Academic Anxiety of LPTK Students: A Predictor Analysis in AI-Based Scientific Writing

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| **Abstract** | This study aims to analyze the influence of emotion regulation and self-efficacy on academic anxiety, with motivation as a moderating variable, among students majoring in education in Ponorogo Regency. This study uses a correlational, ex post facto, quantitative approach. A total of 370 respondents who were writing scientific papers were involved. This study employed a validated and reliable questionnaire. Path analysis reveals that emotion regulation has a strong and significant impact on reducing academic anxiety, both directly and through its influence on motivation, whereas self-efficacy has a relatively weak influence. These results confirm that emotional management skills, such as cognitive reappraisal and expression control, are key factors in reducing psychological stress in students during the scientific writing process. Theoretically, these findings support the notion that emotion regulation is a crucial determinant of academic success. Yet, it also practically provides implications for higher education to design interventions based on emotion regulation and motivation enhancement to reduce students' academic anxiety. The results of the study can serve as the basis for a predictive relationship study of the variables. |

1. INTRODUCTION

Scientific work has become a key academic standard for higher education. Therefore, it is the duty of universities to serve as hubs for scientific research and advancement. Students' scientific work reflects this function, as maintaining research integrity standards is a primary requirement for achieving genuine academic quality. However, the reality is that a lot of students struggle with academic anxiety, which makes it difficult for them to write scientific articles. Academic anxiety is an individual's perception of danger in an academic setting that affects how they perceive, understand, and react to circumstances (Cassady et al., 2019). In addition, Nihayah and Sadnawi (2021) defined academic anxiety as a feeling of tension and fear of something that may happen, which interferes with the performance of various tasks and activities in academic situations. Academic anxieties share common features, including a perceived risk of failure and resultant disapproval by significant others who evaluate performance in comparison to a standard of achievement (Caviola et al., 2022). Rehman (Rehman, 2016) stated that academic anxiety is one of many challenges faced by students in higher education. Those

definitions show that academic anxiety refers to feelings of tension, fear, and perceived threat in academic settings that interfere with students' understanding, reactions, and performance, often rooted in fear of failure and negative evaluation by others, and represents a common challenge faced by higher education students.

Higher academic demands and complex expectations in the higher education context have led to academic anxiety, which can eventually affect students' academic achievement and well-being. In line with this, academic anxiety plays a significant role amongst various factors that can be attributed to a large number of failures and low achievers in academic tasks (Jain, 2012). According to earlier studies, academic anxiety was significantly more common among medical students (Permata & Widiasavitri, 2019) and students attending teacher education institutions (Trianita et al., 2020). Furthermore, academic anxiety is a strong predictor of students' academic achievement (Grover & Smith, 1981) and is defined as a painful or concerning state of mental disturbance related to academic tasks (Shangal et al., 2018). Students experiencing academic anxiety feel apprehensive about academic tasks (Dobson, 2012). Academic anxiety can lead to serious academic problems (Hooda & Saini, 2017). The research findings of Shakir revealed significant differences between the academic achievement of high and low academic anxiety groups of students (Shakir, 2014). These results highlight the importance of understanding and addressing academic anxiety to improve students' academic performance. Therefore, this issue is related not only to an individual's weakness but also to a psychopedagogical issue worth addressing through learning design or adaptive educational support.

The emphasis on critical thinking and communication skills in academic settings drives the demand for academic writing in the higher education context. As academic writing activities of students are increasingly measured and scrutinised, students appear to experience anxiety in completing their academic work (Loveday, 2018). However, artificial intelligence (AI) is developing at an increasingly rapid pace and is being incorporated into academic activities, such as composing student scientific papers. AI-based technologies, such as ChatGPT, are frequently used to assist with writing tasks, clarify knowledge, and teach specific concepts in a field of study (von Garrel & Mayer, 2023). Nevertheless, the presence of AI does not immediately eliminate students' academic anxiety. Yang et al. (2019) stated that students who are overly dependent on technology tend to experience anxiety when completing academic tasks, including scientific writing. The use of AI poses new challenges, both ethically and from the perspective of academic culture. AI can indeed simplify technical tasks; however, it has the potential to exacerbate students' dependence if used solely as a means of acceleration without a balance of creativity and critical thinking (Chubb et al., 2022). Thus, the phenomenon of academic anxiety in writing scientific papers persists, even though students have used AI-based technology as an assistant.

