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Bridging Heart and Mind: Exploring emotional intelligence among undergraduates in the age of Artificial Intelligence

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Abstract
In today's dynamic educational landscape, integrating Artificial Intelligence (AI) technology presents opportunities and challenges for educators, especially undergraduates. Emotional Intelligence (EI) is crucial in the AI age, impacting resilience (RI). However, the relationship between RI and EI among undergraduates is under explored. This study investigates this relationship among Chinese undergraduates, examining EI's significance amidst AI integration. Surveying 420 undergraduates from X University, China, using 2 questionnaires and PLS-SEM analysis, the study reveals high EI levels, particularly in emotional regulation, and a positive relationship between RI and EI. Findings stress the importance of socio-emotional skills in navigating AI-driven education.

Keywords: Emotional Intelligence, Resilience, Undergraduates, Artificial Intelligence

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1.0 Introduction

1.1 Background of study

In the rapidly evolving educational landscape, the integration of Artificial Intelligence (AI) technology has become crucial, presenting both opportunities and challenges for educators. These challenges are particularly significant for undergraduates, who are positioned at the forefront of educational innovation and development. As these future educators prepare to nurture young minds' cognitive, emotional, and social growth, they must also grapple with the complexities introduced by AI. This includes adapting to new teaching tools, methodologies, and the shifting expectations of digital literacy.

In this AI-driven era, the importance of emotional intelligence (EI) among educators is increasingly recognized. EI is essential for effective communication, empathy, and understanding in educational settings, which are vital skills when integrating AI tools that can sometimes depersonalize interactions. Despite its acknowledged importance, the exploration of EI among undergraduates within the context of AI integration remains limited. Understanding how undergraduates develop and utilize EI in this landscape is crucial, as they face unique challenges such as balancing technical proficiency with emotional and relational skills. By focusing on this specific group, the study addresses a critical gap: the need to understand how undergraduates, who are future educators, develop the EI necessary to

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navigate and leverage AI technologies effectively.Through a comprehensive study utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, this research aims to uncover the current status of undergraduates' EI, elucidate the factors influencing their EI development, and identify predictors that contribute to their EI proficiency.

1.2 Research Problem

As Artificial Intelligence (AI) continues to reshape education, the growing significance of EI among undergraduates becomes increasingly apparent. Recognizing the pivotal role EI plays in effective learning, it is imperative to understand how undergraduates develop and demonstrate EI within AI-driven educational environments. Recent research highlights the multifaceted nature of EI and its critical role in fostering positive teacher-student relationships, enhancing student engagement, and promoting socio-emotional development in education (Adwan et al., 2020). However, as AI technologies become more integrated into education, questions arise regarding their impact on the cultivation and expression of EI among undergraduates. While studies have explored various factors influencing EI, such as educational programs, self-efficacy, and classroom management practices (Kim & Lee, 2020; Lee, 2018), empirical research specifically investigating the interaction between EI and AI in the training and development of undergraduates is still lacking. Hence, this study aims to explore undergraduates' levels of EI in the AI era, utilizing SPSS 26.0 and Smart PLS 4.0 for analysis. It focuses on examining the relationship between EI and RI, along with factors like self-efficacy and time management. Additionally, the study seeks to investigate how RI predicts EI among undergraduates. By addressing these objectives, the study aims to deepen our understanding of the intricate relationship between EI and RI in AI-driven education. The findings are expected to inform education programs and support initiatives aimed at enhancing undergraduates' EI and RI, ultimately bridging the gap between heart and mind in education.

2.0 Literature Review

2.1 Reviewed of EI in the AI-Education Context

The integration of AI technology in education presents both opportunities and challenges. AI can enhance learning experiences through personalized education, efficient administrative tasks, and data-driven insights (Holmes et al., 2019). EI plays a crucial role in navigating the complexities introduced by AI in education. Educators with high EI are better equipped to manage the emotional and relational aspects of teaching, which are essential in maintaining a balance between technological efficiency and human interaction (Goleman, 1995). In the context of AI integration, EI helps educators address ethical concerns, foster inclusive learning environments, and support students' emotional well-being (Howard and Thomas, 2020).

