Emotional intelligence and academic achievement among first-year undergraduate university students: the mediating role of academic engagement

Derib Gosim Bereded*, Amare Sahile Abebe and
Reda Darge Negasi

Department of Psychology, College of Education and Behavioral Sciences, Bahir Dar University, Bahir
Dar, Ethiopia

The purpose of this study was to investigate the relationship between emotional intelligence (EI) and academic achievement, with academic engagement serving as a mediator. A correlational research design was employed to achieve this objective. First-year regular undergraduate students attending Wollo University during the 2023/2024 academic year comprised the target population. The Trait Emotional Intelligence Questionnaires-Short Form (TEIQue-SF) and Utrecht Work Engagement Scale-Student Version (UWES-S) were used to collect data from 1,351 randomly selected students. The first-semester grade point average was used to assess academic achievement scores. The following analyses were performed: descriptive statistics, Pearson product–moment correlation, measurement model analysis to ascertain the reliability and validity of the measures used in the study, and structural equation modeling (SEM) analysis to test the relationships between the study variables. The results revealed that trait EI was positively related to academic engagement ($r = 0.350$), academic achievement ($r = 0.407$), and the relationship between academic engagement and academic achievement ($r = 0.628$). The measurement model analysis confirmed an acceptable level of reliability and construct validity for the TEIQue-SF and UWES-S measures. Findings showed that trait EI had a positive and direct effect on academic achievement and engagement. Trait EI and academic engagement accounted for 49.9% of the variance in academic achievement. Mediation analyses indicated that academic engagement partially mediates the effect of EI on students' academic achievement ($\beta = 0.220$, $p = 0.000$). This suggests that the positive effect of EI on academic achievement is further enhanced by academic engagement. It is recommended that curriculum developers and educators focus on intervention strategies that foster students' EI skills and academic engagement.

KEYWORDS

emotional intelligence, academic engagement, academic, achievement, engagement

1 Introduction

Emotional intelligence (EI) has received increased attention in the educational context since its inception, largely due to its significant correlation with positive academic and learning outcomes. Researchers highlight its role in fostering greater resilience (Ononye et al., 2022), improving school-related adjustment, and cultivating adaptive coping strategies (Perera and DiGiacomo, 2015). Additionally, EI has been linked to increased academic engagement

(Dehyadegary et al., 2012; Maguire et al., 2017) and demonstrates a positive relationship with academic performance (Qaiser et al., 2019; Sanchez-Ruiz et al., 2013).

Psychologists have defined EI in various ways (Palmer et al., 2009). Some define EI broadly as non-cognitive competencies that include both emotionally and socially intelligent behaviors (Goleman, 2001). Others describe EI as a personality trait highlighting individuals' perceived ability to identify, interpret, and use emotion-laden information (Petrides and Furnham, 2001). Furthermore, several scholars view EI as a subset of social intelligence, emphasizing individuals' capacity to recognize and manage their own emotions, as well as those of others, while applying this information to inform thoughts and behaviors (Mayer et al., 2008).

The various views of EI have led to the creation of ability and trait models of EI. The ability model of EI refers to an individual's ability to effectively identify, interpret, and apply emotion-laden information (Petrides et al., 2004). According to the ability model, EI is perceived as a cognitive ability, similar to understanding arithmetic or other abstract concepts, which requires individuals to recall and process information (Allen et al., 2010). These assessments involve items with clear correct and incorrect answers, such as evaluating individuals' abilities to accurately perceive and interpret emotional expressions (Petrides and Furnham, 2001). In contrast, a trait EI model includes various factor structures that demonstrate behavioral tendencies and perceptions of one's capability to recognize and manage emotional information (Cooper and Petrides, 2010; Bar-On, 2006). For example, the emotional-social intelligence (ESI) model outlines social and emotional skills that affect one's ability to: (a) recognize, understand, and manage emotions; (b) establish and maintain social relationships; (c) address personal and interpersonal challenges and adapt to changes; and (d) cope effectively with daily demands, pressures, and obstacles (Bar-On, 2006). Similarly, a four-dimensional framework for EI was introduced (Goleman, 2001), which includes self-awareness, self-regulation, social awareness, and relationship management. Subsequently, another model highlights four interconnected facets of abilities and behaviors: (1) Emotionality: the ability to sense, articulate, and connect with one's own emotions and those of others. (2) Sociability: the ability to integrate socially, manage others' emotions, and engage in social relationships. (3) Well-being: a sense of happiness and fulfillment rooted in self-perception, achievement, and positive expectations. (4) Self-control: the ability to effectively navigate impulses, emotions, and stress has been cultivated (Petrides, 2009). The trait EI model was adopted for this study, acknowledging the significance of trait EI competencies in facilitating learning, especially during students' transitions into unfamiliar educational environments (Saklofske et al., 2012; Zhoc et al., 2018).

There is a growing body of evidence regarding the role of EI in students' academic achievement, particularly in stressful and challenging learning contexts where academic demands exceed cognitive resources (Martínez et al., 2019; Ferrando et al., 2011; Petrides et al., 2004). Clarifying the role of trait EI in academic performance may assist educators in designing intervention strategies that incorporate skills related to EI into the teaching-learning process in higher education (Perera and DiGiacomo, 2013). However, the specific mechanism by which EI affects academic achievement remains unclear. This study is, therefore, intended to investigate whether the influence of EI on academic achievement is mediated by academic engagement.

1.1 Benefits of EI

EI includes a wide range of emotional and interpersonal abilities that allow learners to sustain high levels of academic achievement (Brackett et al., 2011). Emotionally intelligent students demonstrate enhanced interpersonal, intrapersonal, and stress management capabilities vital for academic success (Villegas-Puyod et al., 2021). For example, a student with strong interpersonal skills can seek academic assistance, guidance, and support from teachers, friends, and peers, resulting in improved academic performance (Lopes et al., 2003).

Students who understand and manage their emotions, for example, are more engaged and focused in class. They demonstrate greater energy and motivation to exert effort in learning and persist through challenges that arise during coursework (Afridi and Ali, 2019). Emotionally intelligent students are more likely to experience positive emotions during learning, such as motivation, focus, recall, and problem-solving skills (Zhoc et al., 2018). They also possess enhanced intrapersonal and interpersonal skills, along with enhanced adaptability and stress management, all of which are essential for academic success in college (Mohzan et al., 2013). Emotionally intelligent students exhibit higher achievement motivation, improved problem-solving and planning skills, and a positive attitude toward learning, all of which contribute to academic success (Jan and Anwar, 2019).

1.2 EI and academic achievement

Cognitive abilities such as standardized test scores and GPAs have long been used as important measures of academic success in the educational landscape. However, recent changes in the education system have led educators to seek factors beyond cognitive ability (Maccann et al., 2020). Among these, EI has garnered increasing attention for its potential to enhance students' learning outcomes (Maccann et al., 2020; Brackett et al., 2011).

