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Development and psychometric evaluation of the motivational self-regulation strategies questionnaire for health sciences students

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Abstract

Background & Objective: Motivation is essential for learning, but sustaining it over time requires active self-regulation. This study aimed to develop and psychometrically evaluate a 33-item adaptation of a motivational self-regulation instrument for health students. Confirmatory factor analysis (CFA) was conducted to determine whether the original seven-factor structure was retained in this population.

Materials & Methods: This psychometric study was conducted from November 1, 2022, to October 31, 2023 among 174 health students at Kashan University of Medical Sciences. All eligible students were invited to participate voluntarily. The instrument was adapted from the questionnaire developed by Norouzi et al. Item modifications were informed by a qualitative phase involving 10 experts and cognitive interviews with six students. Reliability was assessed using Cronbach's alpha, and structural validity was evaluated through confirmatory factor analysis.

Results: The Content Validity Index (CVI) was 0.98. The instrument demonstrated excellent internal consistency (Cronbach's $\alpha = 0.939$; ICC = 0.993). Confirmatory factor analysis showed an acceptable model fit ($\chi^2 = 840.95$, df = 443, RMSEA = 0.069, SRMR = 0.071, CFI = 0.96, NFI = 0.92). Age was significantly associated with progressive situational awareness, proactive situational awareness, and value adjustment strategies ($p < 0.05$).

Conclusion: The 33-item instrument demonstrated acceptable validity and reliability for assessing motivational self-regulation strategies among health students and can be used in future health education research.

Keywords: motivation; psychometrics; questionnaires; students, health occupations; factor analysis, statistical

Introduction

Motivation is essential for learning because it energizes the learning process. Importantly, it can also be renewed and sustained over time. A greater challenge, however, is sustaining motivation over time. Learners must not only be motivated to begin learning but also sustain that drive over long stretches. Because motivation is malleable and dynamic, sustaining it becomes a critical self-regulatory task. To achieve this, learners need to recognize the factors that influence their motivation in different situations. They also need to understand that motivation itself is regulated through self-regulatory processes [1]. Research shows that strategies for regulating motivation positively influence effort, persistence, and later performance [2, 3]. Wolters

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identified the self-regulation of motivation as a key component of self-regulated learning [4]. Motivational self-regulation refers to learners' deliberate efforts to maintain or enhance their motivation [2]. Through this process, learners become aware of the factors influencing their motivation and regulate their thoughts and behaviours accordingly [5]. Previous studies have shown that learners who use motivational self-regulation strategies report more adaptive motivational beliefs, including lower procrastination, greater task value, higher effort, stronger self-efficacy, and greater focus on goal attainment [6–11].

The strategies learners deploy to overcome motivational obstacles are typically sorted by the targets of their control: motivation, emotion, attention, encoding, environment, and information processing [12–14]. Several instruments have been created to capture different motivational self-regulation strategies [6, 9, 13–16]. Wolters developed the Motivational Regulation Strategies Questionnaire and identified five strategies [2]. Schwinger et al. [9] then translated and adapted the Wolters questionnaire into German, adding two subscales. In 2013, Wolters revised his own instrument by appending a further subscale and renaming the existing ones [6].

Across learning domains, researchers have worked to design comparable tools, especially for the self-regulation of motivation. Norouzi et al. constructed a questionnaire with sound reliability and validity evidence to measure extrinsic motivational strategies among medical students.

That instrument was purpose-built to assess strategies that help preserve the quantity and quality of students' motivation throughout the long, demanding period of medical education [17]. Studies of health faculty students point to challenges such as lack of motivation, depression, disinterest in their field, obsessive thoughts, and low self-confidence [18]. Collectively, these findings highlight the importance of strengthening motivation among health students and examining the self-regulation strategies they use to maintain it. Although the health field falls under the Ministry of Health, substantial differences separate health disciplines from clinical medicine. The original Motivational Self-Regulation Questionnaire (MSRQ) developed by Norouzi et al. [19] was validated among medical students working in demanding clinical settings, whereas health students are primarily educated in classroom-based environments with different educational and professional contexts. Applying the MSRQ to health students therefore requires a context-specific psychometric analysis. The primary aim of this study was to develop and psychometrically evaluate an adapted 33-item version of the Motivational Self-Regulation Scale for health students. Confirmatory Factor Analysis (CFA) was conducted to determine whether the original seven-factor structure remained valid after the addition of health-specific items for this population.

