

## Emotional Intelligence, Academic Motivation, and Achievement among Health Science Students in Saudi Arabia: A Self-Deterministic Approach

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**Purpose:** This study used a self-deterministic approach to explore the relationship between emotional intelligence (EI), academic motivation (AM), and achievement among health science students. **Methods:** A descriptive cross-sectional study was conducted in three cities of Saudi Arabia (Dammam, Riyadh, and Jeddah). A convenience sample of 450 students was incorporated using the multistage cluster sampling technique. The online survey contained three sections: students' basic data and academic achievement level, the modified Schutte self-report inventory, and the Academic Motivation Scale lowercase. **Results:** This study revealed moderate overall scores for EI (57.1%), AM (55.6%), and grade point average (GPA) (57.6%). The overall EI score, its domains, and GPA had significant positive correlations with overall AM and intrinsic and extrinsic motivation ( $p < .01$ ). Amotivation had an insignificant correlation with GPA ( $p < .05$ ), but it was negatively correlated with EI and its domains ( $p < .01$ ). Multiple regression analysis proved that EI domains predicted 5.0% of GPA variance; emotions appraisal and expression ( $\beta = .02, p = .024$ ), regulation ( $\beta = .11, p = .032$ ), and utilization ( $\beta = .24, p < .01$ ). EI domains also predicted 26.0% of AM variance; emotions appraisal and expression ( $\beta = .11, p = .04$ ), regulation ( $\beta = .33, p < .01$ ), and utilization ( $\beta = .23, p < .01$ ). Moreover, AM predicted 4.0% of the variance in GPA; intrinsic ( $\beta = .25, p = .004$ ) and extrinsic ( $\beta = .11, p = .022$ ) motivation. AM also predicted 25.0% of the variance in EI: intrinsic ( $\beta = .34, p < .01$ ) and extrinsic motivation ( $\beta = .26, p = .026$ ). **Conclusion:** EI and AM have a bidirectional influence on each other, significantly shaping the GPA of health sciences students in Saudi Arabia, where intrinsic motivation has a predominant role. Thus, promoting students' AM and EI is recommended to foster their academic achievement.

**Key words:** Emotional Intelligence; Academic Success; Motivation

### INTRODUCTION

The role of emotions in the educational milieu has attracted substantial research interest in recent years [1–3]. The interweaving of individual feelings and thoughts emphasizes emotions' considerable role in effective thought processes and wise decisions [2,4]. This emotion–cognition interaction is widely studied from a psychological perspective through modern psychosocial theories or from a biological perspective to examine the neural basis of the bidirectional interaction

between cognition and emotions. This has resulted in significant scientific advances in affective neuroscience, specifically in the emotional intelligence (EI) field [5,6]. Evidence shows that intellectual ability alone is insufficient to guarantee an individual's success in diverse life spheres. They represent 20% of the determining factors of an individual's life success; this sets aside space for 80% of additional factors, the greatest of which is the EI. They are critically developed during childhood but are not fixed based on the surrounding sociocultural contexts and emotionally oriented caregivers in

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building emotionally intelligent children, which is considered the best news. Thus, emotional literacy and EI skills can be nurtured and reinforced throughout life, benefiting health, relationships, educational achievement, and career development [7,8].

EI skills are paramount during university life, which is full of challenges, social interactions, explorations of one's and others' feelings, friendships, and personality development. Thus, EI is one of the leading forces in managing this challenging educational context and guaranteeing better students' learning performance and success [7–9]. Moreover, Khan [9] (2019) proved the narrow contribution of cognitive intelligence to the academic life of Saudi University students, which does not expand the horizon of their lifelong learning in addition to proving that EI is vital and plays an outstanding role in strengthening their cognitive intelligence and shaping their future career achievements. Therefore, most employers evaluate graduate applicants from several perspectives, including cognitive intelligence, emotional stability, EI skills, and operational competencies [9].

Salovey and Mayer [4] introduced the EI concept in 1990. It is described as an individual's ability to monitor and appraise their own emotions and those of others (either verbal or nonverbal), discriminate between them, and effectively utilize emotion-related information to guide creative thinking and cognitive behaviors (e.g., problem-solving, communication, managing stress), flexible planning, redirecting attention, and facilitating motivation [4]. Thus, EI is a continuous process that boosts personal competencies as a vital element of life empowerment and development [10]. Recently, many studies have examined the role of emotional skills in academic performance, such as resilience, self-regulation, emotional and social skills, personality traits, attitudes, and motivation [11–13]. Evidence has shown that individuals with high EI skills are better able to build strong and long-lasting relationships, which has a general positive influence on their intellectual development. Moreover, the intrapersonal side of EI is linked to self-motivation and regulation, which boosts many behavioral traits, promotes emotional well-being, and reduces stress levels, which might enhance academic performance [14,15].