Social and emotional abilities are recognized as important in educational settings worldwide, from preschool to university level. For example, in the United States, most institutions provide comprehensive training programs to improve emotional intelligence (EI) skills (Joseph et al., 2019). Students must learn to identify and label their own and others' emotions, as well as a variety of socially related skills (Nica and Sabie, 2023).

In Africa, EI is widely recognized as an important factor across various sectors, including academic achievement. For instance, in Kenya, children are introduced to the concept of EI through guidance and counseling, as well as through both short- and long-term training programs aimed at enhancing students' perception, expression, control, and use of emotions (Karimi et al., 2020). Similarly, in Nigeria, EI has been integrated into the school curriculum as essential for cultivating well-rounded citizens capable of navigating the daily demands of life (Bukar et al., 2023).

Accordingly, several studies have been conducted to examine the relationship between EI and academic achievement. However, the empirical evidence regarding this relationship remains unclear. For example, some researchers demonstrated a strong positive association between the two variables (Qaiser et al., 2019; Fallahzadeh, 2011), while others reported no significant relationship between EI and

academic achievement (Zirak and Ahmadian, 2015; Abu Alkhayr et al., 2022). Some studies reported a negative relationship between EI and academic achievement (Shah et al., 2014; Bilimale et al., 2024), whereas others claimed that, being an emotional trait, EI is not directly associated with academic achievement (Mavroveli and Sánchez-Ruiz, 2011). Given these inconsistent findings, we believe that further research on this topic is essential.

1.3 EI studies in the Ethiopian context

In countries such as Ethiopia, where ethnic conflicts and socio-economic disparities are common, emotional intelligence (EI) has become an important skill for students' academic achievement (Dagne and Belay, 2024; Herut et al., 2024). This notion is consistent with the belief that social and emotional competencies—such as the ability to accurately perceive, express, understand, and manage one's own and others' emotions—are essential for sustaining high academic achievement, even in learning environments where students face various social and emotional challenges (Maccann et al., 2020).

There is a consensus among educators regarding the importance of promoting EI skills in higher education to enhance students' academic performance. For example, scholars in the field have identified teaching EI as an effective technique for fostering academic behaviors among university students (Babamba et al., 2024). There is a clear need to equip students with the emotional and social skills necessary for success, both academically and personally (Trish, 2023). Consequently, educators have begun to integrate skills related to EI into the teaching-learning process in higher education (Khuan and Koh, 2021). Curriculum designers, educators, and university administrators have prioritized the inclusion of emotional skills such as emotional awareness, regulation, and emotion management in their higher education curricula to enhance academic performance (Halimi et al., 2020). Furthermore, programs and intervention strategies aimed at developing students' EI should be examined more thoroughly to improve the overall educational environment in higher education (Khuan and Koh, 2021). Various researchers have conducted studies investigating the application of EI in academic settings (Fallahzadeh, 2011).

However, the Ethiopian education system has largely overlooked the significance of emotional intelligence (EI) skills. Educators and education experts often focus on cognitive aspects while neglecting the role of EI in students' academic success (Getahun Abera, 2021). Additionally, although extensive research on the relationship between EI and academic achievement has predominantly been conducted abroad, studies specifically targeting the Ethiopian context remain limited. Furthermore, among the few studies conducted locally, the findings in this area are notably inconsistent. For instance, some researchers have reported a significant positive correlation between EI and academic achievement (Melese, 2018; Dagne and Belay, 2024). In contrast, other researchers revealed an insignificant relationship between EI and academic achievement, as well as among its dimensions (Getahun Abera, 2021). The discrepancy in findings may be partly attributed to the sampling procedures and the inclusion criteria for participants. For example, Melese (2018) noted that EI had a considerable impact on the academic achievement of first-year college students. Supporting this, researchers emphasized EI as a significant predictor of academic success during students' transition

from high school to tertiary education, a period characterized by substantial lifestyle changes, such as forming new social relationships and adapting to a new academic environment (Saklofske et al., 2012). Conversely, other researchers claimed that the predictive power of EI regarding academic achievement diminishes once students successfully navigate the potential adjustment challenges of the transition period (Saklofske et al., 2012; Parker et al., 2004). Thus, the transition from high school to university could serve as a context for investigating the relationship between EI and academic achievement (Parker et al., 2004).

Furthermore, as an affective trait, EI influences academic achievement indirectly through other mediator variables (Chang and Tsai, 2022; Mavroveli and Sánchez-Ruiz, 2011). However, most previous research conducted in Ethiopia has primarily focused on the direct correlation between EI and academic accomplishment, with little attention given to the processes that facilitate this relationship. Therefore, it is important to design a study that further analyzes how EI affects academic achievement among university students.

1.4 Academic engagement as a mediator variable

Academic engagement, an important factor for academic success (Appleton et al., 2008), is defined as a positive state of mind and the active involvement of students in academic activities. It includes three dimensions: (a) vigor, characterized by resilience, high energy levels, persistence, and proactive behavior toward learning; (b) dedication, which involves feelings of pride, inspiration, and enthusiasm, along with viewing academic tasks as meaningful; and (c) absorption, indicating deep concentration and immersion in academic tasks to the point that time appears to pass quickly (Schaufeli et al., 2002). Both personal and contextual factors influence academic engagement (Fredricks et al., 2004).

EI is a significant personal factor that plays a crucial role in maintaining positive attitudes and fostering academic engagement, thereby enhancing academic performance (Akhtar et al., 2015). Higher levels of EI among learners, for example, can lead to increased effort, attention, and persistence, as well as the effective completion of academic tasks (Thomas and Allen, 2021). Emotionally intelligent students excel at managing their emotions and nurturing strong interpersonal relationships, which contributes to the development of emotional resources. These resources can promote greater commitment and enthusiasm toward academic pursuits (Akhtar et al., 2015). High EI promotes meaningful peer interactions, enhances emotional resilience, and motivates students to invest effort and energy in academic tasks. Consequently, EI serves as a valuable asset for students, playing a significant role in fostering academic engagement (Maguire et al., 2017). It can improve academic performance by encouraging engagement, which, in turn, influences success through various causal pathways (Thomas and Allen, 2021). Work engagement, often described as an affective and motivation-related variable, functions as an important mediator between personal resources and performance outcomes (Schaufeli et al., 2002).

However, few previous studies have examined the mediating role of academic engagement in the relationship between EI and academic achievement. These studies demonstrated that there is no direct relationship between EI and academic achievement (Perera and

DiGiacomo, 2015). EI has been shown to significantly impact academic success by increasing student engagement in academic tasks (Dehyadegary et al., 2012). In other words, EI affects students' academic performance by influencing their involvement in academic activities (Maguire et al., 2017). Therefore, advancing this issue by testing academic engagement as a mediator in the relationship between EI and academic achievement warrants future investigation.