Numerous research studies are being conducted in an effort to understand academic anxiety better. The five primary components of academic anxiety are procrastination, concern, emotionality, task-related distraction, and a lack of learning capacity (Cassady et al., 2019). Procrastination refers to the tendency to delay tasks, while concern involves worrying about academic performance. In the context of academic writing, students who experience academic anxiety tend to delay their writing tasks (exhibit high procrastination) (Ugur Akpur, 2017). Emotionality encompasses feelings of stress and anxiety, task-related distraction pertains to difficulty focusing on assignments, and a lack of learning capacity involves struggling to retain information. Academic anxiety can be conceptualized as the process by which people receive, process, and react to emotional information (Cassady, 2022). Several factors can influence the rise of academic anxiety. David (David & Situmorang, 2018) Believes that academic anxiety is a cognitive distortion of maladaptive core beliefs. These maladaptive core beliefs may include perfectionism, fear of failure, and self-doubt, which can lead to feelings of inadequacy and overwhelm. Overcoming these distorted beliefs helps students manage their anxiety and improve their overall thesis experience.

The causes of academic anxiety can vary from internal and external factors. Internal factors such as an individual's motivation level and self-esteem can contribute to academic anxiety. Shahrouri

(Shahrouri, 2016) explains that students' low motivation and restricted learning capacities might lead to academic anxiety. The findings indicate a significant yet moderate association between motivation and anxiety (Dubravac, 2020). Working on students' motivation levels to reduce academic anxiety can help build their confidence and enable them to approach their thesis work with a more positive mindset. Lavasani's (Lavasani[a] et al., 2014) findings indicate that students' levels of academic motivation play a crucial role in shaping their academic anxiety. In line with this, Cecilio's (Cecilio et al., 2012) findings highlight that students' academic motivation (particularly extrinsic motivation) significantly contributes to the level of academic anxiety they experience. Even Akçakanat & Antalyali's research confirms that intrinsic motivation affects academic anxiety. Elmelid (Elmelid & Ruchkin, 2014) finds that academic motivation is positively associated with students' anxiety. Those findings are evidence that students' levels of academic motivation, whether intrinsic or extrinsic, can have a significant impact on their experience of academic anxiety. Meanwhile, external factors such as pressure from the social environment and high academic demands also contribute to this condition. Mohebi et al. found that assertiveness training can reduce academic anxiety, highlighting the importance of social skills. Examples of assertiveness training include learning how to communicate effectively, set boundaries, and express one's needs confidently. This type of training can empower students to navigate challenging academic situations with greater ease and confidence, ultimately reducing their levels of anxiety and stress.

Beliefs shaped by prior classroom experiences also play a role in elevated academic anxiety (Rasool et al., 2022). The same procedure is used when drafting research proposals, Onwuegbuzie (Onwuegbuzie, 1997) Showed that research proposal writing anxiety in graduate students includes components related to finding related references and doing statistics, as well as writing and the research process. In the context of academic writing, writing anxiety has proven to be a serious obstacle, with students who experience less anxiety producing better writing than those who experience more anxiety due to limited vocabulary, weak grammar, minimal writing practice, and fear of negative evaluation (Rohmah & Muslim, 2021). Even at the high school level, academic anxiety was also found to have a significant negative correlation to academic achievement, with female students showing higher levels of anxiety compared to male students (Laduniyyah & Suyanti, 2022). These findings confirm that academic anxiety, including the scientific papers, is a psycho-educational phenomenon that remains relevant even though students are now supported by AI-based technology.

Furthermore, another factor that also influences students' academic anxiety is self-efficacy, or self-belief. Self-efficacy, according to Bandura, is a person's belief in their own ability to regulate and perform a series of actions necessary to produce a result (Rustika, 2016). Educational institutions, including universities and other levels of education, need to focus on aspects that can enhance students' self-efficacy. According to research findings, self-efficacy contributes 28.1% to the reduction of students' academic anxiety levels (Purwanti et al., 2020). Based on these findings, increasing self-efficacy through various methods such as self-reinforcement and problem-solving can be an effective strategy for overcoming academic anxiety.

