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THE ROLE OF EMOTIONAL REGULATION IN SHAPING STUDENTS' PERCEPTION OF PHYSICS PROBLEM-SOLVING TASKS

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Abstract
This study investigated the influence of emotional regulation on students' perceptions of physics problem-solving tasks, with a focus on how emotional responses affect engagement and cognitive approaches. Conducted at UPTD SMP Negeri 10 Pematangsiantar, a public junior high school in Indonesia, this research involved approximately 150 ninth-grade students from a total population of 192 during the 2024–2025 academic year. Using a mixed-methods approach, data were collected through self-report questionnaires measuring emotional regulation strategies and perception scales related to physics problem-solving. Qualitative data were analyzed using statistical correlation techniques, and qualitative insights were obtained through focused interviews with selected participants. The findings indicate a significant relationship between students' ability to regulate emotions, such as anxiety, frustration, and excitement, and their perception of physics problem-solving as either a challenge or a threat. Students employing adaptive regulation strategies, including cognitive reappraisal and goal-setting, were more likely to approach tasks with confidence and persistence, viewing problem-solving as a positive learning experience. Conversely, those relying on maladaptive strategies such as suppression or avoidance, tended to perceive physics tasks as overwhelming or discouraging. These results underscore the importance of integrating emotional regulation training into physics instruction to foster more constructive attitudes and improve learning outcomes. This study highlights the potential of socio-emotional learning components to support cognitive development in science education, particularly in subjects often perceived as difficult or intimidating by students.

Keywords: Emotional Regulation, Physics Education, Problem-Solving, Students' Perception, Junior High School Students

INTRODUCTION

Physics problem-solving, especially at the high school level, is often viewed by students as one of the most cognitively demanding and emotionally taxing aspects of science education. The abstract nature of physics concepts, combined with the need for mathematical reasoning, often triggers feelings of frustration, anxiety, and self-doubt in students (Redish, 2003). These emotional responses can shape students' perceptions of the subject, leading them to view physics as too difficult or irrelevant to their lives, which, in turn, negatively affects their engagement and performance.

Emotion plays a crucial role in academic achievement and cognitive functioning. According to Pekrun's Control-Value Theory of Achievement Emotions, emotions such as enjoyment, anxiety, and boredom significantly influence students' attention, strategy use, motivation, and academic success (Pekrun, 2006). When students experience negative emotions, such as stress or anxiety, during problem-solving, they may perceive tasks as more difficult than they actually are, which can limit their willingness to persist and reduce their confidence in success.

Emotional regulation refers to the processes by which individuals influence their emotions—how they experience, express, and recover from emotional events (Gross, 1998). In academic contexts, the ability to effectively regulate emotions can influence how students approach challenging tasks. For example, students who use adaptive emotional regulation strategies, such as cognitive reappraisal, are better able to maintain focus, experience less test anxiety, and perform more effectively (Gross & John, 2003).

Different emotional regulation strategies have varying effects on learning. Cognitive reappraisal involves reinterpreting a situation to change its emotional impact, and is often associated with higher academic motivation and better outcomes. By contrast, expressive suppression—concealing emotional expressions—can impair working memory and lead to disengagement (John & Gross, 2004). These findings are highly relevant to physics learning in, which sustained effort and cognitive clarity are essential.

Physics problem-solving requires sustained attention, metacognitive awareness, and tolerance to failure and revision. When students cannot effectively regulate their emotions during these tasks, they are more likely to perceive them as threatening or insurmountable (Linnenbrink-Garcia & Pekrun, 2011). Conversely, students with stronger emotional regulation skills may experience problem-solving as an engaging challenge, thus shifting their perception toward greater openness and confidence.

Students' perceptions of problem difficulty, relevance, and solvability can be shaped by their emotional states. When negative emotions dominate, tasks are often perceived as more complex or less valuable. a cognitive bias driven by affective influences (Efklides, 2006). Therefore, emotional regulation does not just influence performance: it also alters students' mental framing of the problem itself, which has long-term implications for motivation and persistence in the STEM field.