1.5 Conceptual framework

The role of EI in academic achievement is based on the broaden-and-build theory of emotion, which posits that positive emotions expand thought-action repertoires and develop enduring personal resources essential for optimal functioning (Fredrickson, 2001). Additionally, the strength-based approach of positive psychology highlights the significance of social and emotional competencies in students' academic achievement (Thomas and Allen, 2021). Positive emotions can enhance students' thought-action repertoires and promote lasting personal resources, including physical, intellectual, social, and psychological assets (Fredrickson, 2001). For instance, students with high EI often experience emotions such as enthusiasm for learning tasks and enjoyment of the learning process, which broadens their range of strategies for task engagement and academic performance (Zirak and Ahmadian, 2015; Perera, 2016). The positive correlation between EI and academic success may stem from students' relationship-building skills, strong self-awareness, adaptability, and resilience, which enable them to navigate the challenges encountered in their academic journeys (Thomas and Allen, 2021). The three-component model of commitment, which includes affective, continuance, and normative components and was originally developed for employee commitment in industrial or service organizations (Meyer and Allen, 1991), can also significantly apply to students' engagement in higher education. Similar to employees, students may remain dedicated to their studies for various reasons. For example, Davis (2014) indicated that students with affective commitment adhere to their subjects due to their positive emotional attachment to the university, while those with continuance commitment continue their studies based on the costs associated with leaving.

1.6 Research gaps

Although numerous studies have examined the direct relationship between EI and academic achievement (Qaiser et al., 2019; Chew et al., 2013; Fallahzadeh, 2011), there is no consensus regarding the causal link between EI and academic success (Estrada et al., 2021). Some researchers argue that EI, as an affective characteristic, may not directly impact academic performance (Maguire et al., 2017). Instead, EI may contribute to academic success by facilitating various factors that positively affect academic achievement through different causal pathways (Thomas and Allen, 2021). The vital role of EI in students' academic achievement becomes evident when mediated by motivational and cognitive processes (Nieto-Carracedo et al., 2024). Students with high EI tend to experience positive emotions that may expand the repertoire of strategies for engaging in academic activities (Perera, 2016). EI may affect academic performance because its dispositional tendencies, such as positive emotionality, self-control, and self-motivation, can serve as adaptive

mechanisms that promote sustained and directed efforts to achieve academic goals (Perera and DiGiacomo, 2015). Students with higher levels of EI tend to be more academically engaged, which ultimately leads to enhanced academic achievement (Maguire et al., 2017).

Examining the mediating role of academic engagement in the connection between EI and academic achievement could help educators, curriculum designers, and teachers develop effective, evidence-based interventions and instructional strategies to enhance students' academic achievement (Maguire et al., 2017; Nieto-Carracedo et al., 2024). However, this type of mediation analysis has primarily focused on Western countries, and the topic has not been thoroughly explored in non-Western cultures (Maguire et al., 2017; Estrada et al., 2021). Therefore, further research into the mediation of academic engagement in the relationship between EI and academic achievement is essential.

Furthermore, studies investigating the relationship between EI and academic achievement, as well as the mediating role of academic engagement in this relationship, are notably scarce in Ethiopia. Therefore, this study aims to address this gap by exploring the relationship between these two variables, with academic engagement serving as a mediator among undergraduate university students (see Figure 1).

1.7 Study objectives and hypotheses

The study aimed to investigate the effect of EI and academic engagement on students' academic achievement. More specifically, it was designed to test whether the influence of EI on students' academic achievement is mediated by academic engagement. Based on previous evidence, the following hypotheses were formulated.

Hypothesis 1. Trait EI has a significant direct effect on the academic achievement of university students.

Hypothesis 2. Trait EI has a positive and significant effect on students' academic engagement.

Hypothesis 3. Academic engagement has a significant positive effect on students' academic achievement.

Hypothesis 4. Academic engagement mediates the relationship between trait EI and students' academic achievement.

2 Methods

2.1 Research design

A correlational research design and a quantitative research approach were employed to explore the relationships among the study variables.

2.2 Study population

The target population of the study consisted of first-year undergraduate students enrolled at Wollo University during the

FIGURE 1
Conceptual model illustrating the relationships between EI and academic achievement, as mediated by academic engagement.
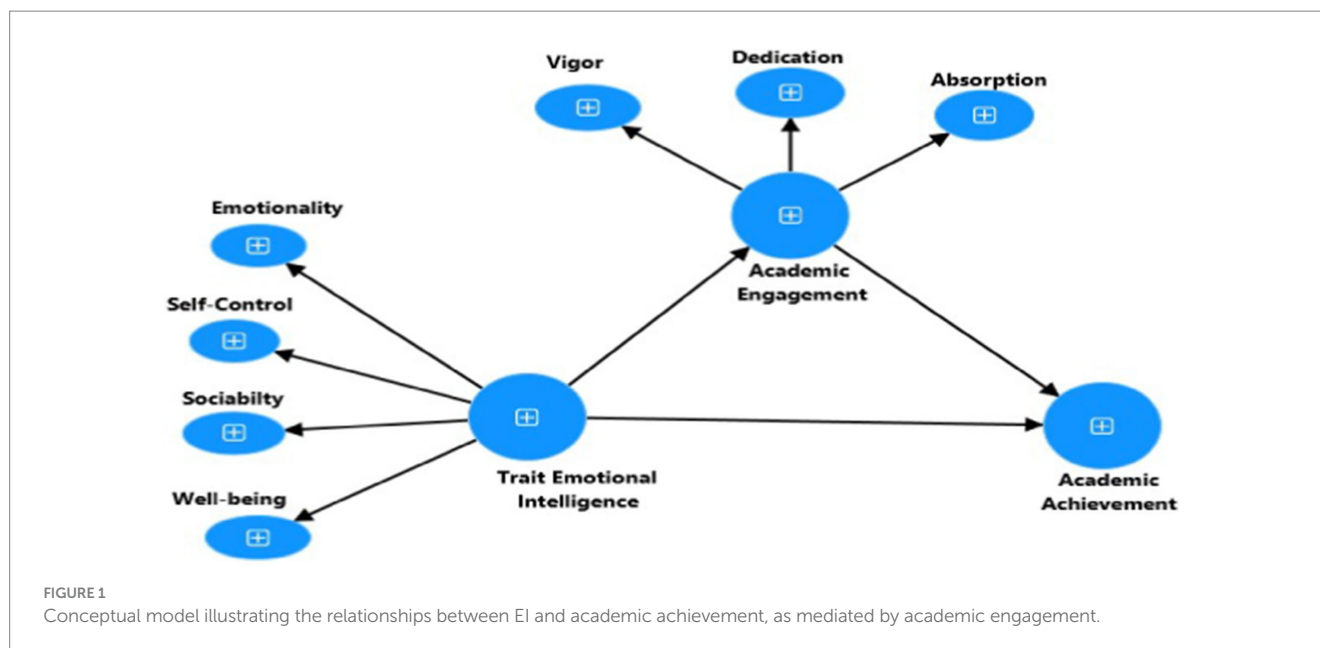
2023/2024 academic year. There were a total of 3,566 students (2,315 men and 1,251 women), with 2,000 students in natural science programs and the remaining 1,566 pursuing social science programs.