Materials & Methods

Design and setting(s)

This methodological psychometric study was conducted from November 1, 2022, to October 31, 2023 at the Faculty of Health, Kashan University of Medical Sciences, Kashan, Iran.

Participants and sampling

The study population consisted of undergraduate students at the Faculty of Health who had completed at least one in-person academic semester. Convenience sampling was used, and all eligible students were invited to participate voluntarily.

The standard recommendation that psychometric sample sizes should be 5 to 10 times the number of items [20, 21] meant a minimum of 165 participants was needed (33 items × 5). The final sample of 174 health students—Environmental Health (n = 59), Occupational Health (n = 63), and Public Health (n = 52)—exceeded this minimum and was deemed sufficient.

Tools/Instruments

The instrument was adapted from the Motivational Self-Regulation Questionnaire (MSRQ) developed by Norouzi et al. [19] for medical students. To ensure contextual relevance, a qualitative phase was conducted with a purposive sample of 10 experts in medical and health education. The experts were given the study objectives and the theoretical framework of motivational self-regulation, reviewed the 28 original items, and suggested modifications through semi-structured feedback.

Qualitative data were analysed using a directed content analysis approach, and trustworthiness was supported through two rounds of expert review aimed at reaching consensus. This process yielded five new items tailored to the health education context, bringing the total to 33 items.

The Content Validity Index (CVI) was calculated using the Waltz and Bausell (1981) formula based on relevance, clarity, and simplicity, each rated on a 4-point

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Likert scale. Items with a CVI ≥ 0.79 were accepted; those between 0.07 and 0.79 required revision, and items below 0.07 were deleted [22]. CVI = (number of experts rating the item as 3 or 4) / (total number of experts). Experts also rated each question on a 3-point scale: "necessary," "useful but not necessary," and "not necessary." The content validity ratio (CVR) was computed using Lawshe's formula [23]: CVR = (n_e – n/2) / (n/2), where n_e is the number of panellists identifying the item as "necessary" and n is the total number of reviewers. With 10 experts, items with a CVR below 0.62 were removed.

The final 33-item questionnaire, comprising seven subscales, is presented in **Table 1**.

Table 1. Motivational self-regulation strategies questionnaire for health students

Strategy	Items
Regulation of Value (RoV)	1. I remind myself of the value and importance of what I am learning for my future career. (RoV1)
	2. I devote more time to learning activities that I believe will be valuable for my future career. (RoV2)
	3. I remind myself of the value of course materials by linking theoretical knowledge with practical applications. (RoV3)
	4. I remind myself of the importance of course materials by relating them to my future profession. (RoV4)
	5. I remind myself of the importance of the field I have chosen to study. (RoV5)
Environmental Organization (ES)	6. I try to provide a favorable environment for my studies. (ES1)
	7. I try to remove the factors that cause distraction and disrupt my concentration in my environment. (ES2)
	8. I try to create a calm and supportive environment for studying. (ES3)
	9. I try to avoid people who cause frustration and decrease motivation in the educational environment. (ES4)
	10. I try not to dwell on unpleasant experiences that reduce my motivation to study. I seek advice from experienced professionals and faculty members in my field. (ES5)
Regulation of Relationship (RoR)	11. I try to talk to elders and intellectuals in my field and get advice. (RoR1)
	12. I try to talk to my family members or close friends about academic matters. (RoR2)
	13. I try to get guidance from upper-semester students. (RoR3)
	14. I try to talk to my friends and relatives about academic subjects. (RoR4)
Progressive Situational Awareness (PROSA)	15. I evaluate whether my assignments and study efforts produce the results I expect. (PROSA1)
	16. I learn from successful teachers and students by using them as role models. (PROSA2)
	17. I try to reflect on how I performed in past academic situations for my academic progress. (PROSA3)
	18. I try to think about my strengths and weaknesses in past academic situations for my academic progress. (PROSA4)
	19. I actively receive feedback from others about my academic performance. (PROSA5)
	20. I remind myself of my ideal goals from education (such as success in life, professional advancement, etc.). (PROSA6)
Regulation of Situational Interest (RSI)	21. I try to make course materials and assignments interesting and enjoyable by connecting them to my interests. (RSI1)
	22. I try to create a fun and enjoyable atmosphere in the educational situation by doing interesting things. (RSI2)
	23. I try to make lessons and assignments interesting and enjoyable by turning them into games. (RSI3)
	24. I try to make educational situations interesting and enjoyable by spending time with my favorite people. (RSI4)
Self-Promise (SC)	25. I reward myself with an enjoyable activity after completing an academic task. (SC1)
	26. I promise myself a reward if I complete my homework. (SC2)
	27. I promise myself that I will start my favorite work when I finish my homework. (SC3)
	28. I promise a close friend that we will do something enjoyable if I complete my homework. (SC4)
Proactive Situational Awareness (PRESA)	29. I observe ineffective teachers or unsuccessful students to learn what approaches I should avoid. (PRESA1)
	30. Before starting the lesson, I try to learn about the specific style and characteristics of the respective teacher to behave according to his example. (PRESA2)
	31. Before entering a phase or academic position, I try to learn about the dos and don'ts of that place to behave according to the pattern there. (PRESA3)
	32. I try to find out about the educational status of my friends and relatives so that I don't fall behind them if possible. (PRESA4)
	33. I remind myself of my competitive goals from education (such as being ahead of others, being better than others, etc.). (PRESA5)