2.2 Relationship between EI and RI

Studies by Droppert et al. (2019) and Nguyen (2023) demonstrate EI's significant predictive power over various dimensions of RI. While EI and RI are often regarded as independent concepts, research suggests a bidirectional relationship between them (Ngui and Lay, 2020). Individuals with high RI exhibit positive emotions and demonstrate strong adaptability when facing challenges (Trigueros et al., 2020). Conversely, EI nurtures RI by facilitating positive emotional responses and adaptive coping strategies (Zheng et al., 2020). Undergraduates with high RI demonstrate enhanced emotional regulation and decision-making abilities, contributing to academic success (Slatten et al., 2021). Despite the lack of evidence supporting RI's predictive effect on EI, the correlation between these constructs is evident (Da et al., 2021). This reciprocal relationship underscores the importance of both constructs in promoting educators' learning and professional achievement.

3.0 Research Questions

RQ_1: What's the level of EI among Chinese undergraduates?
RQ_2: Is there any significant positive relationship between RI and EI among Chinese undergraduates?
RQ_3: Does RI sub-constructs (hardiness, optimism, self-improvement) predict EI among Chinese undergraduates?

4.0 Research Hypothesis

RH_1:There is a significant positive relationship between RI and EI among Chinese undergraduates.
RH_2: RI sub-constructs (hardiness, optimism, self-improvement) predict EI among Chinese undergraduates.

5.0 Methodology

This study was conducted in X University, China. There were 14 faculties in this university. This study invited 420 undergraduates (population:12938 undergraduates, 27 majors, 100% response rate) for this study via Wen Juan Xing App. This study used proportionate random sampling to select 95 freshman undergraduates, 108 sophomore undergraduates, 107 junior undergraduates, and 110 senior undergraduates within 15 weeks. SPSS 26.0 and Smart PLS 4.0 were used to analyze the data. Research questions 1 used Mean values and Standard Deviations. Research question 2 and 3 test the inferential statistics by PLS-SEM.

This study adopted two research instruments: (1) the Self-report Emotional Intelligence Test (SREIT); (2) the Connor-Davidson Resilience Scale (CD-RISC). They were all tested by several researchers with good reliability and validity (Schutte et al., 1998; Petrides & Furnham, 2000; Connor & Davidson, 2003; Campbell-Sills & Stein, 2007).

6.0 Findings

6.1 Level of EI

Table 6.1 shows the EI among undergraduates. The overall mean score of EI was 3.688. There were four sub-constructs of EI.

Table 6.1:Descriptive Statistics of All EI Construct (*N*=420)

	Mean	Std. Deviation	Level
RE	3.826	.712	High
UE	3.696	.716	High
EF	3.681	.783	High
EP	3.549	.732	High
Overall EI	3.688	.736	High

Note: EI=Emotional Intelligence, EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion

The highest Mean among the four sub-constructs is regulation emotion (*M*=3.826, *SD*=.712), followed by understanding emotions (*M*=3.686, *SD*=.716), emotion facilitation (*M*=3.681, *SD*=.783), and emotion perception (*M*=3.549, *SD*=.732). undergraduates' emotional abilities were more familiar with using emotional regulation ability in their daily lives. Their emotion facilitation ability and understanding emotion ability were in the moderate level. Their emotional perception ability was the most needed to improve.

6.2 Relationship between RI and EI

6.2.1 Path Coefficient between RI and EI

In Table 6.2, the path coefficient of the relationship between RI and EI was .559. Figure 6.1 showed a significant negative relationship between RI and EI (β =.559, *n*= 420, *p*<.01). Based on the regression equation calculation, an increase of one in the covariance of RI resulted in a .559 increase in the slope of the covariance of EI.

Table 6.2: Path Coefficient of the Relationship between EI and RI

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	95%Confidence Interval of the Direct Effect
RI -> EI	.559	.559	.035	15.963	.000	[.486, .624]

Note: EI=Emotional Intelligence, RI=Resilience

As shown in Table 6.2, the structural model indicated that the t-value for "RI and EI" was 15.963, greater than the suggested value of 1.96. At the same time, the p-value of the relationship between these two variables was .000, which is lower than .05. Therefore, it was concluded that RI was correlated with EI. Furthermore, the correlation was significant at *p*<.05, indicating that RI and EI were significantly positively correlated.

