistent but not very good at controlling their emotions, or very confident but not very good at responding to feedback. This type of detailed analysis gives a multidimensional picture of how a learner thinks, rather than just one overall score. To evaluate the stability of the measurement within the actual research sample, a reliability reconfirmation analysis was conducted subsequent to data collection. Internal consistency was reassessed to demonstrate that the instrument exhibited reliable performance under authentic study conditions, thereby enhancing the credibility of the findings.

Finally, the results were analyzed to see what they meant. This stage involved recognizing the strong and weak aspects of learners' mindsets, identifying students who may need additional psychological or pedagogical support, and formulating evidence-based recommendations for developing challenge-oriented instructional strategies in chemistry education. This multi-layered analytical method made sure that the study's results were not only descriptive statistics but also useful insights that connected diagnostic data directly to the development of instruction.

### 3. Findings and discussion

#### 3.1 Findings

##### 3.1.1 Instrument Validity and Reliability

The Learner Mental Readiness Questionnaire underwent a comprehensive validation process, including expert evaluation for content validity and statistical testing for reliability. Specialists in chemistry education and educational psychology conducted content validation to ensure conceptual coherence among the theoretical framework, aspects, indicators, and individual statements. Using a 4-point scale, experts rated each item on how relevant, clear, and representative it was. The Content Validity Index (CVI) for each item was greater than 0.80, which means that experts strongly agreed that the items accurately represented the intended structures. We used Cronbach's Alpha to test reliability and see how consistent the results were. The reliability was deemed exceptional, with an overall dependability coefficient of  $\alpha = 0.92$ . The reliability of the subscales was between  $\alpha = 0.82$  and  $0.88$ , which showed that each facet had stable and consistent measurement features.

**Table 1.** Summary of Instrument Validity and Reliability

Aspect	Indicator	Item No	Statement (Summary)	Expert Validity (Aiken's V)	Item Validity (r)	Subscale Reliability ( $\alpha$ )	Conclusion
<b>Learning Persistence</b>	Sustained effort	1	I keep trying even when chemistry problems are difficult	0.92	0.61	0.85	Valid & Reliable
		2	I do not give up when I fail to solve a chemistry task	0.90	0.59		Valid
		3	I review my mistakes to improve understanding	0.91	0.63		Valid
		4	I spend extra time understanding complex concepts	0.93	0.67		Valid
		5	I remain focused despite challenging exercises	0.88	0.55		Valid
<b>Learning Persistence</b>	Task endurance	6	I complete chemistry tasks even when they are long	0.89	0.58		Valid
		7	I am patient when solving multi-step problems	0.91	0.64		Valid
		8	I try alternative methods if the first fails	0.90	0.62		Valid
		9	I stay engaged in difficult laboratory analysis	0.87	0.53		Valid
		10	I persist until I understand the solution	0.94	0.68		Valid
<b>Academic Self-Confidence</b>	Concept belief	11	I believe I can understand complex chemistry concepts	0.93	0.66	0.84	Valid & Reliable
		12	I am confident in solving chemistry equations	0.91	0.60		Valid
		13	I feel capable during chemistry discussions	0.88	0.52		Valid
		14	I trust my ability in	0.90	0.58		Valid