Data collection methods

After revising the questionnaire based on expert feedback, Face validity was assessed by administering the questionnaire to six health students at Kashan University of Medical Sciences, selected through simple random sampling. Cognitive interviews with these students used "think-aloud" and "concurrent verbal probing" techniques. Students read each item aloud and explained what it meant to them. This step ensured that the final items were interpreted consistently by the target

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population. All 174 participants then completed the questionnaire online.

Data analysis

Data were analysed using IBM SPSS Statistics (version 26) and LISREL (version 8.8). The factor structure was examined using Confirmatory Factor Analysis (CFA) with maximum likelihood estimation. Model fit was judged against these standard criteria: Goodness of Fit Index (GFI) > 0.90, Comparative Fit Index (CFI) > 0.90, Normed Fit Index (NFI) > 0.90, and Root Mean Square Error of Approximation (RMSEA) < 0.08. Because the data were non-normally distributed, nonparametric tests (Mann–Whitney U and Kruskal–Wallis) were used for demographic comparisons by gender, marital status, residence, and field of study. Finally, simple linear regression examined the effect of age on the use of motivational self-regulation strategies.

Results

The structural validity of the 33-item motivational self-regulation instrument was evaluated using Confirmatory Factor Analysis (CFA). The seven-factor model showed an acceptable fit: $\chi^2 = 840.95$, df = 443 ($p < 0.001$), giving a χ^2/df ratio of 1.89, comfortably within acceptable bounds. The Root Mean Square Error of Approximation (RMSEA) was 0.069 (90% CI: 0.062–0.077). Additional fit indices also supported the adequacy of the model, including CFI = 0.96, NNFI = 0.95, NFI = 0.92, and IFI = 0.96. The Standardized Root Mean Square Residual (SRMR) was 0.071, also indicating an acceptable model fit. Although the Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) were 0.77 and 0.73, respectively, the remaining fit indices supported the adequacy of the overall model (**Tables 2** and **3**).

Table 2. Reliability coefficients of the motivational self-regulation strategies subscales (n = 174)

Subscale	Items	Cronbach's α
Regulation of value	5	0.803
Environmental organization	5	0.817
Regulation of relationship	4	0.693
Progressive situational Awareness	6	0.893
Regulation of situational Interest	4	0.789
Self-promise	4	0.866
Proactive situational awareness	5	0.822
Total scale	**33**	**0.939**

Note: Cronbach's alpha coefficient was used to assess internal consistency.
Abbreviations: N, total sample size; α, Cronbach's alpha coefficient.

All factor loadings were statistically significant, with t values ranging from 5.90 to 8.61, exceeding the critical value of 1.96 ($p < 0.05$). reflecting moderate to strong item–factor associations. R^2 values (0.21–0.92) further indicate that a sizable share of the observed-item variance is accounted for by the underlying self-regulation strategies, supporting construct validity (**Table 4**, **Figure 1**)

Table 3. Goodness-of-fit indices for the confirmatory factor analysis model (n = 174)

Index	Value
Chi-square (χ^2)	840.95
Degrees of freedom (df)	443
χ^2/df ratio	1.89
RMSEA	0.069 (90% CI: 0.062–0.077)
SRMR	0.071
NFI	0.92
NNFI	0.95
CFI	0.96
IFI	0.96
RFI	0.91
GFI	0.77
AGFI	0.73

Note: RMSEA and SRMR values below 0.08 indicate acceptable fit; CFI, NFI, NNFI, IFI, and RFI values above 0.90 indicate good fit. GFI and AGFI values may be lower due to model complexity and sample size.
Abbreviations: N, total sample size; RMSEA, Root Mean Square Error of Approximation; CI, Confidence Interval; SRMR, Standardized Root Mean Square Residual; NFI, Normed Fit Index; NNFI, Non-Normed Fit Index; CFI, Comparative Fit Index; IFI, Incremental Fit Index; RFI, Relative Fit Index; GFI, Goodness of Fit Index; AGFI, Adjusted Goodness of Fit Index.