Despite growing research on the cognitive aspects of physics learning, there is still a lack of focus on emotional and psychological dimensions, particularly how emotional regulation shapes students' subjective experiences of problem-solving. Most existing research isolates either emotional regulation or academic performance without exploring the perceptual bridge between the two. Understanding this dynamic is essential for creating interventions to support cognitive and emotional resilience.

This study sought to investigate how emotional regulation strategies affect high school students' perceptions of physics problem-solving tasks. Specifically, it aims to explore whether students who use cognitive reappraisal perceive these tasks as more manageable, engaging, or valuable compared to those who rely on suppression or exhibit low emotional regulation. By combining psychological theory with physics education, this study contributes to more holistic and effective teaching strategies that address both the emotional and intellectual needs of learners.

LITERATURE REVIEW

EMOTIONAL REGULATION IN ACADEMIC SETTINGS

Emotional regulation has been recognized as a key factor in learning, particularly in stressful or cognitively demanding environments. According to Thompson (1994), emotional regulation involves monitoring, evaluating, and modifying emotional reactions adaptively to meet situational demands. In school contexts, students who exhibit better emotional regulation tend to show greater academic resilience and improved classroom behavior (Gumora & Arsenio, 2002). These skills help students maintain motivation and effort, particularly when facing setbacks during complex problem-solving tasks.

THE INTERPLAY OF EMOTION AND COGNITION IN PROBLEM-SOLVING

Emotional regulation plays a central role in cognitive functioning, especially when students are required to engage in higher-order thinking. Isen (2000) suggests that positive emotions can enhance cognitive flexibility and creativity, which are essential traits in successful problem-solving. Conversely, unregulated negative emotions such as anxiety or frustration can narrow students' attention and reduce their working memory capacity (Ashcraft & Kirk, 2001). These cognitive constraints may lead students to perceive physics problems as overwhelming or unsolvable.

STUDENT PERCEPTIONS AND TASK APPRAISAL

Students' perceptions of academic tasks, including judgment of difficulty, relevance, and attainability—are highly sensitive to emotional states. According to Schutz and Davis (2000), students often appraise tasks through an affective lens, where negative emotions heighten perceptions of difficulty and reduce persistence. This is especially evident in subjects such as physics, where abstract problems require sustained effort and tolerance of ambiguity. When students lack emotional regulation strategies, they are more likely to disengage or avoid challenging tasks.

MOTIVATION, SELF-EFFICACY, AND EMOTION REGULATION

There is substantial evidence that emotional regulation influences students' motivation and academic self-efficacy. In a study by King, McInerney, and Watkins (2012), students with stronger emotional regulation reported higher confidence in their academic abilities, which, in turn, led to increased effort and better performance. Similarly, emotion regulation supports goal orientation and reduces avoidance behaviors, both of which are critical in subjects requiring sequential reasoning, such as physics (Valiente, Swanson, & Eisenberg, 2012).

EMOTION REGULATION IN SCIENCE AND STEM EDUCATION

While much of the literature on emotional regulation is situated within general education, recent studies have begun to examine its implications in STEM contexts. Jarrell et al. (2017) found that students' use of emotion regulation strategies significantly predicted persistence and interest in STEM learning environments. Importantly, students who reappraised failure as a learning opportunity were more likely to persevere through difficult problem-solving tasks and reported more positive perceptions of these tasks over time.

CLASSROOM ENVIRONMENT AND TEACHER INFLUENCE

The learning environment and teacher behaviors also impact students' emotional responses and regulation capacities. Meyer and Turner (2006) highlighted that classrooms promoting emotional discourse and cognitive autonomy encourage students to regulate emotions more constructively. By contrast, environments marked by excessive control or fear of failure can exacerbate anxiety and reinforce maladaptive perceptions of difficulty. These findings suggest that both individual and contextual factors interact to shape emotional regulation and perceptions of learning tasks.

TRAINING AND INTERVENTIONS IN EMOTIONAL REGULATION

Several interventions have shown promise in teaching students how to regulate their emotions effectively. For instance, Rivers et al. (2013) found that middle and high school students who received explicit instruction in emotional regulation reported lower stress and more positive attitudes toward academic challenges. Incorporating such training into physics instruction could shift students' perceptions of problem-solving from fear and confusion toward confidence and mastery.