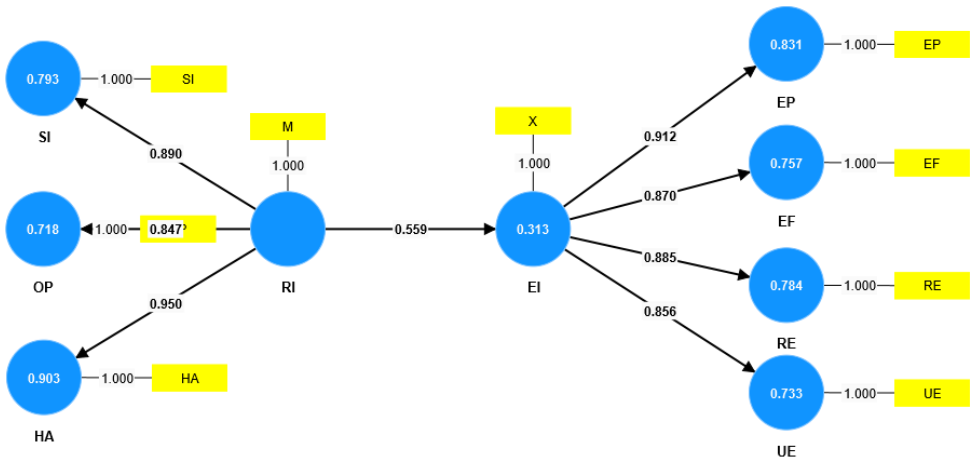

Figure 6.1:Path Coefficient of the Structural Model between EI and RI

6.2.2 Predictive Power between RI and EI

In this study, the following was a graph of the R-square coefficients. The applicability of the model is shown in Table 6.3 below.

Table 6.3:Predictive Powers of RI on EI

	R^2	Adjusted R^2	f^2	Q^2
EI	.313	.311	.455	.311

The findings showed that 31.3% of the variance in EI was affected by RI. Other factors also influenced the remaining 68.7% of the variance in EI. In addition, the F-square of RI -> EI was .455, greater than .35, suggesting a large effect size of RI on EI. In this study, the PLS-SEM analysis did not include any indicators with RMSE (or MAE) values higher than the LM benchmark. Hence, the model had high predictive power.

Table 6.4: PLS Predict of RI on EI

	RMSE	MAE	Q^2_predict
EP	.871	.720	.247
EF	.874	.723	.242
UE	.877	.717	.236
RE	.873	.721	.243

Note: EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion

Table 6.5:LM Benchmark of RI on EI

	RMSE	MAE	Q^2_predict
EP	.636	.526	.246
EF	.684	.565	.241
UE	.627	.513	,236
RE	.621	.513	.243

Note: EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion

In conclusion, undergraduates demonstrated a significant relationship between RI and EI. Therefore, the alternative hypothesis H_1 was supported. RI had a significant effect on EI.

6.3 RI Sub-constructs Predict EI

6.3.1 Path Coefficients between RI and EI

The results of bootstrapping are shown in Table 6.6, and the hypothesis test results are reported in the following section.

Table 6.6: The Path Coefficients Value between RI and EI

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
HA -> EI	.267	.268	.071	3.774	.000
OP -> EI	.097	.098	.067	1.453	.146
SI -> EI	.250	.250	.064	3.910	.000

Note: EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion,HA=Hardiness, OP=Optimism, SI=Self-improvement

Table 6.6 showed that two sub-constructs (hardiness, self-improvement) of RI could predict EI; the p values were all lower than .05. Only one sub-construct (optimism) could not predict EI. The first predictor of EI is hardiness (β = .267, p <.05). The second predictor of EI is self-improvement (β = .250, p <.05). The hypothesis was accepted and indicated that most of dimensions of RI had a positive prediction effect on undergraduates' EI. Figure 6.2 shows that the two sub-constructs of RI can predict EI.