EI has a significant influence on the quality of learning and the practical application of the learned knowledge. Its usage is now being identified as an essential requirement in providing healthcare to patients. Health sciences colleges are well-known as demanding and stressful and require effective student coping to facilitate academic achievement. They also must manage several clinical situations, cope with various instructors' teaching styles and expectations, work independently, and manage conflicts. Aside from facing special aspects of academic work, such as practicing health care procedures and taking tests in the care settings, that may be highly stressful, requiring effective emotional management. They are also expected to realize and value the patients' emotions, assess their needs, and provide interventions that communicate caring attitudes toward patients and their families. Hence, they should be able to recognize, use, and manage emotions in themselves and others. Thus, EI is a powerful factor among health sciences students to deal with these stressful situations, facilitate effective decision-making skills, and enhance clinical and academic achievement. Evidence has consistently demonstrated that EI is associated with better coping and well-being and is a protective factor against stress [8,10].

Motivation is a dynamic, multidimensional process mainly based on the presence of a motive or purpose that drives an individual to initiate and complete a behavior. Individual biological, sociocultural, cognitive, and learning factors typically shape it. Thus, it varies within and between individuals, creating different behavioral responses. These deduce the existence of different types of motivations in self-determination theory (SDT). It is a motivation theory that predicts health behaviors and facilitates behavioral change [16,17]. It has a wide application in various contexts such as physical health, lifestyle, workplace, education, and counseling, proving a remarkable effect on self-motivation of the respective domains of success and achievement [18–20]. SDT assumes that motivation indicates an intention to act and is constructed on a continuum of motivation regulation from intrinsic or autonomous to extrinsic or controlled, to amotivation, or from the highest to lowest self-determined behavior. Intrinsically motivated individuals engage in a particular behavior for enjoy-

ment and interest, whereas extrinsically motivated individuals do so to gain positive outcomes or avoid negative ones. However, amotivation reflects the absence of an act or intention to act, possibly due to internal or external factors [16,17]. Recent evidence has shown a positive association between EI and learning motivation, strongly predicting students' academic performance [2,21]. Evidence also reveals that intrinsic and extrinsic motivations positively impact Saudi University students' academic performance [22].

Evidence indicates that students must obtain knowledge and cultivate emotional and social capabilities to facilitate academic performance and achievement. This study provides valuable knowledge about the relationship between EI, academic motivation (AM), and academic achievement. This can aid in establishing targeted educational interventions to improve students' EI skills for appraising, regulating, and efficiently using emotions for stress management, communication, problem-solving, and self-motivation. Consequently, they enhance their academic performance and achievement [2,21,22]. Furthermore, the results of this study can help policymakers and managers to provide resources and direct efforts to strengthen their EI skills and motivation. This can further enhance the image of the higher education potential in Saudi Arabia, especially in the health sciences, by investing in future generations. Hence, this study aimed to examine the relationship between EI, AM, and academic achievement among health science students using a self-deterministic approach by answering the following research questions: (1) What are the EI, AM, and grade point average (GPA) levels of the students? and (2) Are there associations between AM, EI, and GPA mean scores and participants' characteristics? (3) What is the nature of the relationship between EI, AM, and GPA? (4) Are there effects of EI domains on AM and GPA? (5) Do different types of AM affect GPA and EI?

## METHODS

### 1. Study design and setting

This descriptive cross-sectional study was conducted in three health science colleges in three randomly selected cit-

ies in Saudi Arabia (Riyadh, Jeddah, and Dammam).

### 2. Participants and sampling

A convenience sample of 450 health science students was incorporated using the multistage cluster sampling technique. Initially, a simple random technique was used for selecting three cities (Riyadh, Jeddah, and Dammam), one university campus in each city, and three health colleges from each university campus. Finally, a convenience sample of men (212) and women (238) undergraduate students who agreed to participate in the study were recruited through email invitations. The required sample size was estimated using the Steven K. Thompson formula [23]. It is based on the total number of man (2,189) and woman (2,174) health sciences students enrolled in the spring of the 2022 semester, with a confidence level of 95%, 0.05 error proportion, and 50.0% probability level. It generated a minimum sample size of 353.2, which increased to 450 after considering the cluster size and effect while considering a 30.0% attrition rate. Moreover, cluster homogeneity is excluded by measuring the interclass correlation coefficient to ensure that it is "zero" to control possible covariance associated with the multistage cluster sampling technique.