			15	lab work I can explain chemistry ideas to peers	0.87	0.50		Valid
<b>Academic Self-Confidence</b>	Performance belief		16	I can succeed in chemistry assessments	0.92	0.63		Valid
			17	I believe effort improves my chemistry ability	0.94	0.69		Valid
			18	I am confident tackling new topics	0.89	0.57		Valid
			19	I do not panic during difficult tests	0.86	0.48		Valid
			20	I feel prepared for challenging tasks	0.91	0.62		Valid
<b>Challenge Orientation</b>	Task engagement		21	I enjoy challenging chemistry problems	0.93	0.65	0.86	Valid & Reliable
			22	I prefer tasks that make me think deeply	0.92	0.63		Valid
			23	I am curious about difficult chemistry topics	0.95	0.71		Valid
			24	I volunteer to solve complex questions	0.88	0.54		Valid
			25	I see challenges as learning opportunities	0.94	0.70		Valid
<b>Challenge Orientation</b>	Cognitive risk-taking		26	I try solving problems before asking for help	0.89	0.58		Valid
			27	I attempt unfamiliar chemistry problems	0.91	0.61		Valid
			28	I experiment with new learning strategies	0.90	0.60		Valid
			29	I engage in optional challenging exercises	0.87	0.52		Valid
			30	I am not afraid of making mistakes	0.92	0.66		Valid
<b>Feedback Responsiveness</b>	Openness to feedback		31	I listen carefully to teacher corrections	0.94	0.68	0.88	Valid & Reliable
			32	I revise my work after receiving feedback	0.95	0.72		Valid
			33	I ask questions when feedback is unclear	0.90	0.59		Valid
			34	I value suggestions from peers	0.88	0.53		Valid
			35	Feedback helps me improve my performance	0.93	0.67		Valid
<b>Feedback Responsiveness</b>	Reflective improvement		36	I reflect on mistakes after assessments	0.92	0.64		Valid
			37	I compare my work before and after feedback	0.89	0.56		Valid

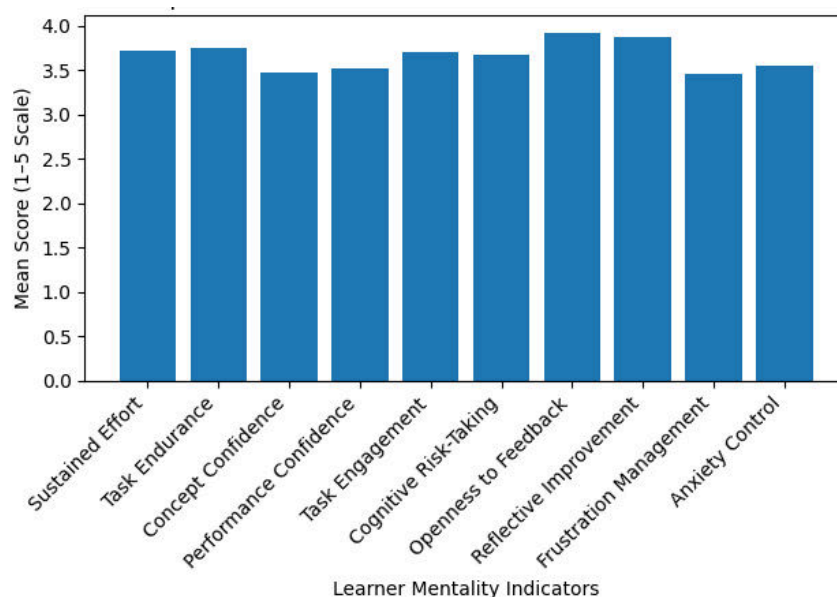
<b>Emotional Regulation</b>	Managing frustration	38	I keep notes of corrections for review	0.91	0.62	0.82	Valid
		39	I seek clarification on errors	0.87	0.50		Valid
		40	I see feedback as a tool for growth	0.95	0.73		Valid
		41	I stay calm when chemistry tasks are difficult	0.90	0.58		Valid & Reliable
		42	I control my emotions during challenging lessons	0.88	0.52		Valid
		43	I recover quickly after making mistakes	0.92	0.64		Valid
		44	I do not feel overwhelmed easily	0.87	0.49		Valid
<b>Emotional Regulation</b>	Anxiety control	45	I manage stress during exams	0.91	0.61	Valid	
		46	I remain confident despite nervousness	0.89	0.55	Valid	
		47	I use strategies to calm myself	0.90	0.60	Valid	
		48	I stay positive when learning is tough	0.93	0.66	Valid	
		49	I do not avoid tasks due to fear	0.86	0.47	Valid	
		50	I handle academic pressure well	0.91	0.63	Valid	

### 3.1.2 Descriptive Analysis of Learner Mental Readiness

A comprehensive psychological profile of students' mental readiness to tackle chemistry learning challenges was obtained through descriptive analysis. The study examined ten diagnostic indicators pertaining to five primary traits of learner mentality. We figured out how strong each indicator was by finding the mean scores on a five-point Likert scale. The results indicate that students demonstrate a considerable level of mental preparedness, although notable variations exist among psychological variables. Indicators associated with feedback and reflective learning demonstrate the most substantial growth, whereas indicators pertaining to emotional regulation under pressure continue to be markedly lower.