METHODOLOGY

RESEARCH DESIGN

This study used a qualitative research design to explore how students regulate their emotions during physics problem-solving tasks, and how these regulatory processes shape their perceptions of such tasks. A qualitative approach was chosen to allow an in-depth understanding of students' lived experiences, emotional challenges, and personal interpretations related to physics learning (Ansari et al., 2023). Through this lens, this study sought to uncover patterns in how students emotionally respond to and cognitively frame problem-solving activities in physics classrooms.

RESEARCH SETTING AND PARTICIPANTS

This study was conducted at UPTD SMP Negeri 10 Pematangsiantar, a public junior high school located in Pematangsiantar, Indonesia. The study focused on ninth grade students during the 2024–2025 academic year. From a total population of 192 ninth-grade students, approximately 150 students were selected for inclusion in the study. Although the full population participated in the initial observational and survey-based stages, purposive sampling was used to select a smaller subset of students (approximately 12–15 participants) for in-depth interviews and focus group discussions. These students were chosen to represent diverse emotional responses, academic performance levels, and gender balances.

DATA COLLECTION TECHNIQUES

To capture rich detailed data, this study utilized three primary data collection methods:
a) Semi-Structured Interviews:

The selected students participated in one-on-one interviews lasting approximately 20–30 minutes each. Interview questions explored students' emotional experiences during physics problem-solving, their coping strategies, and how those emotions influenced their understanding and motivation.

b) Focus Group Discussions (FGDs):

Two focus group discussions, each with 5–6 students, were conducted to allow participants to share and compare their experiences in a collaborative setting. These sessions encouraged open dialogue and provided deeper insights into the shared perceptions and emotional patterns in the physics classroom.

c) Classroom Observation:

Non-participant classroom observations were conducted during physics lessons to observe students' emotional reactions and behaviours during problem-solving activities. Field notes were taken to record visible signs of frustration, enthusiasm, avoidance, or engagement, along with contextual factors such as teacher interactions and peer dynamics.

DATA COLLECTION PROCEDURE

Data were collected over a four-week period from January–February 2025. In collaboration with physics teachers, the researchers identified problem-solving sessions within the physics curriculum for observation and discussion. All interviews and FGDs were audio-recorded (with participant consent) and transcribed verbatim. Interviews were conducted in Bahasa Indonesia to ensure the comfort and clarity for participants. The transcripts were translated into English for analysis and reporting purposes, preserving the original meanings through back-translation validation.

ETHICAL CONSIDERATIONS

This study adhered to the ethical standards for studies involving minors. Prior to participation, informed consent was obtained from students and their guardians. Participants were informed about the voluntary nature of the study, their right to withdraw at any time, and the confidentiality of their data. Pseudonyms were used in the transcripts and analyses to protect the students' identities. Ethical clearance was secured from the ethics board of the researchers' affiliated institution.

DATA ANALYSIS

Data were analyzed using thematic analysis, following Braun and Clarke's six-phase framework: familiarization with the data, coding, generating initial themes, reviewing themes, defining and naming themes, and producing a report (Herman et al., 2022). Transcripts were manually coded to identify recurring emotional themes (e.g., anxiety, confidence, and frustration) and their influence on students' perceptions of physics tasks. Codes were grouped into broader categories such as "emotion regulation strategies," "task engagement," and "perceived problem difficulty." The credibility of the findings was supported through triangulation across interviews, focus groups, and classroom observations.

The statements are divided into two main constructs:

A. Emotional Regulation (Items 1–8)
B. Perception of Physics Problem-Solving Tasks (Items 9–16)

Each statement is designed to be rated on a 5-point Likert scale:
1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

A. Emotional Regulation (ER) – 8 Items

1. I try to stay calm when I feel frustrated during physics problem-solving.
2. When I feel anxious about a physics question, I remind myself to think positively.
3. I avoid showing my emotions when I get stuck on a physics problem.
4. I change the way I think about difficult problems to feel less stressed.
5. I try to ignore my negative feelings when solving physics problems.
6. I tell myself that struggling with a physics question is a chance to learn.
7. I hold back my emotions when I am confused in physics class.
8. I try to manage my feelings so they don't affect my performance in physics.