### 3. Measurements

The researchers developed an online survey after a thorough review of relevant literature:

#### 1) Students' basic data and academic achievement level

Age, gender, marital status, residence, working status and place, academic level, and perceived income level. Besides, the students reported their academic achievement level in the previous semester as a percentage GPA and categorized as high (86~100), moderate (71~85), and low ( $\leq 70$ ).

#### 2) Modified Schutte self-report inventory

It was developed based on Salovey and Mayer's [4] (1990) model and validated by Schutte et al. [24] (1998) with satisfactory internal consistency reliability (Cronbach's  $\alpha = 0.87$ ). Scale items were then modified for distribution over the three subscales and cross-validated by Austin et al. [25]

(2004). The investigators adapted and translated it into Arabic using DeepL Translator software (DeepL SE Co., Cologne, NW, Germany) with a back-translation by another expert researcher to verify its accuracy. Six experts evaluated the scale's content validity and revealed a satisfactory content validity index (CVI) = 0.83. The internal consistency reliability was guaranteed (Cronbach's  $\alpha = 0.817$ ). It comprises 33 items in three subscales: emotion appraisal and expression (13 items), emotion regulation (10 items), and emotion utilization (10 items). Responses were rated on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Three items had reversed scores (numbers 5, 28, 33), creating a total score ranging from 33 to 165, which was leveled as low (33~77), moderate (78~121), or high (122~165) EI, with a high score indicating higher EI skills. The total subscales were also calculated for the first domain, which ranged from 13 to 65 and leveled as low (13~30), moderate (31~47), and high (48~65). The other two subscales each had a total score of 10 to 50 and were classified as low (10~22), moderate (23~35), and high (36~50).

### 3) Academic Motivation Scale

It was designed based on the tenets of the SDT [16] by Vallerand et al. [26] and proved satisfactory internal consistency reliability (Cronbach's  $\alpha = 0.81$ ). It was adapted and translated into Arabic using DeepL Translator software (DeepL SE Co.) with back-translation by another researcher to ensure its accuracy. Six experts appraised the scale's content validity using a satisfactory CVI = 0.86. The internal consistency reliability was also confirmed (Cronbach's  $\alpha = 0.839$ ). It comprises 28 items with three categories of motivation: intrinsic (12 items), extrinsic (12 items), and amotivation (4 items). The students' responses were rated on a five-point Likert scale: does not correspond at all (1), to exactly correspond (5). The total score ranges from 28 to 140 and is categorized as low (28~65), moderate (66~102), or high (103~140), with higher scores indicating higher AM. The total scores of both the intrinsic and extrinsic domains were also calculated and ranged from 12 to 60 and leveled as low (12~28), moderate (29~44), or high (45~60). The amo-

tivation domain score ranged between 4 and 20 and was leveled as low (4~9), moderate (10~15), or high (16~20).

## 4. Procedures

The researchers designed the questionnaire using the SurveyMonkey Software (SurveyMonkey Co., San Mateo, CA, USA). They sent an official letter and survey link to the Ministry of Higher Education for approval of the data collection process. After approval, the survey link was published by each college's student affairs department to man and woman students through their university emails. The study instrument was piloted on 45 students who were omitted from the final study sample to ensure the scales' clarity, applicability, and cultural compatibility. Students' feedback was positive, and no modifications were required. The required sample size was achieved from mid-April to the end of May 2022. The typical documented time for questionnaire completion was 8~11 minutes.

## 5. Data analysis

The researchers exported raw data from the SurveyMonkey Software (SurveyMonkey Co.) into Microsoft Excel 2007 (Microsoft, Redmond, WA, USA) format. It was then fed into and analyzed using SPSS version 26.0 (SPSS, Inc., Chicago, IL, USA). Researchers described the variables using frequencies, proportions, means, standard deviations, and confidence interval (CI). A one-sample t-test was used to guarantee the significance of the total sample mean score difference in the categories of the studied variables in the target population. Pearson's linear correlation coefficient guaranteed the correlation of the studied variables. Multiple linear regression analysis was used to examine the effect of EI on AM and GPA and the effect of the types of motivation on EI and GPA. The models were assessed for potential multicollinearity using the variance inflation factor (VIF) < 10, and the adjusted  $R^2$  value was used to judge the goodness of fit. The association of students' characteristics with the mean EI, AM, and GPA scores was tested using a one-way analysis of variance and an independent sample t-test. Statistical significance was considered if the  $p$ -value was lower than .05.