The highest mean score was for Openness to Feedback and Reflective Improvement. This shows that students can learn from feedback and are generally willing to be corrected. This shows that students have a good attitude toward learning because they see mistakes as chances to get better instead of signs of failure.

On the other hand, the mean values for Frustration Management and Concept Confidence were much lower. This means that even though students are willing to deal with problems, they aren't as emotionally stable or confident when it comes to dealing with abstract or hard chemistry ideas. These less developed areas may make it harder to stay focused for long periods of time on tasks that require a lot of thought, like solving problems with multiple steps or thinking about things that are too small to see. Indicators associated with task engagement and persistence (Sustained Effort, Task Endurance, and Task Engagement) demonstrate consistently elevated averages. This demonstrates that the majority of students display the behavioral propensity to maintain engagement in challenging learning environments, despite fluctuations in emotional and cognitive confidence.



**Figure 2.** Descriptive Profile of Learner Mental Readiness Across Indicators

### 3.1.3 Distribution of Learners’ Mental Readiness Levels

The distribution indicates that nearly 70% of students fall into the “Challenge-Ready” or “Highly Challenge-Ready” categories, suggesting a generally positive psychological preparedness. However, the presence of 30% in the developing or at-risk range signals the need for targeted instructional and emotional support mechanisms.

**Table 2.** Distribution of Learners’ Mental Readiness Levels

Readiness Category	Score Interval	Frequency (n)	Percentage (%)	Cumulative (%)	Interpretive Meaning
Highly Challenge-Ready	≥ 4.20	8	24.2	24.2	Students demonstrate strong resilience, confidence, and adaptive coping when facing chemistry learning challenges
Challenge-Ready	3.40 – 4.19	15	45.5	69.7	Students are generally prepared to engage with difficult chemistry tasks, though minor emotional or cognitive fluctuations may occur
Developing Readiness	2.60 – 3.39	8	24.2	93.9	Students show emerging readiness but require scaffolding and emotional reinforcement
At Risk	1.80 – 2.59	2	6.1	100.0	Students are likely to avoid challenging tasks and may experience academic anxiety
Highly At Risk	≤ 1.79	0	0.0	100.0	Severe lack of challenge-readiness (not observed in sample)

**Table 3.** Aspect-Level Diagnostic Profile of Learner Mental Readiness

Aspect	Indicator	Mean	SD	Readiness Level	Relative Strength	Diagnostic Interpretation
Learning Persistence	Sustained Effort	3.72	0.48	High	Strong	Students maintain effort even when tasks are cognitively demanding
	Task Endurance	3.75	0.45	High	Strong	Students show consistency in completing complex chemistry activities

Academic Self-Confidence	Concept Confidence	3.48	0.54	Moderate	Developing	Some students doubt their conceptual mastery in abstract topics
	Performance Confidence	3.52	0.51	Moderate–High	Developing	Confidence improves in structured tasks but declines in novel situations
Challenge Orientation	Task Engagement	3.70	0.47	High	Strong	Students actively engage in intellectually demanding activities
	Cognitive Risk-Taking	3.68	0.49	High	Strong	Students are willing to attempt unfamiliar or difficult problems
Feedback Responsiveness	Openness to Feedback	3.92	0.41	Very High	Very Strong	Learners value and utilize corrective input effectively
	Reflective Improvement	3.88	0.44	Very High	Very Strong	Students demonstrate reflective learning behaviors
Emotional Regulation	Frustration Management	3.46	0.56	Moderate	Vulnerable	Emotional control weakens under prolonged difficulty
	Anxiety Control	3.55	0.53	Moderate–High	Developing	Anxiety remains a barrier for some students during assessments