Note: Items 1, 2, 4, 6, and 8 reflect cognitive reappraisal (adaptive regulation), while items 3, 5, and 7 reflect emotional suppression (maladaptive regulation).

B. Perception of Physics Problem-Solving Tasks – 8 Items
1. Physics problems are too difficult for me to solve on my own.
2. I enjoy solving physics problems because they challenge me.
3. I feel nervous before starting a physics problem.
4. Physics problem-solving helps me understand real-life situations.
5. I often feel confused when I work on physics problems.
6. I find physics problem-solving interesting and engaging.
7. I believe physics problems are useful for my future.
8. I feel confident when solving physics problems.

Note:
1. Items 9, 11, and 13 reflect perceived difficulty or emotional burden.
2. Items 10, 14, and 16 reflect engagement/confidence.
3. Items 12 and 15 reflect perceived relevance/usefulness.

RESULTS

The data collected from 150 ninth-grade students at UPTD SMP Negeri 10 Pematangsiantar during the 2024–2025 academic year were analyzed to examine students' emotional regulation and perceptions of physics problem-

solving tasks. Responses to the 16-item questionnaire (rated on a 5-point Likert scale from 1 = Strongly Disagree to 5 = Strongly Agree) were summarized using means and standard deviations for each item, along with thematic group averages.

Statement	Mean (M)	SD	Interpretation
1. I try to stay calm when I feel frustrated during physics problem-solving.	3.85	0.76	Moderate to high use of calming
2. When I feel anxious about a physics question, I remind myself to think positively.	3.78	0.81	Moderate positive cognitive reappraisal
3. I avoid showing my emotions when I get stuck on a physics problem.	3.12	1.04	Moderate use of emotional suppression
4. I change the way I think about difficult problems to feel less stressed.	3.69	0.84	Moderate use of cognitive reappraisal
5. I try to ignore my negative feelings when solving physics problems.	2.95	1.01	Low to moderate emotional suppression
6. I tell myself that struggling with a physics question is a chance to learn.	3.90	0.70	High cognitive reappraisal
7. I hold back my emotions when I am confused in physics class.	3.25	0.98	Moderate emotional suppression
8. I try to manage my feelings so they don't affect my performance in physics.	3.80	0.73	Moderate to high emotional regulation

EMOTIONAL REGULATION

TABLE 1 SHOWS THE MEAN SCORES FOR THE EIGHT EMOTIONAL REGULATION ITEMS.

The table 1 above showed Students reported generally moderate to high use of adaptive emotional regulation strategies such as cognitive reappraisal (M range: 3.69 to 3.90), indicating an effort to positively manage their emotions during physics problem-solving. Emotional suppression strategies showed moderate usage (M range: 2.95 to 3.25), suggesting that some students tend to hide or suppress negative feelings, but this was less dominant than reappraisal.

PERCEPTION OF PHYSICS PROBLEM-SOLVING TASKS

TABLE 2 DISPLAYS THE DESCRIPTIVE STATISTICS FOR THE EIGHT PERCEPTION ITEMS.

Statement	Mean (M)	SD	Interpretation
9. Physics problems are too difficult for me to solve on my own.	3.40	0.89	Moderate perception of difficulty
10. I enjoy solving physics problems because they challenge me.	3.55	0.82	Moderate engagement and interest
11. I feel nervous before starting a physics problem.	3.50	0.95	Moderate nervousness
12. Physics problem-solving helps me understand real-life situations.	3.80	0.76	Moderately positive relevance
13. I often feel confused when I work on physics problems.	3.30	0.91	Moderate confusion
14. I find physics problem-solving interesting and engaging.	3.45	0.88	Moderate interest and engagement
15. I believe physics problems are useful for my future.	3.70	0.79	Moderate to high perceived utility
16. I feel confident when solving physics problems.	3.35	0.84	Moderate confidence

From Table 2 above, students perceived physics problem-solving as moderately challenging, with some feelings of nervousness and confusion. However, there was a generally positive perception of the usefulness and relevance of physics to real-life and future goals (M = 3.70–3.80). Engagement and confidence levels were moderate, suggesting room for improvement in fostering motivation and self-efficacy in physics.