## 6. Ethical considerations

The Institutional Review Board of the Research Ethics Committee of Saudi Electronic University approved this study (SEUREC-22023). The study was conducted as per the Declaration of Helsinki. The students received the survey's link with an elaboration of the study's goal and all essential explanations for answering the questions. The researchers obtained all the students' online informed consent before completing the survey. Thus, they ensured voluntary participation by having the right to decline their replies at any time. Students' answers were anonymous and used only to satisfy the purpose of the study.

## RESULTS

### 1. General characteristics of the participants

Table 1 illustrates that out of the 450 students who partic-

**Table 1.** General Characteristics of Participants ( $N = 450$ )

Parameters	Categories	n (%)
Age (yr)	≤ 20	98 (21.8)
	21~< 23	226 (50.2)
	23~< 25	126 (28.0)
	M ± SD (95% CI)	21.58 ± 2.11 (21.43, 22.10)
Gender	Men	212 (47.1)
	Women	238 (52.9)
Marital status	Single	193 (42.9)
	Married	229 (50.9)
	Widow or divorced	28 (6.2)
Residence	Riyadh	159 (35.3)
	Dammam	139 (33.8)
	Jeddah	152 (30.9)
Academic level	1~3	214 (47.6)
	4~6	132 (29.3)
	7~8	104 (23.1)
Working status	Yes	234 (52.0)
	No	216 (48.0)
Working place	Governmental sector	186 (41.3)
	Private sector	161 (35.9)
	Free business	103 (22.9)
Perceived income level	Not enough	165 (36.7)
	Enough	205 (45.6)
	Enough and saving	80 (17.8)

M = Mean; SD = Standard deviation; CI = Confidence interval.

ipated in the study, 50.2% were between 21 and 23 years, with a mean age of  $21.58 \pm 2.11$ , and more than half were women (52.9%) and married (50.9%). Approximately one-third were fairly distributed over three residential areas: Riyadh (35.3%), Dammam (33.8%), and Jeddah (30.9%). The highest percentage (47.6%) was enrolled in grades one to three, working (52.0%) in the government sector (41.3%), and had sufficient income (45.6%).

### 2. Total scores of the studied variables

Table 2 portrayed that 57.1% of the participants had moderate EI with a mean of  $76.03 \pm 14.91$  (95% CI 74.65, 77.41) with moderate emotional appraisal and expression (60.4%), regulation (47.8%), and utilization (52.4%). Moderate AM was found among 55.6% with a mean of  $65.41 \pm 18.24$  (95% CI 63.72, 67.10) with moderate intrinsic (56.4%) and extrinsic (53.1%) motivation and low amotivation among 57.3% of them. Moreover, 57.6% of the participants had a moderate GPA with a mean of  $84.88 \pm 10.41$  (95% CI 84.12, 86.80). All studied variable categories had significant mean differences ( $p < .001$ ) with a narrow 95% CI.

### 3. Association between the studied variables and the participants' characteristics

Table 3 shows that increasing age ( $F = 4.67, p = .010$ ), working status ( $t = 1.34, p = .036$ ), and residence ( $F = 10.29, p < .01$ ) had significant positive associations with higher EI levels. There was also significant positive association between higher AM levels and woman gender ( $t = 3.59, p < .01$ ), working experience ( $t = 2.05, p = .041$ ), higher academic level ( $F = 4.72, p = .009$ ), and perceived higher income ( $F = 7.57, p < .01$ ). Moreover, being a woman ( $t = 0.93, p = .016$ ), married ( $F = 5.51, p = .007$ ), working ( $t = 1.97, p = .036$ ), and having higher academic level ( $F = 12.05, p < .01$ ) showed significant positive associations with higher GPA.

### 4. Correlation between the main study variables

Table 4 illustrates that total EI and its domains (emotions appraisal and expression, regulation, and utilization) had a significant positive correlation with GPA and total AM, and intrinsic and extrinsic motivations ( $p < .01$ ). GPA was posi-

**Table 2.** Distribution of Participants by the Total Scores of the Studied Variables

(N = 450)