In addition to these factors, other elements also impact students' academic performance. Singh and Singh (research showed that difficulties in emotional regulation are negatively related to academic motivation and achievement, with greater difficulties in emotional regulation leading to lower learning performance. This result is supported by subsequent research, which also shows similar trends (Järvenoja et al., 2018). Poor emotional regulation can impede a person's ability to perform academic tasks effectively. Emotional regulation is the ability to assess, cope with, manage, and express feelings appropriately to achieve emotional balance (Astuti et al., 2024). In line with this definition, Bridges defines emotion regulation as the process of managing emotions through various strategies (Bridges et al., 2004). For Gross, emotional regulation is understood as a form of evaluation that encompasses the processes of recognizing emotions that require regulation (identification), selecting appropriate strategies (selection), and implementing those strategies (implementation) (Gross, 2015). This opinion

is supported by Tull's statement, which emphasizes that emotional regulation is not only about what is done (strategies) but also about an individual's capacity (ability) to regulate emotions (Tull & Aldao, 2015). These findings indicate that emotion regulation is an important factor in understanding and managing academic anxiety.

These various findings indicate that emotion regulation is one of the important factors in understanding and overcoming academic anxiety. Since most studies focused on examining the differences based on demographic variables, while the relationship of academic anxiety with other variables remains underexplored (Kaygı et al., 2023). This study aims to analyze the influence of emotion regulation and self-efficacy on students' academic anxiety in writing scientific papers, with motivation as a moderating variable. The urgency of this research lies in the fact that despite the widespread use of artificial intelligence to support academic writing, student anxiety remains high and has not been fully understood from a psychological perspective. The research gap being addressed is the role of emotional regulation and self-efficacy in reducing academic anxiety through the mediating effect of motivation. This study hypothesizes that emotional regulation and self-efficacy negatively influence academic anxiety, and this effect is strengthened by high motivation. Thus, the variables studied include emotional regulation and self-efficacy (independent variables), motivation (moderator), and academic anxiety (dependent variable).

2. METHODS

This research uses a quantitative approach with an ex post facto design, as the researcher does not directly administer treatment to the variables but analyzes the causal relationship based on data obtained from respondents. The research focuses on four variables: academic anxiety as the dependent variable, emotional regulation and self-efficacy as independent variables, and motivation as the mediating variable. The study population consists of all active students at Teacher Education Institutes (LPTK) in Ponorogo Regency. According to data from the Higher Education Database (PD-DIKTI), the number of active students is recorded as 4,849. The study's sample size was determined using Taro Yamane's or Slovin's formula, with a 5% precision level, yielding an ideal sample size of 370 participants.

The sampling technique employed was convenience sampling. The selection of this technique is based on methodological considerations related to the widely dispersed population members, making it difficult to reach them evenly. Convenience sampling allows researchers to collect data from population members who are easily accessible while still representing the research needs. Research data was collected by filling out a questionnaire designed to measure the four variables. Each research instrument is an adaptation of previous research questionnaires. Each has been retested for validity and reliability until it is declared valid and reliable. The source of the adapted instrument is detailed in the following table.

Table 1. Source of Instrument Adaptation

No Variable	Variable	Source
1	Self-Efficacy	https://journal.unm.ac.id/index.php/MediaTIK/article/download/1409/875
2	Emotional Regulation	https://doi.org/10.56326/jpk.v1i2.1284
3	Motivation	https://doi.org/10.23887/jippg.v3i2.28264
4	Academic Anxiety	https://www.frontiersin.org/articles/10.3389/feduc.2019.00011/full

The instrument adaptation is mostly related to the topic of scientific writing for students. Validity testing was obtained by involving 100 respondents. The validity test shows that all instrument items are declared valid. The Cronbach's alpha value also indicates high reliability ($\alpha > 0.6$).

The collected data were then documented and analyzed using path analysis with the assistance of the SmartPLS 3 program. Path analysis was chosen because it can explain causal relationships between variables, including those that act as mediators. The use of SmartPLS 3 is based on its advantages in accurately analyzing models with many variables and complex paths. Additionally, SmartPLS 3 also enables the analysis of latent variables formed from multiple indicators, which is the primary focus of this research. Thus, the use of SmartPLS 3 is expected to provide accurate analysis results regarding both direct and indirect relationships between variables.

3. FINDINGS AND DISCUSSIONS

This research involved 370 respondents consisting of students from education study programs at various universities located in Ponorogo Regency. Thus, the study population is limited to students who are registered and active at universities located within the administrative area of Ponorogo Regency. Students residing in Ponorogo but registered as students outside of that area were excluded from the study population. In accordance with the research objectives, which aim to analyze the influence of emotion regulation, self-efficacy, and motivation on academic anxiety in writing scientific papers, the research sample focuses on students currently in the process of writing scientific papers. This writing process includes writing for coursework assignments, final projects, and other academic needs.