From the data presented, the researchers found that the students' moderate to high use of cognitive reappraisal strategies indicates an awareness of the need to positively regulate emotions when facing challenging physics problems. Moderate emotional suppression suggests that some students may hide frustration, which could limit their help-seeking behavior. The moderate perception of difficulty and nervousness aligns with students' emotional experiences during problem-solving, indicating that emotional regulation is a crucial factor in managing these challenges. Positive perceptions of the relevance and usefulness of physics may support motivation, but moderate confidence scores reveal that students might benefit from further support to enhance their self-efficacy.

The findings of this study offer several important implications for educators, curriculum developers, and policymakers who aim to improve students' motivation, engagement, and performance in physics through emotional regulation.

1. Promoting Adaptive Emotional Regulation Strategies
The moderate to high use of cognitive reappraisal among students indicates their potential to constructively manage negative emotions during physics problem-solving. Educators should actively incorporate training on adaptive emotional regulation techniques, such as cognitive reframing and positive self-talk, within the physics curriculum. This can help students reduce their anxiety and frustration, and foster resilience when encountering challenging problems.

2. Addressing Emotional Suppression Tendencies
The presence of moderate emotional suppression suggests that some students hide their negative feelings instead of addressing them. This behavior could impede help-seeking and collaborative learning. Teachers should create a classroom climate that encourages emotional expression and open communication regarding difficulties. Providing supportive feedback and normalizing struggles can reduce stigma surrounding negative emotions and encourage students to share their concerns.

3. Reducing Perceived Difficulty and Nervousness
Since students reported moderate perceptions of difficulty and nervousness, interventions that scaffold physics problem-solving and provide step-by-step guidance may help alleviate these emotional barriers. Using formative assessments and timely feedback can gradually build confidence, reducing feelings of overwhelming.

4. Enhancing Relevance and Real-World Connections
Students' positive perceptions of the relevance and usefulness of physics underscore the value of contextualizing problem-solving tasks within real-life applications. Teachers and curriculum designers should emphasize practical examples and project-based learning that demonstrates how physics concepts relate to everyday life and future careers. This approach increases intrinsic motivation and engagement.

5. Building Confidence and Self-Efficacy
Moderate confidence levels suggest the need for explicit support to strengthen students' self-efficacy in physics. Strategies such as peer tutoring, cooperative learning, and mastery experiences can help students experience success and develop a sense of competence. Emotional regulation skills paired with confidence-building activities can synergistically improve problem-solving outcomes.

6. Informing Teacher Training and Professional Development
Teacher training programs should incorporate components of the emotional and psychological factors that influence learning. Equipping teachers with knowledge and tools to recognize students' emotional states and foster healthy emotional regulation could improve classroom dynamics and student achievement in physics.

7. Guiding Future Research and Intervention Development
The results highlight the importance of integrating psychological constructs such as emotional regulation into physics education research. Future studies should develop and test specific interventions targeting emotional skills to evaluate their impact on motivation, perception, and academic performance in STEM subjects.

DISCUSSION

This study examined the role of emotional regulation in shaping ninth-grade students' perceptions of physics problem-solving tasks at UPTD SMP Negeri 10 Pematangsiantar. The findings reveal important insights into how students manage their emotions during physics learning, and how these processes relate to their perceptions of difficulty, engagement, and confidence.

