LEVELS AND ASSOCIATED FACTORS OF COGNITIVE ENGAGEMENT AMONG FOURTH-YEAR MEDICAL STUDENTS AT CAN THO UNIVERSITY OF MEDICINE AND PHARMACY

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ABSTRACT

Background: Cognitive engagement is a core determinant of effectiveness in medical training, reflected in students' use of metacognitive strategies to comprehend complex knowledge and develop clinical skills. Although international research has expanded rapidly since 2019, empirical evidence in Vietnam remains limited, particularly for fourth-year students-a critical transition to full-time clinical placement under high academic demands. Objectives: To quantify cognitive engagement among fourth-year medical students at Can Tho University of Medicine and Pharmacy and examine factors associated with it. Materials and methods: A cross-sectional analytical study was conducted among 300 fourth-year medical students. A standardized questionnaire was administered, including 25 items measuring cognitive engagement and 15 items assessing potential influencing factors. Data were analyzed using descriptive statistics and multivariable regression using SPSS version 26.0. Results: High, moderate, and low levels of cognitive engagement were observed in 50.7%, 30.3%, and 19.0% of students, respectively. Curriculum content and learning motivation showed the strongest association ($\beta = 0.268$; $R^2 = 0.626$), followed by personal factors ($\beta = 0.191$) and teaching methods ($\beta = 0.157$). The overall model explained 69.5% of the variance ($p < 0.001$). Conclusion: Curricular content should be strengthened for clinical applicability; psychoeducational interventions are warranted to improve stress management and self-efficacy; and faculty development should prioritize feasible, context-appropriate active teaching approaches.

Keywords: Cognitive positivity, medical students, influencing factors, medical education.

I. INTRODUCTION

Continuous transformation in healthcare places medical education under increasing pressure to prepare physicians with strong professional competence, lifelong learning capacity, and adaptability [1]. Central to this objective is learner engagement, particularly cognitive engagement [2]. Cognitive engagement denotes learners' metacognitive investment through planning, monitoring, and evaluation to master complex knowledge and clinical skills. Distinct from mere behavioral participation, it entails proactive integration of new knowledge with clinical experience and critical application of higher-order thinking in problem-solving [3].

Cognitive engagement results from reciprocal interactions between learner attributes and the learning environment. Evidence shows that professionally relevant content and intrinsic motivation are primary antecedents, outperforming static learning-style typologies in showing stronger associations with academic achievement than static learning-style typologies [4]. Active pedagogies (e.g., PBL, TBL) enhance self-regulation, collaboration, and clinical reasoning, while blended learning and simulation create psychologically safe

contexts that reduce anxiety and promote reflection [5]. Conversely, stress and burnout may diminish cognitive investment and increase the risk of attrition [6].

This study integrates Self-Determination Theory (SDT) and Social Cognitive Theory (SCT) to explain medical students' cognitive engagement in clinical learning [7]. SDT highlights autonomy, competence, and relatedness as key conditions fostering intrinsic motivation and internalization, operationalized through learning content and motivation (FLCM), teaching methods (FTM), and faculty roles (FFR). SCT complements this perspective by emphasizing reciprocal personal–behavioral–environmental interactions, particularly self-efficacy, thereby supporting the inclusion of individual characteristics (FIC) and learning methods (FLM) [8].

Since 2019, research on cognitive engagement among medical students has expanded rapidly; however, empirical evidence remains limited in Viet Nam. In particular, few studies have focused on fourth-year medical students, who are transitioning into full-time clinical practice while facing examination pressure, substantial cognitive load, and ethical challenges. The absence of large-scale quantitative surveys constrains educational leaders' ability to design pedagogical interventions that are culturally responsive and aligned with the national training system.

In light of the above, this study was conducted to pursue the following objectives: 1. To determine the level of cognitive engagement among fourth-year medical students at Can Tho University of Medicine and Pharmacy using a standardized measurement scale. 2. To identify and analyze factors associated with cognitive engagement—including individual characteristics, teaching–learning methods, and faculty roles—among fourth-year medical students at Can Tho University of Medicine and Pharmacy.