Each variable in this study was measured using a questionnaire instrument adapted from previous research, which was then retested for validity and reliability. Self-efficacy variables are measured through three indicators: (1) confidence in completing responsibilities, (2) confidence in mastering concepts or situations, and (3) confidence in achieving desired results. These three indicators are broken down into eight questions. The emotion regulation variable consists of two indicators (cognitive reappraisal and expressive suppression), each expressed in nine question items. Meanwhile, the motivation variable consists of five indicators (the presence of a desire and willingness to succeed, the presence of drive and needs in learning, the presence of future hopes and aspirations, the presence of interesting activities in learning, and the presence of a conducive learning environment), which are developed into seventeen question items.

**Table 2.** Construct Validity and Reliability

Variable	Cronbach's Alpha	CR	AVE
Self-Efficacy	0.816	0.879	0.645
Emotional Regulation	0.918	0.931	0.550
Motivation	0.946	0.952	0.539
Academic Anxiety	0.947	0.953	0.527

Based on the analysis results in the table, it is known that each variable has an Average Variance Extracted (AVE) value above 0.5 (> 0.5), a Cronbach's Alpha value greater than 0.6 (> 0.6), and a Composite Reliability (CR) value greater than 0.6 (> 0.6). This indicates that all question items are valid, underlying the latent variable, and reliable in measuring the intended construct. This condition meets the primary requirements of a research instrument suitable for use in a measurement process, as explained by Retnawati. (2016). With the fulfillment of the convergent validity and reliability criteria, the construct developed in this study is declared suitable for use in path coefficient analysis.

Table 3. Direct Effect among Variables

	Anxiety	Motivation
Self-Efficacy	-0.161	0.212
Motivation	-0.113	
Emotional Regulation	-0.694	0.668

Based on the analysis presented in the table, it is known that self-efficacy (-0.161) and motivation (-0.113) have a weak influence on academic anxiety. Meanwhile, emotion regulation (-0.684) has a strong influence on academic anxiety. The assessment was based on criteria put forward by Chin. (1998). The negative direction of the coefficient indicates that an increase in emotion regulation significantly lowers students' academic anxiety levels. This finding is consistent with the results of Mohebi's research (2012), which revealed that emotion regulation training is proven effective in reducing academic anxiety. Additionally, this strengthens the findings of Purwanti et al (2020), which stated that self-efficacy contributes 0.281 (weakly) to students' academic anxiety. The self-efficacy variable has a weak direct effect (0.212) on motivation, while emotional regulation has a strong direct effect (0.668) on motivation. A positive coefficient indicates that an increase in both self-efficacy and emotion regulation variables will lead to an increase in the motivation variable. This supports the novelty presented in this research, which is then structured in a path analysis diagram as follows:
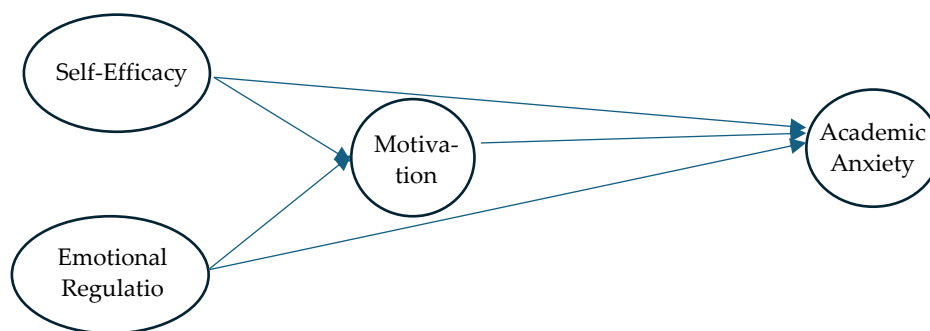
Figure 1. Path Analysis Diagram

This study aims to investigate the impact of emotion regulation and self-efficacy on academic anxiety, with motivation serving as a moderating variable, to address the research questions.