2.3 Sample size determination

The sample size was determined using the guidelines proposed to establish the minimum sample size necessary for conducting structural equation modeling (SEM). It is generally accepted that SEM requires a larger sample size compared to other statistical techniques (Collier, 2020; Kline, 2016). In terms of sample size, the ratio of cases to variables is the most commonly used method for determining the required sample size (Hair et al., 2019). Researchers suggest larger sample sizes (200 or more) as the number of variables and expected factors increases (Collier, 2020; Hair et al., 2019). Consequently, numerous recommendations have been made to ascertain the necessary sample size for SEM (Kline, 2016). For example, it has been suggested that a minimum of 20 cases per variable is needed to estimate the sample size required to achieve sufficient statistical power (Jackson, 2003). Another rule of thumb suggests at least 15 cases per indicator variable as a lower limit for an adequate sample size (Stevens, 2009).

Therefore, the suggested rule of thumb was employed to determine the sample size for this study. This research includes approximately 85 indicators. Since our study comprises 85 observed variables or indicators, the minimum sample size requirement is 1,275 participants ($15 \times 85 = 1,275$). Considering the 10% response rate, a sample of 1,403 students was drawn from the target population.

2.4 Sampling technique

Using the above-mentioned rule of thumb and considering a 10% non-response rate, 1,403 students were selected through a random sampling technique, recruiting participants from natural and social

science fields in proportion to their overall student enrollment. However, due to non-returns and missing data, 52 questionnaires were excluded from the sample, leading to a response rate of 96.3%. Thus, 1,351 participants were included, of whom 759 (56%) were from natural sciences and 592 (44%) from social sciences. In terms of gender, 880 (65%) of the participants were men, and 471 (35%) of them were women.

2.5 Measures

2.5.1 Socio-demographic information
Students were required to disclose their gender and field of study.

2.5.2 Trait EI Questionnaires-Short Form
The Trait Emotional Intelligence Questionnaires-Short Form (TEIQue-SF), developed by Petrides (2009), was used to assess students' EI. This tool consists of 30 items, of which 26 measure a four-factor structure: six items for well-being (e.g., I generally do not find life enjoyable), six items for self-control (e.g., I usually find it difficult to regulate my emotions), six items for sociability (e.g., I can deal effectively with people), and eight items for emotionality (e.g., most often, I cannot explain what emotion I'm feeling). The remaining four items contribute directly to the global trait EI score without being assigned to any specific factor. The TEIQue-SF uses a seven-point Likert scale, ranging from 1 (completely disagree) to 7 (completely agree). The reported alpha values (α) for its subscales range from 0.51 to 0.76, with $\alpha = 0.85$ for Total EI (Zirak and Ahmadian, 2015).

2.5.3 The Utrecht Work Engagement Scale-Student Version
The Utrecht Work Engagement Scale-Student Version (UWES-S), developed by Schaufeli et al. (2002), is rated on a seven-point Likert scale ranging from 0 (never) to 6 (always) and is used to assess student engagement in academic work. The UWES-S consists of 14 items, including five items for vigor (e.g., I feel strong and vigorous when

studying or attending class), five items for dedication (e.g., I am enthusiastic about my studies), and four items for absorption (e.g., when engaged in my academic tasks, I forget everything else around me). Originally, the instrument had reliability scores of $\alpha = 0.78$ for vigor, $\alpha = 0.91$ for dedication, and $\alpha = 0.73$ for absorption.

2.5.4 Students' academic achievement

The GPA from the first semester of the first year was used to collect data regarding students' academic achievement.

2.6 Methods of data analysis

The first stage of the analysis involved obtaining descriptive statistics, including means, standard deviations, skewness, kurtosis values, and correlations between the study variables using IBM SPSS 29.0.

Smart PLS (version 4) was employed to conduct structural equation modeling (SEM) with Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the relationships among trait EI, academic engagement, and academic achievement of undergraduate students. The analysis followed a two-step process for assessing the measurement and structural models, as suggested by Subhaktiyasa (2024). Initially, the measurement model, which examines the relationships between latent variables and their indicators, was assessed to ensure the reliability and validity of the study variables. This analysis of the measurement model included evaluating factor loadings, internal consistency, and both convergent and discriminant validity. Subsequently, the structural model assessment was conducted to test the hypothesized relationships between the study variables. The overall findings of the study were derived from the subsequent sequential phases of analysis.

2.6.1 Assessment of normality assumption

Skewness and kurtosis indices were used to assess the normality of the distribution. A perfectly normal data distribution is achieved when both the skewness and kurtosis values are zero (Field, 2009). However, since achieving an exact zero value for skewness and kurtosis is rare, acceptable thresholds must be established to assess normality (Demir, 2022). For the given data, kurtosis values exceeding ± 7 and skewness values exceeding ± 2 indicate a deviation from a normal distribution (Byrne, 2016).

2.6.2 Analysis of factor loading

The strength of the relationship between indicators and the latent variables they represent was evaluated using factor loadings. Factor loading is used to assess how effectively each indicator measures its corresponding latent variable. Generally, a factor loading of 0.708 or higher confirms a strong relationship between indicators and their associated constructs, providing evidence of construct validity (Subhaktiyasa, 2024; Hair et al., 2019).

2.6.3 Reliability evidence

Both Cronbach's alpha and composite reliability were employed to assess the reliability of the instruments used in the study. Generally, a value of 0.70 or higher indicates an acceptable standard for both Cronbach's alpha and composite reliability (Collier, 2020). While values below 0.70 are considered poor, values exceeding 0.95 may

indicate redundancy among items, implying that the items are nearly identical (Hair et al., 2019).

2.6.4 Evidence of convergent and discriminant validity

Average variance extracted (AVE) is a widely used method for assessing the convergent validity of a construct (Subhaktiyasa, 2024). When the AVE values of a construct are 0.50 or higher, the items effectively converge to measure the underlying construct, thereby confirming convergent validity (Riou et al., 2008). Both the heterotrait-monotrait ratio (HTMT) and the Fornell–Larcker criterion were used to assess the discriminant validity of the construct. HTMT values below 0.85 indicate that discriminant validity is established, confirming that the constructs are distinctly different (Collier, 2020). According to the Fornell–Larcker criterion, discriminant validity is achieved when the square root of a construct's AVE exceeds its correlations with all other constructs (Riou et al., 2008).