The aspect-level profile shows that feedback responsiveness is the strongest psychological domain. This suggests a culture of learning that encourages self-reflection and growth. Staying the course and facing challenges Orientation is also very advanced, showing a willingness to deal with the difficult chemistry subject. But emotional control and self-assurance are the parts that are most likely to be affected, especially when there is a lot of mental stress. This pattern means that even though students are willing to face challenges, their emotional stability and confidence in their abilities may get in the way of them doing their best.

### 3.1.4 Inferential Analysis: Interrelationships Between Aspects

A Pearson correlation analysis was performed among the five dimensions to elucidate their interrelationships within learner mentality. The findings indicate that learner mentality functions as a multidimensional yet interconnected system, wherein strengths in one domain can facilitate growth in others. The most robust correlation was found between Learning Persistence and Challenge Orientation ( $r \approx 0.45$ ). This moderate positive correlation indicates that students who consistently persevere in challenging tasks are also more inclined to engage in cognitively demanding activities. Persistence seems to serve as a behavioral foundation for attitudes that seek out challenges.

Another significant correlation was identified between Academic Self-Confidence and Emotional Regulation ( $r \approx 0.38$ ). Students who have faith in their chemistry skills tend to be better at controlling their emotions when things get tough. This suggests that confidence may function as a psychological safeguard against anxiety and frustration. Feedback Responsiveness exhibited only weak to moderate correlations with the other dimensions. Even if students are open to feedback, that doesn't mean they will be more emotionally stable or confident. This finding shows that just being willing to reflect is not enough; you also need to be emotionally and cognitively strong. In general, these relationships suggest that boosting self-confidence could have a ripple effect on emotional regulation, and that encouraging persistence could naturally make people more open to challenges. Consequently, the development of a learner mentality should be regarded as a cohesive psychological system rather than as discrete attributes.

**Table 4. Correlation Matrix of Learner Mentality Aspects**

Aspect	Persistence	Self-Confidence	Challenge Orientation	Feedback Responsiveness	Emotional Regulation
Persistence	1.00	0.32	0.45	0.28	0.30
Self-Confidence	0.32	1.00	0.34	0.26	0.38
Challenge Orientation	0.45	0.34	1.00	0.29	0.27
Feedback Responsiveness	0.28	0.26	0.29	1.00	0.22
Emotional Regulation	0.30	0.38	0.27	0.22	1.00

### 3.2 Discussion

The results of this study indicate that learners' mental preparation in chemistry is not merely a peripheral affective variable but a fundamental psychological factor influencing students' engagement with academic challenges. The instrument's high psychometric properties (Table 1) show that the dimensions studied are both theoretically sound and empirically stable. This corroborates current views in educational psychology, which contend that non-cognitive attributes, including mindset, resilience, and emotional regulation, profoundly affect academic achievement, especially in cognitively challenging areas such as science education [16], [17].

The descriptive results (Figure 2 and Table 3) indicate that Feedback Responsiveness is the most prominent domain. This aligns with formative assessment theory [18], which asserts that learning is enhanced when students actively utilize feedback to modify their comprehension. The students' strong willingness to accept feedback is a sign of a reflective learning culture, which is an important part of changing how people think about chemistry, where misconceptions need to be rebuilt over and over again [19], [20]. Nevertheless, in the absence of emotional and cognitive resilience, receptiveness alone cannot ensure profound learning. Zimmerman's (2002) self-regulated learning theory posits that students demonstrate behavioral engagement with challenges, as evidenced by the moderate strength of Learning Persistence and Challenge Orientation (Table 3) [21]. Students who persist in the face of challenges are demonstrating task commitment, an essential aspect of adaptive learning. However, persistence without adequate emotional regulation may lead to burnout or cognitive overload, signifying that emotional coping mechanisms are essential for maintaining endurance.