Table 4. Total Inter-Variable Influence

	Anxiety
Self-Efficacy	-0.185
Motivation	-0.113
Regulation	-0.769

Based on the calculation results, the total effect of self-efficacy on academic anxiety is in the weak category (-0.185), while the total effect of emotional regulation on academic anxiety is in the strong category. (-0,769). These findings suggest that although self-efficacy plays a significant role and is reinforced by motivation, its impact on academic anxiety is relatively modest, and it is likely to contribute more to other variables beyond those examined. Conversely, emotion regulation has been shown to have an increasingly strong influence after being reinforced by motivation, making interventions in this aspect effective in reducing students' academic anxiety. These results are consistent with the basic assumption of the study, which confirms a significant relationship between emotional regulation and academic anxiety, strengthened by high motivation. The path diagram of the analysis results, which illustrates the relationships between variables, is shown in the following figure.
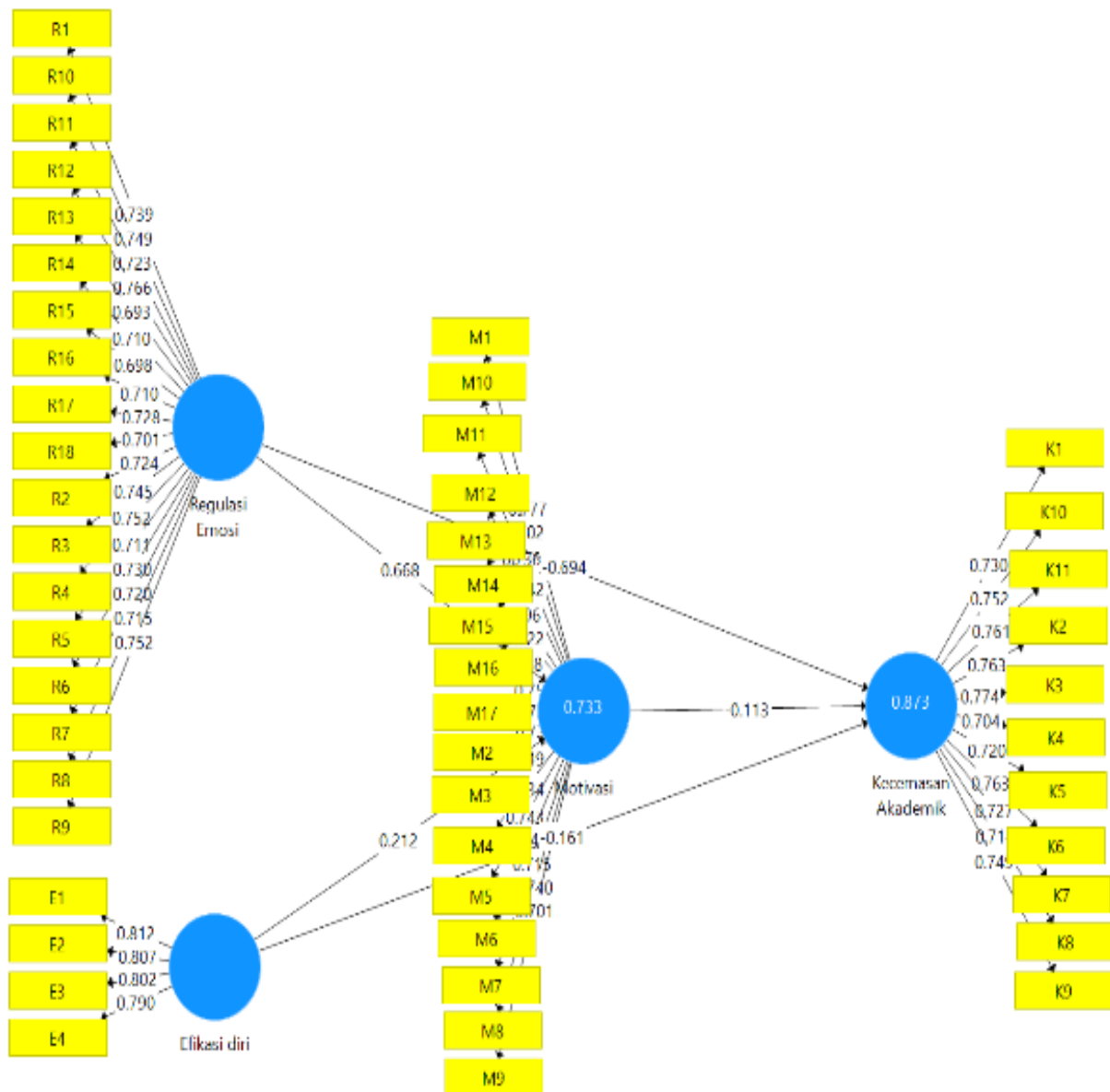
Figure 2. Path Analysis Result Diagram