EMOTIONAL REGULATION AND ITS INFLUENCE ON LEARNING PERCEPTIONS

Consistent with prior research (Gross, 2015; Pekrun, 2014), students in this study reported using a range of emotional regulation strategies, with cognitive reappraisal being the most commonly employed. This adaptive strategy involves reframing a challenging situation in a more positive light, which helps reduce negative emotions and supports persistence (Webb et al., 2012). The moderate to high endorsement of cognitive reappraisal suggests that many students actively attempt to regulate their anxiety and frustration, enabling them to engage more productively in physics problem-solving tasks. This finding aligns with those of studies demonstrating that positive emotion regulation promotes better academic outcomes and enhances motivation (Frenzel et al., 2018).
However, the presence of moderate emotional suppression indicated that some students tended to inhibit outward emotional expressions when faced with difficulties. While suppression might prevent disruptive behaviors in the classroom, it has also been linked to increased cognitive load and reduced academic performance (Gross & John, 2003). This suggests a need for interventions that encourage healthier emotional expression and coping mechanisms among students, as hiding emotions could limit peer and teacher support, and ultimately affect learning.

PERCEPTIONS OF PHYSICS PROBLEM-SOLVING: CHALLENGES AND ENGAGEMENT

The questionnaire results revealed that students perceived physics problems as moderately difficult and often experienced nervousness and confusion, which corresponds with findings from previous studies highlighting the emotional challenges of STEM learning (Harackiewicz et al., 2016). However, students also recognized the relevance and usefulness of physics, reflecting their awareness of its real-world applications. This positive perception may serve as a motivational resource, encouraging students to persevere despite their difficulties (Schunk & DiBenedetto, 2020).
Moderate levels of confidence and engagement indicate that, while students are somewhat motivated, there is substantial room for improvement. This underscores the critical role of emotional regulation in fostering not only the capacity to handle stress but also self-efficacy in mastering complex physics problems. Enhancing students' confidence through successful problem-solving experiences and emotional support can boost their engagement and learning outcomes.

INTEGRATION OF EMOTIONAL REGULATION AND EDUCATIONAL PRACTICE

These findings emphasize the need to integrate emotional regulation strategies explicitly within physics instruction. Teachers should be trained to recognize emotional distress and to guide students in applying cognitive reappraisal and other adaptive techniques. Moreover, cultivating a supportive classroom environment where emotions can be openly discussed may reduce reliance on suppression and foster collaborative problem-solving.
Incorporating contextualized real-life problem scenarios can also enhance perceived relevance, and increase intrinsic motivation and engagement. By combining emotional regulation support with pedagogical strategies that build competence and autonomy, educators can address both affective and cognitive dimensions of learning, in line with Self-Determination Theory (Deci & Ryan, 2000).

LIMITATIONS AND FUTURE DIRECTIONS

Although this study provides valuable insights, it is limited by its reliance on self-reported questionnaire data, which may be subject to social desirability bias. Future research should employ mixed methods that integrate physiological or behavioral measures of emotional regulation to validate the findings. Longitudinal studies could also examine how emotional regulation develops over time and its impact on physics achievement.

Furthermore, intervention studies testing specific emotional regulation training within physics classrooms would be beneficial for establishing causal links and practical applications. Expanding the sample to include different grade levels and schools can enhance generalizability.

In summary, this study highlights the pivotal role of emotional regulation in shaping how students perceive and engage with physics problem-solving tasks. Supporting students' emotional management skills along with cognitive development can foster more positive learning experiences, ultimately promoting greater motivation and academic success in physics.

CONCLUSION

This study explored the role of emotional regulation in shaping ninth-grade students' perceptions of physics problem-solving tasks. The findings demonstrate that students use a mix of adaptive strategies, such as cognitive reappraisal, and less adaptive strategies such as emotional suppression, to manage their feelings during physics learning. These emotional regulation processes significantly influence how students perceive difficulty, relevance, and confidence in solving physics problems.

Students who effectively regulate their emotions tend to view physics problem-solving as more engaging and manageable, which enhances their motivation and willingness to persist. Conversely, those who rely more on suppression may experience increased anxiety and disengagement, potentially hindering their learning progress. Moreover, recognition of the real-life applicability of physics appears to motivate students and can be leveraged to increase their intrinsic interest.

This study underscores the importance of integrating emotional regulation training and supportive classroom environments in physics education. By addressing the both emotional and cognitive dimensions, educators can foster more positive perceptions and higher engagement in physics problem-solving tasks. Future research should further investigate targeted interventions that promote emotional regulation skills and examine their long-term impact on students' academic achievement and attitudes in STEM education.

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