2.6.5 Structural equation modeling

A structural equation model was employed to test the hypothesized relationship among the study variables. The causal relationships between exogenous and endogenous variables were evaluated following the steps recommended by Hair et al. (2019). (a) Examining multicollinearity: Multicollinearity occurs when there is a high degree of linear correlation among the study variables. Tolerance and variance inflation factor (VIF) values were analyzed to detect potential multicollinearity issues among the predictor variables. When the VIF exceeds 10, or the tolerance value falls below 0.10, a multicollinearity issue may exist (Pallant, 2010; Byrne, 2016). As a general rule, VIF values should be 5 or lower (Hair et al., 2011), and tolerance values should be 0.10 or higher (Kline, 2016) to ensure the absence of multicollinearity problems. (b) Assessing model fit: Criteria such as the normed fit index (NFI), standardized root mean square residual (SRMR), geodesic distance (d-G) squared, and Euclidean distances (d-ULS) were used to assess the overall model fit. An SRMR value below 0.08 and NFI values above 0.90 indicate a well-fitting model (Hair et al., 2011). Moreover, to achieve an acceptable model fit, the d-ULS and d-G values should fall within the upper bound of the 99% confidence intervals (Huang, 2021). (c) Assessing R^2: To estimate the model's predictive power, it is essential to examine the coefficient of determination (R^2) for the endogenous variable. Generally, a higher R^2 value indicates greater explanatory power and improved predictions of endogenous constructs (Hair et al., 2019). Specifically, R^2 values of 0.75, 0.50, and 0.25 can be interpreted as the substantial, moderate, and weak predictive power of the model, respectively (Hair et al., 2011). Conversely, an R^2 value of 0.90 or higher may suggest overfitting (Hair et al., 2019). (d) Evaluating the significance of structural path relationships: Path analysis was conducted to evaluate the significance of the hypothesized direct and indirect effects of exogenous variables (EI and academic engagement) on endogenous variables (academic achievement), as well as the mediating effects of academic engagement between EI and academic achievement using the bootstrap method. The standardized coefficients and the bias-corrected 95% confidence

2.7 Procedures of the studies

2.7.1 Translation, adaptation, and validation of measures

Cross-cultural studies indicate that psychometrically sound and meaningful psychological instruments in one context may not be applicable in another (Feher et al., 2019). This is because individuals' interpretations and responses to these instruments are influenced by cultural, linguistic, belief, value, and normative differences (Feher et al., 2019). Consequently, when instruments are applied to study populations that differ from the language and culture in which they were originally developed and validated, it is essential to adapt and validate them using rigorous procedures in the research process (Banville et al., 2000). Therefore, the instrument used in this study was adapted and translated following the procedures suggested by Banville et al. (2000).

Initially, both the Trait EI Questionnaire-Short Form (TEIQue-SF) and the Utrecht Work Engagement Scale-Student Version (UWES-S) were translated from the source language (English) to the target language (Amharic) by translators from the English and Psychology departments. They were chosen for their expertise in both languages and their extensive experience in instrument development and research. Next, two additional translators synthesized the forward-translated materials. The main purpose of this stage was to ensure that the content and meanings of the TEIQue-SF and UWES-S were accurately represented in the original scales. In the third stage, the synthesized Amharic version of the Trait EI Questionnaire-Short Form (TEIQue-SF) and the Utrecht Work Engagement Scale-Student Version (UWES-S) was translated back into English, and the congruence between the original English and the back-translated versions of these instruments was assessed. In the fourth stage, to identify any inconsistencies in the translation process, the original English versions, the Amharic versions, and the back-translated English versions were reviewed. Finally, the adaptation process concluded with the administration and validation of the study instruments to ensure their suitability and reliability in the Ethiopian context.

3 Results

3.1 Results of preliminary analysis

3.1.1 Descriptive statistics, skewness, kurtosis, and correlation analysis of the study variables

Table 1 presents descriptive statistics, including minimum and maximum values, means, and standard deviations for the study variables. The global mean score of 3.77, with a standard deviation of 0.86 for trait EI, and 4.07, with a standard deviation of 1.12 for academic engagement, indicates an average level of students' EI and engagement in academic activities. To assess normal distribution, the values of skewness and kurtosis are also provided. A data set is considered normally distributed if the skewness is $\leq +2$ and kurtosis is $\leq +7$ (Byrne, 2016). As shown in Table 1, the skewness and kurtosis values for each construct fall within the acceptable range. Therefore, the assumption of normality is satisfied.

As shown in Table 2, trait EI was positively related to academic engagement ($r = 0.350$) and academic achievement ($r = 0.407$). As expected, trait EI significantly correlated with the dimensions of academic engagement (Abs: $r = 0.300$; Ded: $r = 0.322$; Vig: $r = 0.293$). Similarly, the four subscales of trait EI were positively correlated with academic engagement (EM: $r = 0.259$; SC: $r = 0.240$; SO: $r = 0.286$; WB: $r = 0.285$).

3.2 Measurement model testing

3.2.1 Factor loadings

As a rule of thumb, a factor loading above 0.708 indicates acceptable item reliability (Hair et al., 2019). The analysis revealed that, with the exception of items SO25 and EM23, all other items in the TEIQue-SF and all 14 items in the UWES-S demonstrated significant loadings, exceeding the recommended threshold of 0.708. Specifically, the standardized factor loadings were 0.751 and above for the TEIQue-SF items (see Table 3) and 0.811 and above for the UWES-S items (see Table 4), indicating that each indicator accounted for a satisfactory proportion of variance in the underlying latent construct. Items SO25 and EM23, which had factor loadings below 0.708, were excluded from further analysis.

TABLE 1 Descriptive statistics, kurtosis, and skewness.

Variables	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis
Trait EI	1.47	6.37	3.77	0.86	−0.091	0.134
Well-being	1.00	7.00	3.84	1.21	−0.371	−0.435
Self-control	1.00	6.67	3.65	1.27	−0.176	−0.949
Emotionality	1.00	6.63	3.76	1.14	−0.409	−0.611
Sociability	1.00	6.83	3.77	1.20	−0.446	−0.428
Academic engagement	1.00	6.50	4.07	1.12	−0.023	−0.480
Vigor	1.00	7.00	4.03	1.21	−0.132	−0.228
Absorption	1.00	7.00	4.09	1.38	−0.025	−0.669
Dedication	1.00	7.00	4.01	1.30	0.019	−0.449

EI, emotional intelligence; Max, maximum; Min, minimum; Std. Dev., standard deviation.

TABLE 2 Pearson correlations among study variables.

Variables		1	2	3	4	5	6	7	8	9	10
1	EM										
2	SC	0.385**									
3	SO	0.415**	0.555**								
4	WB	0.345**	0.565**	0.506**							
5	Abs	0.220**	0.218**	0.240**	0.245**						
6	Ded	0.225**	0.220**	0.276**	0.266**	0.694**					
7	Vig	0.232**	0.188**	0.228**	0.232**	0.546**	0.653**				
8	TEI	0.749**	0.786**	0.772**	0.743**	0.300**	0.322**	0.293**			
9	AE	0.259**	0.240**	0.286**	0.285**	0.849**	0.909**	0.847**	0.350**		
10	AA	0.284**	0.296**	0.306**	0.357**	0.560**	0.567**	0.511**	0.407**	0.628**	

**Correlation is significant at the 0.01 level (two-tailed), EM, emotionality; SC, self-control; SO, sociability; WB, wellbeing; Abs, absorption; Ded, dedication; Vig, vigor; TEI, trait emotional intelligence; AE, academic engagement; AA, academic achievement.