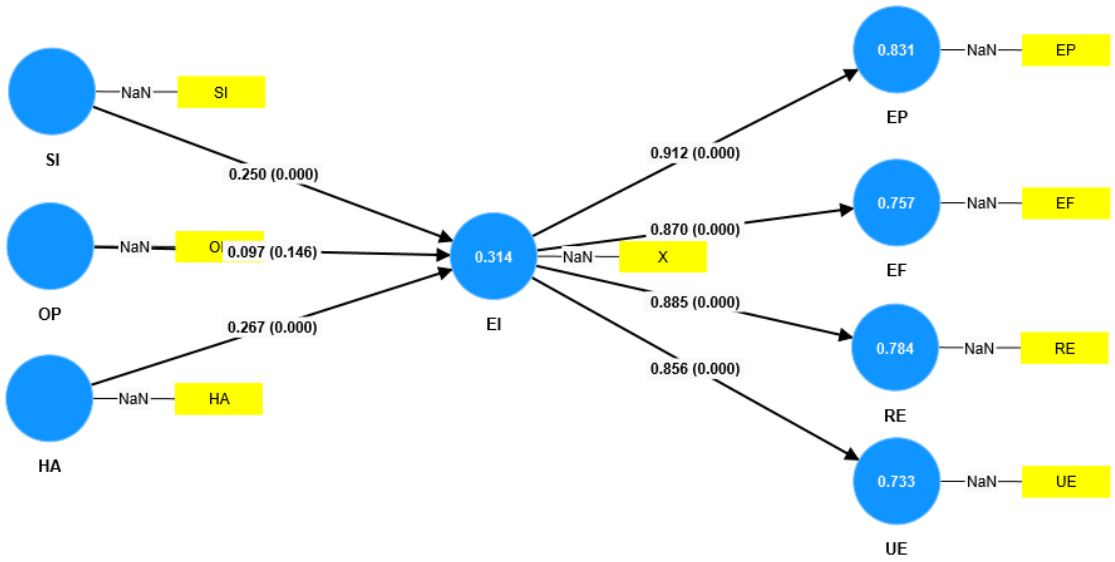

Figure 6.2: Predictors of EI

6.3.2 R square Value

This study's R square value is .314. It indicated that all the RI sub-constructs moderately predicted EI. It also explained that of the two sub-constructs of RI, 31.4% predict EI. It was found that other factors influenced 68.6% of EI. All the other factors should be explored in the future research.

Table 6.7: R^2 of EI

	R-square	**R-square adjusted**
EI	.314	.309

6.3.3 f square Value

The above table presented the effect size of the exogenous variable on the endogenous variable. Bold values represented the small effects value that between .02 and .15. The effect of hardiness and self-improvement had small effects on EI, with the values being .038, and .037. Italic values represented no effects strength less than .02. The effect of optimism had no effects on EI, with the values being .005.

Table 6.8: f^2 of EI

	EI
Hardiness	.038
Optimism	.005
Self-improvement	.037

6.3.4 Q square Value

The Q2 value is shown in Table 6.9. The main endogenous variable EI=.303 was between .25 and .50, indicating the three sub-constructs have a medium degree of predictive relevance on EI.

Table 6.9:Q^2 of EI

	SSO	**SSE**	**Q^2 (=1-SSE/SSO)**
EI	302	210.494	.303

6.3.5 PLS Predict

In this study, the following is a graph of the R-square coefficients. The applicability of the model is shown in Table 6.10 below.

Table 6.10: Predictive Powers of RI Sub-constructs on EI

	R^2	**Adjusted R^2**	**f^2**	**Q^2**
EI	.314	.305	.075	.303

The findings showed that 31.4% of the variance in EI was affected by RI. Other factors also influenced the remaining 68.6% of the variance in EI. In addition, the f2 of RI -> EI was .075, between .02 and .15, suggesting a small effect size of RI sub-constructs on EI.

In this study, the PLS-SEM analysis did not include any indicators with RMSE (or MAE) values higher than the LM benchmark. Hence, the model had high predictive power.

Table 6.11: PLS Predict of RI on EI

	RMSE	MAE	Q^2 _predict
EP	.639	.528	.241
EF	.687	.569	.233
UE	.631	.516	.228
RE	.625	.517	.233

Note: EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion

Table 6.12: LM Benchmark of RI on EI

	RMSE	MAE	Q^2 _predict
EP	.875	.723	.242
EF	.879	.727	.233
UE	.882	.722	.229
RE	.879	.727	.234

Note: EP=Emotion Perception, EF=Emotion Facilitation, UE=Understanding Emotions, RE=Regulation Emotion

Based on the above findings, it was concluded that there was a significant relationship between RI sub-constructs on EI as indicated by the path coefficient analysis and structural model robustness checking. In conclusion, undergraduates demonstrated that there was a significant relationship between RI sub-constructs and EI. Therefore, the alternative hypothesis H_2 was supported. RI sub-constructs (hardiness, self-improvement) significantly affected EI.