Based on the path analysis results presented in Figure 2, a complex pattern of causal relationships exists among the variables studied. Emotion regulation demonstrates the most dominant influence on academic anxiety. This finding is based on a path coefficient of -0.694 for the direct effect and a total effect of -0.769 after accounting for the mediating effect of motivation. This negative value indicates that the better the students' ability to regulate emotions, the lower the level of academic anxiety experienced. Conversely, self-efficacy has a relatively weak influence on academic anxiety, with a direct path coefficient of -0.161 and a total effect of -0.185 after accounting for mediation by motivation. In this relationship, motivation serves as a partial mediator, strengthening the influence of both predictor variables on academic anxiety. Emotion regulation has a strong influence on motivation, with a coefficient of 0.668, while self-efficacy shows a weak influence on motivation, with a coefficient of 0.212. Motivation itself has a weak direct influence on academic anxiety, with a coefficient of -0.113. These findings reveal that the indirect pathway through motivation strengthens the influence of emotion regulation on reducing academic anxiety. However, the contribution of motivation as a mediator is not particularly substantial.

The dominance of emotion regulation compared to self-efficacy in predicting academic anxiety is

attributed to the operation of fundamental emotional processing levels. In this context, emotion regulation can directly reduce the intensity of anxiety responses. According to (Gross, 2015) Emotion regulation involves processes of identification, strategy selection, and implementation that directly interact with an individual's affective system. When students face academic pressure in scientific writing, the ability of cognitive reappraisal enables them to reinterpret stressful situations as manageable challenges. This same ability also allows them to respond to such pressure rather than perceiving it as threatening. Similarly, expressive suppression or emotional expression control helps students avoid excessive emotional responses that can disrupt academic performance. Conversely, self-efficacy, although important, operates at the level of cognitive belief, requiring relatively stable emotional conditions to function optimally. This finding also represents a deviation from Bandura's social cognitive theory, which emphasizes that self-efficacy is a belief about one's capacity. However, this belief can become distorted or fail to manifest in behavior when individuals are experiencing intense emotional turmoil. In other words, a person may possess high self-efficacy. Still, if unable to regulate negative emotions such as anxiety, frustration, or self-doubt, that belief will not be effective in reducing academic anxiety.

In the era of AI technology usage, scientific writing can create multifaceted emotional pressures, including fear of plagiarism, doubts about originality, evaluation anxiety from supervisors and examiners, and frustration in confronting the complexity of research methodology. In this context, the ability to manage negative emotions in real-time becomes more crucial than merely believing in one's own abilities. The research findings confirm that students who can apply cognitive reappraisal strategies—such as viewing revisions as a learning process rather than as failure—experience significant reductions in anxiety. These results are consistent with the findings of Mohebi et al. (2012), which demonstrate that emotion regulation training is effective in reducing academic anxiety and strengthen the argument that difficulties in emotion regulation correlate negatively with motivation and academic achievement (Singh and Singh, 2013). In situations of high academic stress, emotional stability becomes a more urgent need than self-confidence. The findings of this study support a hierarchical model in which emotion regulation functions as a psychological foundation that enables higher-level cognitive functions, including self-efficacy, to operate optimally. The data indicate that without adequate emotion regulation ability, self-efficacy has a limited scope to influence academic anxiety.

The research results demonstrate that motivation serves as a partial mediator, strengthening the influence of emotion regulation on academic anxiety, although this mediation effect is not entirely dominant. Emotion regulation has a strong influence on motivation, with a coefficient of 0.668, which subsequently contributes to reducing academic anxiety with a coefficient of -0.113. This mediation process can be explained through the following mechanism: When students can effectively regulate negative emotions, they experience an increase in positive affect and a decrease in negative affect, which ultimately enhances their psychological energy for engaging in academic tasks or intrinsic motivation. This increased motivation then helps students maintain focus and persistence in scientific writing, which indirectly reduces academic anxiety. These findings are consistent with research by Lavasani (Lavasani[a] et al., 2014) and Cecilio (Cecilio et al., 2012), which shows that academic motivation, both intrinsic and extrinsic, correlates significantly with the level of academic anxiety. However, this study's findings add a new nuance: motivation is more effective as a mediator when supported by strong emotion regulation, rather than merely as an independent variable.

Self-efficacy shows a weak influence on motivation with a coefficient of 0.212, which subsequently contributes to reducing academic anxiety. This pathway suggests that belief in one's abilities can enhance motivation to complete academic tasks, although the effect is relatively small. This may occur because self-efficacy requires repeated successful experiences to significantly increase motivation; however, in the context of complex scientific writing, such experiences are not always consistent or easily achieved. The data indicate that motivation functions as a partial mediator, rather than a complete mediator. Emotion regulation has a strong direct influence on academic anxiety, with a coefficient of -

0.694, even after controlling for effects through motivation. This indicates that emotion regulation has multiple pathways in influencing academic anxiety: a direct pathway through cognitive-affective mechanisms and an indirect pathway through increased motivation. These findings enhance understanding that interventions to reduce academic anxiety need to be multi-component, combining emotion regulation training with motivation enhancement strategies.