TABLE 3 Factor loading, Cronbach's alpha, composite reliability, and average variance of TEIQue-SF.

Construct	Dimensions of construct	Items	FL	α	CR	AVE
			(>0.708*)	(>0.70*)		(>0.50*)
Trait EI	EM	EM1	0.841			
		EM13	0.871			
		EM16	0.818			
		EM17	0.825	0.926	0.927	0.643
		EM2	0.736			
		EM28	0.804			
		EM8	0.839			
	SC	SC5	0.883			
		SC19	0.861			
		SC22	0.846			
		SC30	0.859	0.887	0.888	0.568
		SC7	0.857			
		SC4	0.751			
	SO	SO10	0.882			
		SO11	0.876			
		SO21	0.909	0.902	0.903	0.700
		SO26	0.842			
		SO6	0.797			
	WB	WB12	0.853			
		WB20	0.837			
		WB24	0.790			
		WB27	0.810	0.904	0.904	0.612
		WB5	0.833			
		WB9	0.860			

Trait EI, trait emotional intelligence; EM, emotionality; SC, self-control; SO, sociability; WB, well-being; FL, factor loading; α, Cronbach's alpha; AVE, average variance extracted; CR, composite reliability.

3.2.2 Reliability and validity evidence of the constructs

The factors of both variables achieved an acceptable level of reliability of 0.70 (Hair et al., 2011) for both Cronbach's alpha (α) and composite reliability (CR). For example, the reliability indices for the trait EI dimension were well-being ($\alpha = 0.904$, CR = 0.904), self-control ($\alpha = 0.887$, CR = 0.888), sociability ($\alpha = 0.902$, CR = 0.903), and emotionality ($\alpha = 0.926$, CR = 0.927) (see Table 3). For the

TABLE 4 Factor loading, Cronbach's alpha, composite reliability, and average variance of UWES-S.

Construct	Dimensions of construct	Items	FL	α	CR	AVE
			(>0.708*)	(>0.70*)		(>0.70*)
AE	Ded	Ded12	0.844			
		Ded2	0.811			
		Ded5	0.890	0.878	0.879	0.592
		Ded7	0.895			
		Ded9	0.893			
	Abs	Abs10	0.903			
		Abs14	0.922	0.891	0.891	0.671
		Abs3	0.906			
		Abs6	0.885			
	Vig	Vig1	0.888			
		Vig11	0.898			
		Vig13	0.865	0.933	0.934	0.737
		Vig4	0.901			
		Vig8	0.908			

AE, academic engagement; Ded, dedication; Abs, absorption; Vig, vigor; FL, factor loading; α, Cronbach's alpha; AVE, average variance extracted; CR, composite reliability.

sub-dimensions of students' academic engagement, the indices were vigor (α = 0.878, CR = 0.879), dedication (α = 0.878, CR = 0.879), and absorption (α = 0.891, CR = 0. 891) (see Table 4). Therefore, the reliability of the construct is confirmed.

The average variance extracted (AVE) values for the sub-components of the study variables exceeded the recommended threshold of 0.50 for the TEIQue-SF factors and the three dimensions of the UWES-S. Specifically, the AVE values ranged from 0.568 (self-control) to 0.700 (sociability) for the TEIQue-SF factors (see Table 3) and from 0.592 (dedication) to 0.737 (vigor) for the UWES-S dimensions (see Table 4). These results confirm the establishment of convergent validity.

Furthermore, the analysis of discriminant validity, based on the heterotrait-monotrait ratio (HTMT), indicated that all HTMT values for the sub-constructs of the TEIQue-SF and UWES-S were below the threshold of 0.85 (see Table 5). This supports that discriminant validity is adequately established.

Moreover, the square roots of AVE (highlighted in bold and italics) for each construct (see Table 6) were greater than the corresponding correlation coefficients in the matrix, thereby further confirming the establishment of discriminant validity.

3.3 Structural model testing

Once the appropriate level of validity and reliability coefficient of measurements is determined, the next stage is to evaluate the hypothesized links between the latent variables in the structural model. Since multicollinearity can have a considerable impact on the accuracy of model estimation, the first step in structural model estimation is to address the multicollinearity issue among predictor variables (Hair et al., 2019).

3.3.1 Multicollinearity

Tolerance and variance inflation factor (VIF) values were used to assess potential multicollinearity among predictor variables. A multicollinearity issue may arise when the tolerance value falls below 0.10 and the VIF value is 5 or higher (Hair et al., 2011; Kline, 2016). Since the tolerance values (0.876) and VIF (1.141) (see Table 7) were within the acceptable threshold, multicollinearity was not a concern in this study.

3.3.2 Model fit

Criteria such as the normed fit index (NFI), the standardized root mean square residual (SRMR), squared Euclidean distance (d-ULS), and geodesic distance (d-G) were used to evaluate the overall model fit. As shown in Table 8, the NFI values for the saturated and estimated models (0.876 and 0.835, respectively) and the SRMR values for the saturated and estimated models (0.034 and 0.052, respectively) met the criteria for good model fit (Hair et al., 2011). Moreover, the d-ULS and d-G values for both the saturated and estimated models fell within the upper bounds of the 99% confidence interval, further supporting a good model fit.

3.3.3 Coefficient of determination (R^2 values)

To estimate the predictive power of the model, it is essential to examine the coefficient of determination (R^2) for the endogenous variable. In general, a higher R^2 value indicates greater explanatory power and improved predictions of endogenous constructs (Hair et al., 2019). For example, when R^2 values reach 0.75, the model exhibits high explanatory power, while a model with an R^2 value close to 0.50 demonstrates moderate explanatory power (Huang, 2021). More specifically, an R^2 value of 0.75 indicates substantial predictive power, whereas values of 0.50 and 0.25 suggest moderate and weak predictive power, respectively (Hair et al., 2011). As shown in Table 9, the coefficient of determination (R^2) for academic achievement is 0.499, meaning that the two latent variables—trait EI and academic engagement—accounted for 49.9% of the variance in academic achievement. In addition, trait EI explains 17.3% of the variance in academic engagement. In both cases, the model demonstrates moderate predictive power (Hair et al., 2019).

TABLE 5 Discriminant validity based on HTMT.

Constructs		AA	EM	SC	SO	WB	Ab	Ded	Vig
1.	AA								
2.	EM	0.298							
3.	SC	0.539	0.375						
4.	SO	0.537	0.403	0.529					
5.	WB	0.412	0.347	0.544	0.521				
6.	Ab	0.608	0.245	0.365	0.280	0.306			
7.	Ded	0.632	0.248	0.358	0.309	0.337	0.729		
8.	Vig	0.531	0.248	0.298	0.264	0.269	0.591	0.713	

EM, emotionality; SC, self-control; SO, sociability; WB, well-being; Abs, absorption; Ded, dedication; Vig, vigor; AA, academic achievement.