Variables	Levels	n (%)	M ± SD (95% CI)	t-test <sup>†</sup> (p)
Total EI	Low	177 (39.3)	76.03 ± 14.91 (74.65, 77.41)	108.17 (< .01)**
	Moderate	257 (57.1)		
	High	16 (3.6)		
	Total score	33~165		
<b>Domains of EI</b>				
Emotions appraisal and expression	Low	170 (37.8)	28.87 ± 6.37 (28.28, 29.46)	96.00 (< .01)**
	Moderate	272 (60.4)		
	High	8 (1.8)		
	Total score	13~65		
Emotions regulation	Low	211 (46.9)	21.03 ± 6.27 (20.45, 21.61)	71.17 (< .01)**
	Moderate	215 (47.8)		
	High	24 (5.3)		
	Total score	10~50		
Emotions utilization	Low	193 (42.9)	21.66 ± 5.85 (21.12, 22.21)	78.57 (< .01)**
	Moderate	236 (52.4)		
	High	21 (4.7)		
	Total score	10~50		
Total AM	Low	172 (38.2)	65.41 ± 18.24 (63.72, 67.10)	76.09 (< .01)**
	Moderate	250 (55.6)		
	High	28 (6.2)		
	Total score	28~140		
<b>Types of AM</b>				
Intrinsic motivation	Low	108 (24.0)	31.05 ± 7.68 (30.19, 31.90)	71.54 (< .01)**
	Moderate	254 (56.4)		
	High	88 (19.6)		
	Total score	12~60		
Extrinsic motivation	Low	170 (37.8)	27.13 ± 8.26 (26.36, 27.89)	69.66 (< .01)**
	Moderate	239 (53.1)		
	High	41 (9.1)		
	Total score	12~60		
Amotivation	Low	258 (57.3)	10.25 ± 3.36 (9.94, 10.56)	64.71 (< .01)**
	Moderate	157 (34.9)		
	High	35 (7.8)		
	Total score	4~20		
GPA	Low	43 (9.5)	84.88 ± 10.41 (84.12, 86.80)	172.99 (< .01)**
	Moderate	259 (57.6)		
	High	148 (32.9)		
	Total score	60~100		

EI = Emotional intelligence; AM = Academic motivation; GPA = Grade point average; M = Mean; SD = Standard deviation; CI = Confidence interval.

<sup>†</sup>One sample t-test.

\*\* $p < .01$ .

tively correlated with total AM and intrinsic and extrinsic motivations ( $p < .01$ ). Amotivation had an insignificant negative correlation with GPA ( $p > .05$ ). In contrast, it had a significant negative correlation with EI and its subscale scores ( $p < .01$ ).

## 5. Effect of emotional intelligence domains on academic achievement and motivation

Table 5 illustrates the significance of model one ( $F = 54.47$ ,

**Table 3.** Association between the Studied Variables and the Participants' Characteristics (N = 450)

Parameters	Categories	EI	AM	GPA
		$\bar{x} \pm SD$		
Age	≤ 20	69.40 (16.83)	64.35 (17.36)	82.74 (10.86)
	21~24	72.41 (13.20)	63.43 (18.59)	83.03 (9.93)
	25~28	74.34 (15.26)	66.00 (17.91)	84.79 (10.57)
	F (ρ)	4.67 (.010)*	0.98 (.376)	1.77 (.171)
Gender	Men	71.07 (15.72)	62.01 (17.42)	83.55 (9.53)
	Women	72.00 (16.17)	68.06 (18.31)	85.66 (11.32)
	t (ρ)	- 0.62 (.534)	3.59 (< .01)**	0.93 (.016)*
Marital status	Single	70.09 (14.73)	63.26 (16.20)	84.59 (9.20)
	Married	73.34 (16.80)	66.04 (19.84)	85.04 (10.60)
	Widowed or divorced	67.18 (15.55)	66.25 (14.63)	82.31 (11.12)
	F (ρ)	3.05 (.30)	1.32 (.267)	5.51 (.007)*
Academic level	1~3	70.74 (16.49)	62.35 (19.24)	81.12 (10.20)
	4~6	73.95 (16.22)	65.59 (17.35)	83.76 (11.14)
	7~8	70.24 (14.20)	68.37 (16.09)	85.65 (7.68)
	F (ρ)	2.14 (.119)	4.72 (.009)*	12.05 (< .01)**
Working status	Yes	72.32 (16.54)	66.53 (18.83)	84.87 (11.13)
	No	68.75 (15.58)	63.05 (17.09)	81.90 (9.60)
	t (ρ)	1.34 (.036)*	2.05 (.041)*	1.97 (.036)*
Residence	Riyadh	74.10 (15.45)	67.38 (18.09)	82.25 (10.22)
	Dammam	66.58 (16.09)	63.37 (19.40)	87.12 (10.89)
	Jeddah	73.47 (15.38)	63.59 (16.58)	85.59 (9.59)
	F (ρ)	10.29 (< .01)**	2.40 (.092)	8.96 (< .01)**
Perceived income level	Not enough	71.96 (17.75)	60.78 (18.64)	81.83 (9.84)
	Enough	71.27 (15.78)	66.43 (17.91)	83.41 (10.60)
	Enough and saving	71.51 (12.18)	69.26 (15.71)	85.20 (11.04)
	F (ρ)	0.08 (.919)	7.57 (< .01)*	0.85 (.428)