II. MATERIALS AND METHODS

2.1. Study participants and design

An analytical cross-sectional study was conducted in May 2025 among 300 fourth-year undergraduate medical students enrolled at Can Tho University of Medicine and Pharmacy. All fourth-year medical students who provided informed consent to complete the questionnaire were invited to participate. Students who were absent during data collection were excluded from the study.

2.2. Data collection instruments and analysis

A structured self-administered questionnaire was employed, consisting of three sections. The first section collected basic demographic information, including age and gender. The second section measured cognitive engagement (CE) using a standardized 25-item scale comprising five components: aspiration and learning motivation (5 items; $\alpha = 0.870$), self-efficacy (4 items; $\alpha = 0.866$), positive learning attitudes (4 items; $\alpha = 0.824$), stress and academic pressure management (4 items; $\alpha = 0.859$), and perceptions of student–faculty relationships (8 items; $\alpha = 0.857$). The third section assessed factors influencing cognitive engagement through 15 items grouped into five domains, each containing three items: learning content and motivation (FLCM; ($\alpha = 0.870$), learning methods (FLM; $\alpha = 0.852$), teaching methods (FTM; $\alpha = 0.748$), faculty roles (FFR; $\alpha = 0.802$), and individual characteristics (FIC; $\alpha = 0.840$). All variables were rated on a five-point Likert scale ranging from "very little" to "very much," ensuring response consistency and enabling quantitative analysis.

- **Data collection:** A cross-sectional survey was administered using paper-based questionnaires in 2025.

- **Data analysis:** Data were entered and analyzed using SPSS 26.0, with prior data cleaning procedures applied. The cognitive engagement scale was standardized using Confirmatory Factor Analysis (CFA) in AMOS. Descriptive statistics (mean and standard deviation) were used to summarize the data. Factors associated with cognitive engagement were examined using multivariable regression analyses (multiple linear regression and logistic regression).

- **Ethic approval:** This study was approved by the Ethics Committee of Can Tho University of Medicine and Pharmacy (Decision No. 1900/QD-DHYDCT dated 12 May 2025; protocol code 25.020.SV/PCT-HDDD).
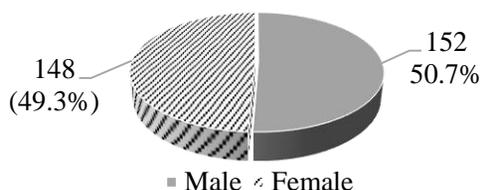
III. RESULTS

3.1. Sample characteristics

Figure 1. Gender distribution.

Male students accounted for 50.7% and female students for 49.3%, indicating a representative and well-balanced gender distribution within the study sample

Table 1. Age distribution of the study sample

Sex	Mean ± SD (Age)	Min	Max
Male	22.2 ± 1.04	21	28
Female	22.08 ± 0.77	21	27
Total	22.14 ± 0.92	21	28

The mean age of participants was 22.14 years, ranging from 21 to 28 years, which is consistent with the typical age of fourth-year medical students.

3.2. Level of cognitive engagement among fourth-year medical students and associated factors

Table 2. Component scores of cognitive engagement among medical students

Components of cognitive engagement	Mean±SD	Min - Max
Aspiration and learning motivation (5 items)	19.16 ± 3.32	9 - 25
Self-efficacy (4 items)	15.08 ± 2.71	6 - 22
Positive attitudes toward learning (4 items)	15.02 ± 2.92	7 - 20
Ability to manage stress and academic pressure (4 items)	12.98 ± 3.18	4 - 20
Perceptions of and relationships with faculty (8 items)	29.28 ± 5.25	9 - 40

All cognitive engagement components were high, with item-adjusted means indicating a uniform distribution of learning-related perceptions across dimensions.

Table 3. Classification of cognitive engagement levels among medical students

Level of cognitive engagement	Number (n)	Percentage (%)
Low level	57	19
Moderate level	91	30.3
High level	152	50.7
Total	300	100

The majority of students demonstrated high (50.7%) or moderate (30.3%) levels of cognitive engagement. Only 19% were classified at a low level, indicating an overall positive engagement profile.