The findings of this research are highly consistent with previous literature in several aspects. The role of emotion regulation as the primary predictor of academic anxiety aligns with Singh and Singh (2013), who found that difficulties in emotion regulation correlate negatively with motivation and academic achievement. These findings also support those of Järvenoja et al. (, which demonstrate the importance of emotion regulation in the learning process, and confirm the results of Mohebi et al. (2012) that emotion regulation training is effective in reducing academic anxiety. Second, the finding that self-efficacy has a weak contribution with a total effect of -0.185 is consistent with Purwanti et al. (2020), who reported a contribution of self-efficacy of 28.1% to academic anxiety. This consistency supports the view that self-efficacy is important but insufficient as a sole predictor of academic anxiety. Third, the role of motivation as a mediator aligns with Akçakanat and Antalyali (2016), who found that intrinsic motivation influences academic anxiety. These findings are also consistent with Lavasani (Lavasani[a] et al., 2014) regarding the important role of motivation in shaping academic anxiety, demonstrating that motivation has a significant influence on academic anxiety.

Nevertheless, this research also provides several unique contributions that distinguish it from previous studies. First, this study provides quantitative empirical evidence of the magnitude difference in influence, where emotion regulation, with a total effect of -0.769, is far stronger than self-efficacy, with a total effect of -0.185. Most previous research has examined these variables separately or has not compared their relative strengths within the same model. This finding shifts the paradigm from the dominant focus on self-efficacy, popular in Bandura's literature, toward a greater appreciation of emotion regulation as a key determinant of academic success. Second, this research differs from studies by Elmelid and Ruchkin (2014) or Dubravac (2020), which only examined correlations between motivation and anxiety. The use of path analysis to reveal complex causal pathways and the mediating role of motivation distinguishes this from previous research. This study shows that motivation functions more effectively as a mediator for emotion regulation (with an influence of 0.668 on motivation and -0.113 on anxiety) compared to self-efficacy (with an influence of 0.212 on motivation and -0.113 on anxiety).

Third, this research represents one of the first studies to examine academic anxiety in the context of AI-based scientific writing. Research by von Garrel and Mayer (2023) and Chubb et al. (2022) did not specifically examine how psychological variables such as emotion regulation and self-efficacy interact in the use of AI in academic contexts. The finding that academic anxiety remains high despite students using AI technology demonstrates that technological solutions do not automatically address underlying psychological problems. This adds a new perspective to the literature on AI in education. Fourth, the findings of this study suggest prioritizing emotion regulation-based interventions with motivational support, differing from conventional approaches that often emphasize increasing self-efficacy as the primary strategy. This research offers an evidence-based framework for designing counseling or training programs that integrate cognitive reappraisal and expressive suppression training with motivation enhancement strategies.

The findings of this research position emotion regulation as a central variable in the theoretical model of academic anxiety, thereby shifting or at least balancing the dominance of self-efficacy that has long been the focus in educational literature. This study also contributes to the growing literature on the role of AI technology in education through the finding that psychological interventions remain crucial in the digital era. However, these findings also raise questions for future research: why does self-efficacy have a relatively weak influence in this context, and whether these findings are specific only to the context of scientific writing, or can they be generalized to other academic contexts? Longitudinal or

experimental research is needed to answer these questions and strengthen the causal inferences that can be drawn from this study.

Although this research makes important contributions, several limitations must be considered when interpreting the results. *First*, the sample distribution is not entirely even across LPTK institutions in Ponorogo Regency. This uneven distribution results from the researcher's limited access to the student population, which is dispersed across various institutions. This distributional inequality can affect the representativeness of research findings to the broader population. Institutions with larger numbers of respondents may have greater influence on the analysis results, so that specific characteristics of those institutions may not be proportionally represented. Generalizability of findings to the entire LPTK student population, let alone beyond Ponorogo Regency, needs to be undertaken with caution. Subsequent research could employ stratified random sampling to ensure more even representation from various institutions, or multi-site studies that explicitly control for institutional variation as a moderator variable.