7.0 Discussions

7.1 Discussion on Level of EI

The overall mean score of 3.688 suggests a high level of EI among undergraduates in this study. This finding resonates with previous research conducted by Di Lorenzo et al. (2019), Martyniak and Pellitteri (2020), and Puffer et al. (2021), which also reported high levels of EI among undergraduates. Despite the diverse contexts and cultural backgrounds of these studies—ranging from Italy to Poland to the USA—the consistency in findings underscores the robustness of the observed high EI levels among undergraduates, irrespective of their educational systems and cultural contexts. However, it's noteworthy to address a discrepancy observed in the study of Di Lorenzo et al. (2019), where they found high EI levels among university undergraduates across different academic years, including the first and third years. This contrasts with the common perception that EI tends to increase over time with experience and maturity. Nonetheless, the persistent high EI levels among undergraduates align with the broader narrative of educators exhibiting considerable emotional competencies early in their careers.

In the context of an AI-driven educational landscape, the high EI levels observed among undergraduates hold significant implications. As AI technologies continue to augment teaching practices, educators' ability to perceive, understand, and regulate emotions becomes increasingly relevant. Undergraduates' adeptness in navigating emotional complexities not only enhances their classroom management skills but also fosters positive teacher-student relationships, which are essential for effective learning experiences (Kanesan & Fauzan, 2019). Mayer and Salovey's EI model provides a robust framework for comprehending the intricate dynamics of EI among undergraduates. By understanding the variations in EI levels and the nuanced interplay of its sub-constructs, educators and educational policymakers can better support undergraduates in developing their emotional competencies to navigate the challenges and opportunities presented by the AI-driven educational landscape.

Additionally, it is important to acknowledge the limitations of this study, such as the cross-sectional design, which restricts the ability to infer causality, and the reliance on self-report measures, which may introduce biases such as social desirability bias. Future research should consider longitudinal designs and incorporate a variety of assessment methods to validate these findings.

7.2 Discussion on the Relationship between RI and EI

The significant positive relationship observed between RI and EI (β =.559, n= 420, p<.01) among undergraduates carries profound implications, particularly in the context of AI integration into education. As AI technologies increasingly permeate educational settings, understanding how RI and EI intersect becomes imperative for the effective functioning of undergraduates in this evolving landscape. In the realm of AI-integrated education, undergraduates encounter novel challenges and opportunities, necessitating a high level of EI to navigate through. The findings of this study resonate with prior research (Droppert et al., 2019; Ngui & Lay, 2020; Nguyen, 2023; Sarrionandia et al., 2018; Trigueros et al., 2020; McCutcheon, 2018), emphasizing the critical role of EI in fostering RI among educators. For instance, Droppert et al. (2019) underscored how EI significantly predicts variance in various facets of RI, suggesting that adept emotional regulation contributes to adaptive responses to challenges posed by AI implementation in education. Furthermore, the linkage between EI and RI elucidates the intricate mechanisms by which undergraduates cope with stressors inherent in AI-driven educational environments. McCutcheon (2018) elucidated that individuals with heightened EI possess better coping mechanisms, essential for managing the complexities associated with integrating AI technologies into their teaching practices. Likewise, the research by Ngui and

Lay (2020) demonstrated that individuals exhibiting RI tend to display positive emotional outlooks, crucial for embracing AI-induced changes in the educational landscape with an open and optimistic mindset.