F = One-way ANOVA; t = Independent sample t-test; EI = Emotional intelligence; AM = Academic motivation; GPA = Grade point average; SD = Standard deviation.

\*p < .05, \*\*p < .01.

**Table 4.** Correlation Matrix between the Studied Variables (N = 450)

Variables (r) p-value	GPA	Total EI	Emotions appraisal & expression	Emotions regulation	Emotions utilization	Total AM	Intrinsic motivation	Extrinsic motivation
Total EI	(.191)**							
Emotions appraisal & expression	(.126)**	(.845)**						
Emotions regulation	(.133)**	(.890)**	(.640)**					
Emotions utilization	(.241)**	(.851)**	(.547)**	(.718)**				
Total AM	(.125)**	(.495)**	(.339)**	(.489)**	(.457)**			
Intrinsic motivation	(.156)**	(.498)**	(.328)**	(.481)**	(.444)**	(.965)**		
Extrinsic motivation	(.113)**	(.441)**	(.336)**	(.474)**	(.444)**	(.943)**	(.843)**	
Amotivation	(- 0.056)	(- .317)**	(- .250)**	(- .364)**	(- .349)**	(- .855)**	(- .835)**	(- .689)**

r = Pearson correlation coefficient; EI = Emotional intelligence; AM = Academic motivation; GPA = Grade point average.

\*\*p < .01.

**Table 5.** Multiple Linear Regression Analysis of the Effect of EI Domains on GPA and AM

(N = 450)

Parameters		B	Beta	t <sup>†</sup>	p-value	R <sup>2††</sup>
Model 1: GPA	Constant	39.99	-	40.45	< .01**	.05
	Emotions appraisal and expression	0.28	.02	1.79	.024**	
	Emotions regulation	0.13	.11	2.01	.032**	
	Emotions utilization	0.39	.24	4.30	< .01**	
Model 2: AM	Constant	28.81	-	8.09	< .01**	.26
	Emotions appraisal and expression	0.13	.11	2.19	.044*	
	Emotions regulation	0.94	.33	5.41	< .01**	
	Emotions utilization	0.71	.23	4.08	< .01**	

EI = Emotional intelligence; GPA = Grade point average; AM = Academic motivation; B = Unstandardized coefficients; Beta = Standardized coefficients.

<sup>†</sup>Student t-test.

<sup>††</sup>Coefficient of determination.

\* $p < .05$ , \*\* $p < .01$ .

**Table 6.** Multiple Linear Regression Analysis of the Effect of AM Types on GPA and EI

(N = 450)

Models		B	Beta	t <sup>†</sup>	p-value	R <sup>2††</sup>
Model 1: GPA	Constant	2.55	-	6.75	< .01**	0.04
	Intrinsic motivation	0.07	.25	2.92	.004*	
	Extrinsic motivation	0.12	.11	1.99	.022*	
	Amotivation	- 0.09	- .13	- 0.17	.119	
Model 2: EI	Constant	42.98	-	17.60	< .01**	0.25
	Intrinsic motivation	0.72	.34	3.44	< .01**	
	Extrinsic motivation	0.50	.26	3.40	.026	
	Amotivation	- 0.50	- .01	- 0.13	.203	

AM = Academic motivation; GPA = Grade point average; EI = Emotional intelligence; B = Unstandardized coefficients; Beta = Standardized coefficients.

<sup>†</sup>Student t-test.

<sup>††</sup>Coefficient of determination.

\* $p < .05$ , \*\* $p < .01$ .

$p < .01$ ), which explains 5.0% of the variance in GPA. All the EI domains have positive effects on GPA: emotions appraisal and expression ( $\beta = .02$ ,  $p = .024$ ), regulation ( $\beta = .11$ ,  $p = .032$ ), and utilization ( $\beta = .24$ ,  $p < .01$ ). Model two also proved its significance ( $F = 9.45$ ,  $p < .01$ ), explaining 26.0% of the variance in the AM. All the EI domains had a positive effect on total AM: emotions appraisal and expression ( $\beta = .11$ ,  $p = .044$ ), regulation ( $\beta = .33$ ,  $p < .01$ ), and utilization ( $\beta = .23$ ,  $p < .01$ ). No multicollinearity was detected between the EI domains in either model where the VIF is less than ten and tolerance was above two.