TABLE 6 Discriminant validity Fornell−Larcker criteria.

Constructs		AA	EM	SC	SO	WB	Ab	Ded	Vig
1.	AA	1.000							
2.	EM	0.283	**0.820**						
3.	SC	0.294	0.385	**0.844**					
4.	SO	0.298	0.390	0.552	**0.862**				
5.	WB	0.364	0.338	0.566	0.493	**0.831**			
6.	Ab	0.555	0.217	0.215	0.231	0.236	**0.904**		
7.	Ded	0.571	0.218	0.215	0.262	0.241	0.680	**0.867**	
8.	Vig	0.511	0.229	0.189	0.224	0.259	0.537	0.667	**0.891**

AA, academic achievement; EM, emotionality; SC, self-control; SO, sociability; WB, well-being; Ded, dedication; Abs, absorption; Vig, vigor. Bold values represent the square roots of AVE (average variance extracted).

TABLE 7 Tolerance and VIF values of the traits TEIQue-SF and UWES-S on academic achievement.

Model	Unstandardized coefficients	Standardized coefficients			Collinearity statistics	
	Beta	Beta	t	Sig.	Tolerance	VIF
Trait TEIQue-SF	0.138	0.204	9.518	0.000	0.876	1.141
UWES-S	0.285	0.575	26.751	0.000	0.876	1.141

TEIQue-SF, Trait Emotional Intelligence Questionnaire-Short Form; UWES-S, The Utrecht Work Engagement Scale Student Version; VIF, variable inflation factors.

TABLE 8 Overall model fit.

Models	Evaluation criteria				Confidence interval	
	NFI	SRMR	d-ULS	d-G	95%	99%
Saturated model	0.876	0.034	0.049	0.058	0.053	0.071
Estimated model	0.835	0.052	0.088	0.064	0.050	0.075

NFI, normed fit index; SRMR, standardized root mean square residual; d-ULS, squared Euclidean distance; d-G, geodesic distance.

TABLE 9 R^2 values.

Path analysis	R^2
Trait EI → Academic engagement	0.173
Academic Engagement → Academic achievement	
Trait EI → Academic achievement	0.499

3.3.4 Testing hypotheses

To assess the significance of the hypothesized direct and indirect effects of exogenous variables (EI and academic engagement) on endogenous variables (academic achievement), as well as the mediating role of academic engagement between EI and academic achievement, path analysis using the bootstrap method was employed. The standardized coefficients and their corresponding 95% confidence intervals obtained through bootstrapping for the structural model are presented in Table 10 and Figure 2.

H1 predicted that trait EI has a significant positive effect on students' academic achievement. The results demonstrated that trait EI had a significant positive effect on academic achievement [$\beta = 0.298$, 95% CI (0.255, 0.340), $p = 0.000$], thereby supporting H1. Furthermore, H2 proposed that trait EI also had a significant positive effect on academic engagement. The findings indicated that trait EI significantly influenced students' academic engagement [$\beta = 0.416$, 95% CI (0.370, 0.460), $p = 0.000$], providing evidence in support of hypothesis H2. Similarly, H3 examined whether academic engagement significantly affects academic achievement. The results revealed that

TABLE 10 Estimated effects of predictors on academic achievement, including both direct and indirect effects with a 95% bias-corrected confidence interval.

	Beta	t-statistics	Bootstrap 95% CI		
			LBC	UBC	p-value
Standardized direct effect					
Trait emotional intelligence → Academic achievement	0.298	14.059	0.255	0.340	0.000
Trait emotional intelligence → Academic engagement	0.416	18.180	0.370	0.460	0.000
Academic engagement → Academic achievement	0.528	27.889	0.490	0.564	0.000
Standardized indirect effect					
Trait emotional intelligence → Academic engagement → Academic achievement	0.220	15.405	0.191	0.248	0.000

CI, confidence interval; LBC, lower bound; UBC, upper bound.

academic engagement had a significant positive effect on academic achievement [$\beta = 0.528$, 95% CI (0.490, 0.564), $p = 0.000$], thereby supporting H3 as well.

H4 projected that academic engagement mediates the relationship between trait EI and academic achievement. Therefore, a mediation analysis was conducted to evaluate the mediating role of academic engagement in the relationship between EI and academic achievement. The results (see Table 10) revealed a significant mediating effect of academic engagement [$\beta = 0.220$, 95% CI (0.0.191, 0.248), $p = 0.000$]. Therefore, both the direct and indirect effects are significant, and academic engagement partially mediates the relationship between trait EI and the academic achievement of university students, thereby supporting H4.

4 Discussion

The primary goal of this study was to investigate the relationship between EI, student academic engagement, and academic achievement.

We found that EI is positively correlated with academic achievement among undergraduate university students. This finding is consistent with prior research confirming that EI has a substantial positive connection with academic performance (Qaiser et al., 2019). Furthermore, this research emphasizes the importance of enhancing students' EI to improve their academic performance. Similarly, other researchers affirmed that EI is an excellent predictor of strong academic achievement (Chew et al., 2013). The positive correlation between EI and academic achievement indicates that academic success does not solely rely on cognitive aspects of intelligence; rather, it is influenced by emotional abilities. Specifically, students' ability to perceive, express, regulate, and appropriately utilize their emotions positively impacts their academic achievement (Karimi et al., 2020). The study is further supported by findings from Fallahzadeh (2011), which identified a significant link between EI and academic performance.

However, the findings of the current study differ from those of Zirak and Ahmadian (2015) and Abu Alkhayr et al. (2022), who concluded that there is no significant relationship between EI and academic achievement, as well as from the conclusions of Bilimale et al. (2024) and Shah et al. (2014), who reported a negative relationship between EI and academic performance.

The direct link between EI and academic engagement aligns with findings from previous studies. For instance, the concept of EI plays a significant role in predicting both the cognitive and affective aspects of academic engagement among college students (Maguire et al., 2017). Higher levels of EI, along with greater emotional resources, serve as valuable assets for fostering vigor, dedication, and absorption during academic tasks (Silva and Almeida, 2023). Furthermore, individuals with elevated trait EI are more likely to develop positive emotions, such as interest in learning tasks and enjoyment of the learning process, which broaden the range of strategies for task engagement and academic performance (Zirak and Ahmadian, 2015; Perera, 2016).

This study identified academic engagement as positively associated with academic achievement. This result aligns with Martínez et al. (2019), who reported significant direct correlations between academic engagement and performance. Furthermore, the present study's results are consistent with those of Nieto-Carracedo et al. (2024) and Lei et al. (2018), who found a positive correlation between overall student academic engagement (along with its dimensions: vigor, dedication, and absorption) and academic achievement.