Second, the use of a convenience sampling technique, or sampling based on ease of access, has the potential to introduce selection bias. Selected respondents may differ systematically from the inaccessible population in terms of characteristics relevant to the research variables; for instance, more easily accessible students may be those who are more active, more cooperative, or have different anxiety levels compared to less accessible students. This bias can affect the external validity of the research, meaning that the findings may not be fully generalizable to the broader student population, as the sample was not randomly selected. In ideal quantitative research, random sampling is preferred to ensure that every member of the population has an equal chance of being selected as a respondent. Subsequent research should employ probability sampling techniques, such as simple random sampling or cluster sampling, to minimize selection bias. If convenience sampling cannot be avoided due to practical limitations, researchers should conduct propensity score matching or sensitivity analysis to test the robustness of their findings against potential bias.

Third, there is a possibility that differences in cultural context, institutional factors, or student characteristics can affect the consistency of measurement results. Instruments that are valid and reliable in one context do not automatically possess the same psychometric properties in different contexts. For instance, questionnaire items about emotion regulation that are relevant in Western cultural contexts may require linguistic or conceptual adaptation for Indonesian student contexts. Self-report instruments used in this study are susceptible to several biases, such as social desirability bias, where respondents may provide answers considered more socially acceptable rather than answers reflecting actual conditions; acquiescence bias, or respondents' tendency to agree with statements without critically considering their content; and recall bias, or respondents' difficulty in accurately recalling their past experiences or feelings. These biases can impact the construct validity and accuracy of variable measurement. Future research needs to employ method triangulation to strengthen measurement validity, such as behavioral observation or direct observation of student behavior in anxiety-inducing academic situations; physiological measures or the use of physiological indicators such as heart rate variability or cortisol levels to measure anxiety objectively; multi-rater assessment or involving assessments from supervising lecturers or peers to complement self-reports; and longitudinal design or measuring variables at multiple time points to understand temporal dynamics and reduce recall bias.

Fourth, this research employs an ex post facto design that is correlational with measurement conducted at a single time point. To establish more definitive causal inferences, experimental or longitudinal designs are necessary to determine whether good emotion regulation leads to a decrease in academic anxiety, or vice versa. Experimental research with a control group, employing a pre-test and post-test design, is required to establish stronger causality. For example, emotion regulation training intervention could be provided to an experimental group, and changes in academic anxiety could be compared with a control group.

Fifth, this research focuses on four main variables: emotion regulation, self-efficacy, motivation, and academic anxiety. However, academic anxiety is a multidimensional phenomenon that can be influenced by various other unmeasured factors, such as social support from friends, family, or supervising lecturers; perfectionism or perfectionistic tendencies that can increase anxiety; procrastination as an antecedent of anxiety; and institutional factors such as supervision quality, task load, or institutional academic culture. Future research should expand the model by incorporating additional contextual and individual variables or by employing multilevel modeling to account for variation at both individual and institutional levels.

Overall, this research comprehensively explains why emotion regulation has a more dominant influence than self-efficacy in predicting academic anxiety, how motivation mediates these relationships, and the position of this study's findings within contemporary literature. The important contribution of this research is the use of path analysis to reveal complex correlational mechanisms and emphasize the priority of emotion regulation-based interventions in the context of AI-based scientific writing. However, the identified methodological limitations suggest the need for caution in generalizing the findings and open opportunities for more robust follow-up research with more rigorous designs and comprehensive variable coverage. The practical implication of this research is the necessity for higher education institutions to develop psychological intervention programs that integrate emotion regulation training with motivation enhancement strategies. The theoretical implication emphasizes the importance of positioning emotion regulation as a central determinant in theoretical models of academic anxiety in the digital era.

4. CONCLUSION

The research findings suggest that emotional regulation, when combined with motivational support, has a significant impact on reducing students' academic anxiety. In contrast, self-efficacy, although strengthened by motivation, has a relatively weaker impact. These findings confirm that students' ability to manage emotions, both through cognitive reappraisal and emotional expression control, plays a crucial role in reducing psychological stress that arises during the process of writing scientific papers. Thus, improving emotional regulation skills can be a priority strategy in efforts to reduce academic anxiety levels, and its effectiveness will be even more optimal when accompanied by strengthening students' learning motivation.

Furthermore, this research has both theoretical and practical implications. Theoretically, the research findings enrich the literature, positioning emotional regulation as a key factor in academic success. Practically, these findings can serve as a basis for universities to design psychological intervention programs, such as emotion regulation training or skill-based counselling services integrated with motivation enhancement strategies. These efforts are expected to help students face academic challenges while also improving their psychological well-being. Thus, this research not only answers the research question but also provides a new contribution to the development of educational policies that are more student-centered.

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