Academic Self-Confidence and Emotional Regulation were the areas that were most at risk (Table 3). This pattern aligns with Bandura's self-efficacy hypothesis (1997), which posits that performance and emotional responses to challenges are directly influenced by an individual's confidence in their own abilities [22], [23]. When students encounter abstract chemical concepts such as submicroscopic representations or symbolic equations, their anxiety may escalate due to a deficiency in confidence. Similarly, the control-value theory of achievement emotions indicates that students who experience inadequate control over learning settings are more prone to anxiety and irritation, which can impair cognitive functioning [24], [25].

The preparedness level distribution (Table 2) further supports this interpretation. About 70% of kids were rated as ready for a challenge, but about 30% are still in developing or at-risk groups. This distribution shows that learner psychology is very different, which backs up Vygotsky's idea that learners work in different zones of proximal development. Students in the developing range may benefit from scaffolded education that gradually increases task difficulty while providing emotional support. Inferential analysis (Table 4) shows important links between different parts of mentality. The moderate correlation between Persistence and Challenge Orientation ( $r = 0.45$ ) indicates that students who maintain effort are also more inclined to engage in challenging tasks. This corroborates the grit framework, wherein persistent effort and enthusiasm for long-term objectives foster adaptive academic behavior [17], [26], [27]. Persistence seems to serve as a behavioral gateway to engagement in challenges.

The correlation between Self-Confidence and Emotional Regulation ( $r = 0.38$ ) indicates a psychological connection between cognitive belief and emotional stability. This finding is consistent with social cognitive theory, which claims that self-efficacy increases stress responses and coping techniques. Students who have confidence in their ability to succeed are more likely to manage their anxiety well when faced with difficult tasks. So, boosting confidence might help you control your emotions better in an indirect way. Interestingly,

Feedback Responsiveness showed only weak to moderate links with other features (Table 4). This suggests that receptiveness to feedback does not instantaneously translate into emotional resilience or self-assurance. Metacognitive theory supports this distinction by differentiating between reflective awareness and affective coping. A student may still feel nervous or self-conscious even if they logically accept criticism. So, emotional support should be a part of educational methods along with reflective learning.

The data from Figure 2 and Tables 2–4 collectively illustrate that the learner mindset functions as an interconnected psychological system rather than isolated attributes. This encourages the incorporation of cognitive, emotional, and motivational dimensions in teaching via comprehensive educational frameworks, such as whole-child education and social-emotional learning (SEL) models. Chemistry learning, characterized by its abstract and multilayered representations, necessitates extensive psychological support. Lastly, these results show that testing a student's mindset is not only descriptive, but it can also change how they learn. By recognizing emotional and confidence-related weaknesses as well as strengths in persistence and feedback utilization, educators can create learning environments that are intellectually challenging while also being emotionally supportive. This aligns with contemporary reforms in science education that prioritize resilience, adaptive expertise, and lifelong learning capabilities.

#### 4. Conclusion

This study shows that a student's mindset is very important for how ready they are to deal with problems in chemistry. The diagnostic results show that most students have positive attitudes, especially when it comes to getting feedback and sticking with difficult tasks. These strengths suggest that students are behaviorally prepared to engage and progress rather than evade challenges. But this readiness isn't always the same across all psychological categories. The most at-risk areas found are managing emotions and having confidence in one's academic abilities. Even though students are persistent, many of them still have trouble understanding abstract chemical concepts and controlling their anxiety when they are under cognitive stress. This difference shows that perseverance alone cannot guarantee good learning resilience. Preparation should be seen as a combination of hard work, faith in one's abilities, and emotional stability. The links between the different parts of the mind show even more how learner psychology works as a whole. Self-assurance and persistence help with emotional control, but being open to criticism doesn't always mean you will be emotionally strong. These findings underscore the importance of pedagogical approaches that simultaneously address cognitive, emotional, and motivational dimensions. By incorporating diagnostic assessments of learner mindset into their teaching, teachers can create chemical learning environments where problems are solved in a positive way, which helps students become more resilient and grow academically over time.

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