Moreover, the findings of Ononye et al. (2022) and Sarwar et al. (2020) underscore the reciprocal relationship between RI and EI, indicating that the enhancement of one construct positively influences the other. In the context of AI-integrated education, this symbiotic relationship becomes particularly pertinent, as undergraduates with heightened RI are better equipped to harness AI technologies to enhance their teaching efficacy. The positive impact of RI on EI, as highlighted by Hartmann et al. (2020), further reinforces the notion that adept emotional regulation fosters a conducive learning environment, essential for harnessing the full potential of AI technologies in education. In essence, the interplay between RI and EI among undergraduates within the AI landscape underscores the necessity for educators to cultivate both attributes. Undergraduates equipped with robust EI and RI are better poised to navigate the complexities of AI-driven educational settings, thereby fostering their professional growth and enhancing student learning outcomes. Thus, fostering EI and RI emerges as a pivotal strategy for preparing undergraduates to thrive in the AI-infused educational landscape, ultimately contributing to the advancement of teaching practices and educational outcomes.

Practical implications of these findings suggest that educational programs should focus on developing both EI and RI among undergraduates. Training sessions and workshops that enhance emotional regulation, adaptability, and stress management can better prepare future educators to integrate AI technologies effectively. By fostering these competencies, undergraduates can improve their resilience and emotional intelligence, thereby enhancing their ability to manage AI-driven educational environments and improve student outcomes.

7.3 Discussion on RI Sub-Constructs Predict EI

Based on the findings regarding the prediction of EI among undergraduates by RI sub-constructs (hardiness, optimism, self-improvement), several important insights emerge in the context of AI. Firstly, the analysis revealed that both hardiness and self-improvement significantly predicted EI among Chinese undergraduates. This suggests that aspects of RI such as perseverance and the drive for self-improvement play a crucial role in shaping EI in educators, even in the era of AI. This finding aligns with the growing recognition of the importance of non-cognitive skills, including RI, in navigating the complexities of the modern educational landscape, which increasingly integrates AI technologies. In the context of AI, where technology is augmenting various aspects of teaching and learning, the ability to adapt and continuously improve one's skills becomes paramount. undergraduates who exhibit RI traits such as hardiness are likely better equipped to handle the challenges and uncertainties associated with integrating AI tools into their teaching practices. Similarly, a focus on self-improvement indicates a proactive approach towards professional development, enabling undergraduates to leverage AI technologies more effectively to enhance their students' learning experiences.

However, it is noteworthy that optimism did not emerge as a significant predictor of EI in this study. While optimism is often regarded as a key component of RI, its lack of predictive power in this context may indicate the need for further exploration. It is possible that in the context of AI integration in education, other factors such as adaptability and technological proficiency may overshadow the influence of optimism on EI among undergraduates. These findings underscore the importance of considering the nuanced relationship between RI sub-constructs and EI in the context of AI-driven educational environments. Educational programs should emphasize the development of perseverance and self-improvement skills among undergraduates to better prepare them for the challenges of AI integration. By fostering these traits, future educators can improve their emotional intelligence, making them more effective in AI-enhanced teaching environments.

In conclusion, the study's findings highlight the critical role of both EI and RI in the context of AI-integrated education. However, limitations such as the cross-sectional design and reliance on self-report measures should be addressed in future research to strengthen the validity of these insights. The practical implications for undergraduate education emphasize the need for targeted training programs to develop these competencies, ensuring that future educators are well-equipped to navigate the evolving educational landscape.

8.0 Conclusion

This study provides valuable insights into the EI levels and RI among Chinese undergraduates within the context of AI-integrated education. The findings reveal a high level of EI among undergraduates, with emotional regulation being particularly pronounced. This underscores the importance of emotional competencies in effectively managing classroom dynamics and fostering positive teacher-student relationships. Additionally, the study highlights a significant positive relationship between RI and EI, emphasizing the role of RI in coping with the challenges posed by AI integration in education. Hardiness and self-improvement emerged as significant predictors of EI, indicating the importance of perseverance and continuous learning in enhancing emotional competencies among undergraduates. Future research should explore longitudinal studies to examine the development of EI and RI over time, particularly in diverse cultural contexts. Additionally, investigating the impact of specific AI tools on the emotional and resilience capacities of undergraduates can provide deeper insights into optimizing AI integration in education. Overall, the findings underscore the need to cultivate socio-emotional skills among educators to thrive in AI-driven educational landscapes and enhance student learning outcomes.

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Paper Contribution to Related Field of Study

This paper underscores the significance of EI in the context of an evolving educational landscape shaped by AI, offering insights into how RI influences EI among undergraduates and emphasizing its critical role in navigating contemporary educational challenges.

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