Table 4. Regression analysis of factors associated with cognitive engagement among fourth-year medical students

Factors influencing cognitive engagement			Estimated coefficient	Standard error (S.E.)	Critical ratio (C.R.)	p	Standardized regression coefficient
CE	<---	FLCM	1.753	0.446	3.933	0.000	0.268
CE	<---	FLM	0.690	0.413	1.672	0.096	0.114
CE	<---	FTM	1.027	0.462	2.221	0.027	0.157
CE	<---	FFR	0.599	0.473	1.266	0.206	0.088
CE	<---	FIC	1.077	0.347	3.106	0.002	0.191

Three factors (FLCM, FTM, FIC) were statistically significant ($p < 0.05$). Learning content and motivation showed the highest regression coefficient (0.268), indicating the strongest effect.

Table 5. R^2 analysis of factors influencing cognitive engagement among medical students

Factors	R^2	Adjusted R^2	p	Durbin-Watson
FLCM: Learning content and motivation	0.626	0.390	<0.001	2.082
FLM: Learning methods	0.582	0.337	<0.001	2.086
FTM: Teaching methods	0.569	0.322	<0.001	1.977
FFR: Faculty role	0.550	0.300	<0.001	2.061
FIC: Individual Characteristics	0.578	0.332	<0.001	2.133
Overall effect	0.695	0.474	<0.001	2.147

The regression model demonstrated high statistical significance ($p < 0.001$). Learning content and motivation accounted for 62.6% of the variance, representing the most influential factor. Collectively, the associated factors explained 69.5% of the variance in cognitive engagement.

IV. DISCUSSION

4.1. Characteristics of the study sample

The study included 300 fourth-year medical students with a mean age of 22.14 ± 0.92 years (range: 21–28), aligning with the expected age profile of fourth-year students in Viet Nam's six-year medical curriculum. Gender distribution was balanced (50.7% male, 49.3% female), supporting representativeness and reducing potential gender-related bias. This relatively homogeneous demographic profile is consistent with Nguyen et al. (2023) on metacognitive awareness among Vietnamese medical students, facilitating benchmarking and cross-study comparison within a shared educational and cultural context [9].

4.2. Level of cognitive engagement among fourth-year medical students

The findings showed that 50.7% of students were classified as having high cognitive engagement, 30.3% moderate, and 19.0% low. This predominance of high engagement suggests that fourth-year students are relatively well prepared for the transition to more time-intensive clinical practice. However, nearly one-fifth exhibited low cognitive engagement, indicating a need for timely interventions to mitigate risks of academic burnout and attrition intentions, as cautioned by Sinval *et al.* [6].

Component-level analysis indicated that perceptions of student–faculty relationships had the highest mean score (29.28 ± 5.25; maximum = 40), followed by aspiration and learning motivation (19.16 ± 3.32; maximum 25). In the Vietnamese educational context, teacher–student relationships are highly valued and exert a strong influence on learning motivation. By contrast, stress and academic pressure management yielded the lowest mean score (12.98 ± 3.18; maximum 20), highlighting a priority area for improvement. Phan et al. (2025) similarly reported high levels of stress among medical students in southern Viet Nam, underscoring the need to integrate stress-management training into the curriculum [10].

Compared with international evidence, Wu et al. (2025) reported that Chinese medical students also exhibit stage-dependent variation in cognitive engagement, with a decline in the third year and a rebound in the final year [2]. In the present study, fourth-year students in Can Tho demonstrated relatively high cognitive engagement, potentially reflecting stronger psychological preparedness when entering the clinical training phase.

4.3. Factors influencing cognitive engagement

Multivariable regression analysis indicated that the model was statistically significant and explained 69.5% of the variance in cognitive engagement (p < 0.001). Among the associated-factor domains, learning content and motivation emerged as the strongest association with cognitive engagement (β = 0.268, p < 0.001), whereas individual factors (β = 0.191, p = 0.002) and teaching methods (β = 0.157, p = 0.027) showed smaller yet significant effects. In contrast, learning methods (β = 0.114, p = 0.096) and faculty role (β = 0.088, p = 0.206) were not statistically significant in the regression model, although they may still contribute to the broader profile of cognitive engagement.