## 6. Effect of AM types on achievement level and emotional intelligence

Table 6 illustrates the significance of model one ( $F = 11.49$ ,  $p < .01$ ), which explains 4.0% of the variance in GPA. A significant positive effect of the intrinsic ( $\beta = .25$ ,  $p = .004$ ) and extrinsic ( $\beta = .11$ ,  $p = .022$ ) motivation on GPA. Model two also proved its significance ( $F = 34.20$ ,  $p < .001$ ), explaining 25.0% of the variance in EI. Intrinsic motivation ( $\beta = .34$ ,  $p < .01$ ) and extrinsic motivation ( $\beta = .26$ ,  $p = .026$ ) had significant positive effects on EI. However, amotivation had no significant effects on neither GPA ( $\beta = -.13$ ,  $p = .119$ ) nor EI ( $\beta = -.01$ ,  $p = .203$ ). There is no multicollinearity between the observed variables in either model where the VIF is less



than ten and the tolerance is above two.

## DISCUSSION

The present study revealed a moderate overall EI level and its emotional appraisal and expression, regulation, and utilization domains. Mean EI scores were significantly higher among older students, those from varied residential areas, and working students. These findings indicate that increasing age, diverse cultures, and social network interactions in the work environment can boost the students' EI. This study also explored moderate overall AM levels, intrinsic and extrinsic motivations, and low amotivation. AM level was significantly higher among women, working students, and those at a higher academic level and perceived higher income. This may be attributed to their desire to complete bachelor's degrees to continue their careers. Moreover, this study revealed that more than half of the studied students had a moderate GPA, significantly higher among women, married individuals, working students, those at a high academic level, and those having varied residences. This may be explained by the proven higher women's AM level, with more experience at a higher academic level and being married, which could increase their sense of family responsibility. Moreover, the GPA variation by residence can be explained by the educational institutions' available educational resources and quality.

In line with the present study, Koyuncuoglu [27] found moderate levels of AM and academic achievement among Turkish University students. These AM levels were significantly higher among woman students than man students and those in higher academic years. Yulika et al. [28] also found that most Indonesian students had moderate EI skills, learning motivation, and achievement. A Saudi study by Altwijri et al. [15] showed no significant differences in EI scores among medical university students by gender and academic year, while motivation increased with academic level. Two recent studies also reported a higher academic performance among woman students than man students: Alabdulkarem et al. [29] in Saudi Arabia and Amador-Licon et al. [11] in Mexico. Moreover, Hamdan-Mansour et al. [30] detected moderate intrinsic motivation levels among Jordanian University stu-

dents, which differed according to their work status, academic level, and age group, consistent with the present study's findings.

Conversely, gender differences in EI scores in favor of woman university students were proven by Shrestha et al. [31] and Zeidner and Matthews [32]. This may be attributed to the higher percentage of woman students in these conflicting studies (62.0%, 57.1%) and the smaller sample size (185, 280) than the current study. Moreover, Banat and Rimawi [33] established that Palestinian University students had high EI scores significantly higher for man students than woman students. This may be attributed to the varied EI measurement scale, smaller sample size, religion, college types, and other background characteristics of this conflicting study. Furthermore, the most dominant reason for cultural diversity is its strong influence on emotions and EI abilities depending on the value of the emotions and the way of dealing with them in each culture. Emotional experience has three elements: a subjective experience or stimulus, a physiological response by the autonomic nervous system, and an expressive or behavioral response determined based on sociocultural norms and personality. Consequently, social norms govern the meaning of how emotions are controlled or communicated. Thus, emotions are biologically determined and significantly affected by environmental, cultural, and social contexts [34–36]. Similarly, the present study showed significant variations in EI levels by student residence, even in the same country.