Despite its limitations, there is empirical evidence supporting the mediating role of academic engagement between EI and academic achievement. For instance, a study by Dehyadegary et al. (2012) identified academic engagement as a mediating variable that partially conveys the influence of EI on academic achievement. Given that EI has an affective characteristic, it cannot be directly linked to academic performance; however, this link may be explained through enhanced academic engagement (Maguire et al., 2017). Interventions aimed at enhancing EI may positively impact various aspects of student engagement and, consequently, academic performance in higher education (Maguire et al., 2017). The findings of this study also align with the theoretical framework of Fredrickson's (2001) broaden-and-build model of emotion, which emphasizes that positive emotions are fundamental to optimal functioning. Similarly, the strength-based approach highlights the importance of social and emotional competencies as critical skills for both short- and long-term academic success (Thomas and Allen, 2021). For instance, learners with high EI are more likely to experience positive emotions, such as interest in learning tasks and enjoyment of the learning process, employing a range of techniques to enhance their focus and increase engagement in academic activities, ultimately leading to improved academic achievement (Zirak and Ahmadian, 2015; Perera, 2016). Furthermore,
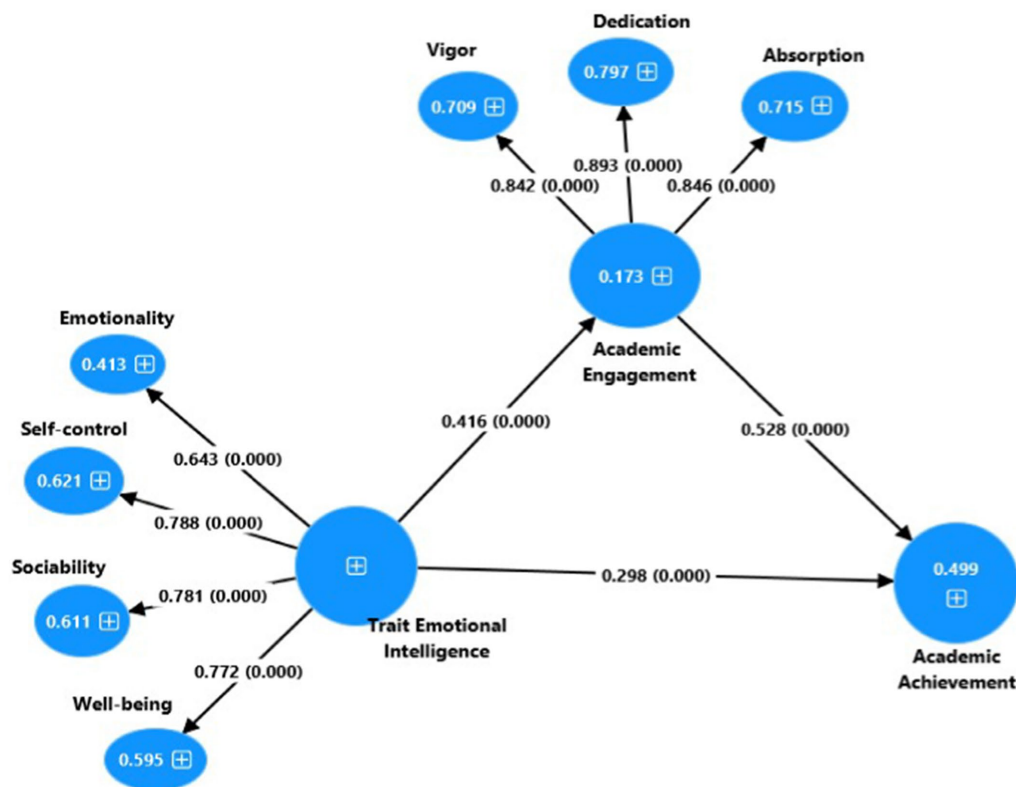
FIGURE 2
The mediating role of academic engagement between trait EI and academic achievement.

EI has been shown to directly affect academic engagement, as students with strong social and emotional competencies tend to invest more effort, persistence, and dedication in their academic studies (Thomas and Allen, 2021). Overall, these factors have a major impact on academic achievement, although more research is needed to fully understand the intricacies of these interactions.

5 Conclusions and implications

Consistent with the broaden-and-build model of emotion (Fredrickson, 2001), the results of this study revealed that trait EI had a significant positive effect on students' academic achievement. The results of the path analysis confirmed that EI had a significant positive effect on academic achievement ($\beta = 0.298$, $p = 0.000$). Therefore, H1, which states that trait EI has a significant direct effect on the academic achievement of university students, is confirmed. The results also indicate that trait EI has a significant positive effect on students' academic engagement ($\beta = 0.416$, $p = 0.000$). This result provides evidence supporting hypothesis H2, which states that trait EI has a positive and significant effect on students' academic engagement. These results suggest that EI enables students to self-regulate and practice interpersonal, intrapersonal, and stress management skills, all of which positively influence their engagement and academic performance.

Moreover, the result of the analysis confirmed that academic engagement significantly improved students' academic achievement ($\beta = 0.528$, $p = 0.000$). Therefore, H3, which asserts that academic engagement significantly improves students' academic achievement, is supported. This outcome indicates that students who engage more in their academic activities are more likely to achieve a high level of academic performance.

Finally, the result of the mediation analysis revealed a significant mediating role of academic engagement between trait EI and academic achievement ($\beta = 0.220$, $p = 0.000$). Thus, H4 posits that academic engagement mediates the effect of EI on students' academic achievement. EI influences students' academic performance by affecting their engagement in academic activities.

These findings suggest the importance of fostering EI intervention strategies to promote academic engagement and achievement among university students. This can be achieved by integrating EI into higher education curricula and designing short-term training programs, such as seminars, workshops, educational resources, and guidance and counseling services that enhance students' EI. Moreover, various programs on EI should be organized for educators to equip them with the necessary information to enhance their students' EI.

6 Limitations of the study and suggestions for future research

While this study has notable strengths, such as shedding light on the role of affective and psychological resources such as EI and students' academic engagement as important predictors of academic achievement, it also has several limitations. The first limitation is

that the sample was drawn from only one university, which may limit the generalizability of the results to students at other universities. Future research could address this issue by including students from various universities to enhance the representativeness of the sample. Additionally, the study focused exclusively on first-year students, a decision justified by the importance of high EI during the transition from high school to higher education, a time when students must navigate a new socio-emotional environment and face unfamiliar academic challenges. However, previous research (Saklofske et al., 2012) suggests that the influence of emotional intelligence (EI) may diminish once the initial adjustment period is effectively managed. Further studies are needed to explore whether the relationship between EI and academic outcomes remains consistent across various year levels of university students. Additionally, students from diverse academic disciplines face unique challenges in college, and those in the social sciences may benefit more from EI-related skills, as competencies in EI, such as understanding human emotions, may overlap with the skills required to master certain subjects such as history, geography, and languages (Maccann et al., 2020). Therefore, future studies could investigate whether the impact of EI on student engagement and achievement varies across academic fields. Finally, this study relied on self-reported measures of trait EI, which are subject to response biases. To address this issue, future studies should consider using ability-based measures of EI.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants or participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

DB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. AA: Conceptualization, Methodology, Supervision, Writing – review & editing. RN: Conceptualization, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

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