Learning content and motivation were the primary drivers of cognitive engagement: when students perceive clear clinical meaning and professional relevance, they invest more intellectually. This finding aligns with Pelaccia and Viau (2017), who frame motivation as both an input and an outcome of instructional design. Practice-transferable, career-aligned learning promotes deep learning and metacognitive regulation [11]. Vietnamese evidence is congruent: Tran Hong Quy et al. (2025) reported more favorable student appraisal of simulation when the practical utility of skills was explicit [12]. These findings support enhancing curricular authenticity via real case materials, locally grounded scenarios, and competency-aligned tasks to strengthen cognitive investment.

Individual factors were the second strongest associated-factor of cognitive engagement (β = 0.191, p = 0.002), encompassing self-efficacy, self-regulation, and learning attitudes. Prior evidence identifies self-efficacy as a robust correlate of achievement, persistence, and coping in demanding learning contexts [13]. In this cohort, mean self-efficacy (15.08 ± 2.71/22) was comparatively lower, likely reflecting heavy knowledge load and stringent clinical assessments. Psycho-academic support and targeted skills training may therefore be warranted to sustain cognitive investment [14].

Teaching methods were significantly associated with cognitive engagement (β = 0.157, p = 0.027), reflecting the shift toward active pedagogies in medical education. Problem-, team-, and case-based learning enhance motivation and outcomes by fostering self-regulation, collaboration, practice-oriented problem solving, and metacognitive engagement. In Viet Nam, faculty and students have reported favorable attitudes toward implementing problem-based learning, although substantial demands for resources, time, and role transformation remain barriers [15]. Additional constraints include staff–student ratios and limited equipment

[16],[17]. Consequently, a pragmatic, context-adapted approach is recommended, integrating guided lectures with small-group discussion, simulation, case-based activities, and structured clinical tasks to optimize effectiveness under resource limitations [18].

Among fourth-year students, learning strategies may be relatively homogeneous because academic and clinical requirements are highly standardized, limiting variance in the "learning methods" construct. Although students rated their relationships with lecturers highly (29.28 ± 5.25), multivariable regression analysis indicated that this factor did not independently predict cognitive engagement ($\beta = 0.088$, $p = 0.206$). This may be because teacher–student relationships in Vietnam function more as a baseline condition; their effects are largely indirect via learning motivation and teaching methods; and the "perception of relationships" measure may not capture feedback quality (e.g., timeliness, specificity). This aligns with Akturan et al. (2025), who argued that descriptive "learning style" accounts typically predict outcomes more weakly than motivation and cognitive engagement [4]. Sandars and Cleary (2011) proposed that faculty function as catalysts for self-regulated learning via specific, timely, and constructive feedback [19]. Nguyen Thi Hoa Huyen et al. (2023) similarly highlighted faculty and clinical staff support as pivotal to Vietnamese nursing students' perceptions of the clinical learning environment [20]. Thus, faculty development should emphasize structured, goal-referenced, and actionable feedback; longitudinal academic mentoring to support self-regulation and professional identity formation; and prioritization of high-quality coaching, reasoning prompts, and reflective debriefing over contact-hour volume.

V. CONCLUSION

The study documented cognitive engagement among fourth-year medical students at Can Tho University of Medicine and Pharmacy as high in 50.7%, moderate in 30.3%, and low in 19.0%. Perceptions of student–faculty relationships yielded the highest scores, whereas stress management and self-efficacy remained comparatively weak. Multivariable regression identified learning content and motivation as the strongest association with cognitive engagement ($\beta = 0.268$; $R^2 = 0.626$), followed by individual factors ($\beta = 0.191$) and teaching methods ($\beta = 0.157$); the overall model explained 69.5% of the variance ($R^2 = 0.695$).

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