This study confirmed a positive correlation between total EI and its domains (emotional appraisal and expression, regulation, and utilization) with GPA and total AM, intrinsic and extrinsic motivations. Regression analysis proved that the EI domains predicted 5.0% of the total variance in GPA. Specifically, emotional utilization had the most potent positive effect on GPA, followed by emotional regulation and emotional appraisal and expression domains. It also revealed that the EI domains predicted 26.0% of the variance in AM. Specifically, the emotion regulation domain had the most substantial positive effect on AM, followed by emotional utilization, appraisal, and expression. This indicates that the individual's awareness of one's own and other's emotions and the

proper utilization and management of these emotions offers an essential base for learning as an influencing resource in the motivation and adaptation process to the learning environment. Evidence has shown that EI plays a dual role through intrapersonal influences on academic performance through motivation and self-regulation. In addition to increasing interpersonal skills that widen academic and social networks, fostering teamwork is paramount in university education [10,32].

Moreover, the present study proved that AM predicted 4.0% of the variance in GPA, where intrinsic motivation had a more substantial positive effect than extrinsic motivation. It also proved that AM predicted 25.0% of the variance in EI, where intrinsic motivation had a more significant positive effect than extrinsic motivation. This indicates that those with an internal motive to learn have a significant positive power to achieve their academic goals [37] and have better self-regulation, emotional control, and regulation [38]. Extrinsic motivation improves academic performance in those with low intrinsic motivation. Thus, this aids in allocating resources for students' motivation [39]. Therefore, both can be present in the same individual based on context. However, amotivation was negatively correlated with both and was not a significant predictor of GPA or EI.

Various studies have reported consistent findings concerning the importance of EI and AM in shaping students' academic performance and achievement. EI had a significantly positive effect on academic performance and success [12,13,15,31]. Evidence proved that EI positively impacted the students' AM [2,21,28] and acted as a mediator between AM and academic achievement [2]. AM positively impacted medical university students' academic performance [22] and predicted academic performance and class participation [21]. EI also positively impacted students' academic self-efficacy [2], resilience [21], clinical ability by managing emotions and facilitating thought among nursing students [40], interpersonal relationships, and empowerment in clinical settings [41]. However, EI has a significant effect on reducing medical students' burnout and stress [42] and clinical practice stress among nursing students; thus, it may have a role in coping with stress and preventing burnout [41]. These findings

highlight the pressing need to improve EI among health sciences students due to the growing diversity of the healthcare environment and rising expectations of clients, which require health professionals with a higher level of emotion control and EI skills [43]. These findings highlight the importance of EI and AM in shaping the students' academic performance and achievement.

Conversely, Mohd Noor et al. [13] found no relationship between extrinsic motivation and academic achievement among Malaysian University students. This contradiction may be due to the smaller sample size and a higher level of intrinsic motivation among the participants in this conflicting study than in the present study, where moderate levels of intrinsic and extrinsic motivation were observed. Shah et al. [44] showed a negative relationship between EI and academic achievement among Indian medical university students. The small sample size could explain this contradiction in the conflicting study (75 men and women) compared with the present study (450 students). Additionally, using a different EI measurement scale, which was recently validated and classified EI into five levels, the significance of the association may have been lost. Furthermore, it focused on the data analysis of only the correlation coefficient, with no in-depth analysis.

In summary, evidence of the importance of emotional intelligence and motivation for academic outcomes is consistent. However, careful consideration is required concerning the study context, sampling technique, sample size, and student characteristics to ensure effective interpretation and generalization of the findings.

## 1. Strengths and limitation

This study is one of the forerunner studies in Saudi Arabia that compiled the EI, AM, and GPA in one study while using multiple regression models and standardized, valid scales. Additionally, we use a large sample size from different cities to capture a holistic image of the study variables. Nonetheless, one of the limitations of this study is its focus on health science students, which limits the generalizability of the findings. Therefore, a careful contextual interpretation of the results is required. Moreover, using the cross-sectional de-

sign provides one-time assessment and may give rise to recall bias, and social acceptability bias.

## CONCLUSION

This study showed that health science college students had moderate EI, intrinsic and extrinsic motivations, and GPA. It also showed significant positive correlations between EI, intrinsic and extrinsic motivations, and GPA. EI positively predicted AM and GPA. Intrinsic motivation significantly affected GPA and EI more than extrinsic motivation. This study found consistent findings regarding the importance of EI and AM in academic achievement. However, variances were detected in the associated factors based on the participants' background characteristics and sociocultural context. Accordingly, these complex and multifactorial variables need to be analyzed in depth in similar studies. Thus, the following are recommended: integrating EI skills into college curricula, designing EI skills education and training sessions for college students, updating teaching methods and strategies to boost students' motivation and EI skills, and raising awareness among the faculty about the importance of EI and AM for the students' achievement.

## CONFLICTS OF INTEREST

The authors declared no conflict of interest.

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## DATA SHARING STATEMENT

Please contact the corresponding author for data availability.

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