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Table 4. Standardized factor loadings, standard errors, t-values, and squared multiple correlations (R^2) for the motivational self-regulation strategies items

Standardized loading	Standard error	t-value	R^2	Item
0.63	0.40	7.64	0.3969	RoV1
0.48	0.32	8.09	0.2304	RoV2
0.60	0.38	7.71	0.3600	RoV3
0.56	0.39	7.95	0.3136	RoV4
0.65	0.57	8.07	0.4225	RoV5
0.50	0.38	8.33	0.2500	ES1
0.57	0.41	8.15	0.3249	ES2
0.67	0.20	5.90	0.4489	ES3
0.61	0.39	7.92	0.3721	ES4
0.58	0.48	8.27	0.3364	ES5
0.65	0.60	7.74	0.4225	RoR1
0.67	0.56	7.48	0.4489	RoR2
0.65	0.88	8.23	0.4225	RoR3
0.61	0.94	8.44	0.3721	RoR4
0.46	0.33	8.56	0.2116	PROSA1
0.64	0.48	8.32	0.4096	PROSA2
0.61	0.35	8.08	0.3721	PROSA3
0.58	0.30	7.98	0.3364	PROSA4
0.60	0.96	7.88	0.3600	PROSA5
0.49	0.40	8.61	0.2401	PROSA6
0.63	0.40	7.83	0.3969	RSI1
0.72	0.34	6.99	0.5184	RSI2
0.90	0.69	7.57	0.8100	RSI3
0.63	0.67	8.44	0.3969	RSI4
0.88	0.31	6.34	0.7744	SC1
0.36	0.57	7.17	0.56	SC2
0.79	0.55	7.96	0.6241	SC3
0.96	0.56	7.33	0.9216	SC4
0.83	0.82	8.06	0.6889	PRESA1
0.78	0.72	8.04	0.6084	PRESA2
0.65	0.57	8.12	0.4225	PRESA3
0.84	0.56	7.45	0.7056	PRESA4
0.86	0.72	7.78	0.7396	PRESA5

Note: All factor loadings were statistically significant ($t > 1.96$, $p < 0.05$).
Abbreviations: R^2, squared multiple correlation (coefficient of determination); RoV, Regulation of Value; ES, Environmental Organization; RoR, Regulation of Relationship; PROSA, Progressive Situational Awareness; RSI, Regulation of Situational Interest; SC, Self-Promise; PRESA, Proactive Situational Awareness.

Mann–Whitney U and Kruskal–Wallis tests found no significant differences in mean motivational self-regulation strategy scores by gender, marital status, residence, enrollment year, or field of study ($p > 0.05$). Simple linear regression analysis showed that age was significantly associated with three motivational self-regulation strategies.

As age increased, scores fell for the value adjustment strategy ($\beta = -0.24$, SE = 0.11, $p = 0.030$), progressive situational awareness ($\beta = -0.27$, SE = 0.13, $p = 0.042$), and proactive situational awareness ($\beta = -0.35$, SE = 0.15, $p = 0.020$).

Age was not significantly related to the remaining strategies ($p > 0.05$) (**Table 5**).

Table 5. Simple linear regression analysis examining the effect of age on motivational self-regulation strategy scores

Strategy	Beta (SE)	p-value
Total score	− 1.18 (0.65)	0.070
Proactive situational awareness	− 0.35 (0.15)	0.020
Self-promise	− 0.01 (0.13)	0.966
Regulation of situational interest	− 0.08 (0.11)	0.502
Progressive situational awareness	− 0.27 (0.13)	0.042
Regulation of relationship	− 0.18 (0.10)	0.095
Environmental organization	− 0.09 (0.11)	0.426
Regulation of value	− 0.24 (0.11)	0.030

Note: Simple linear regression was used; β represents the unstandardized regression coefficient; SE = standard error. Statistically significant associations ($p < 0.05$) are shown in bold.
Abbreviations: SE, standard error; β, unstandardized beta coefficient; p, probability value.

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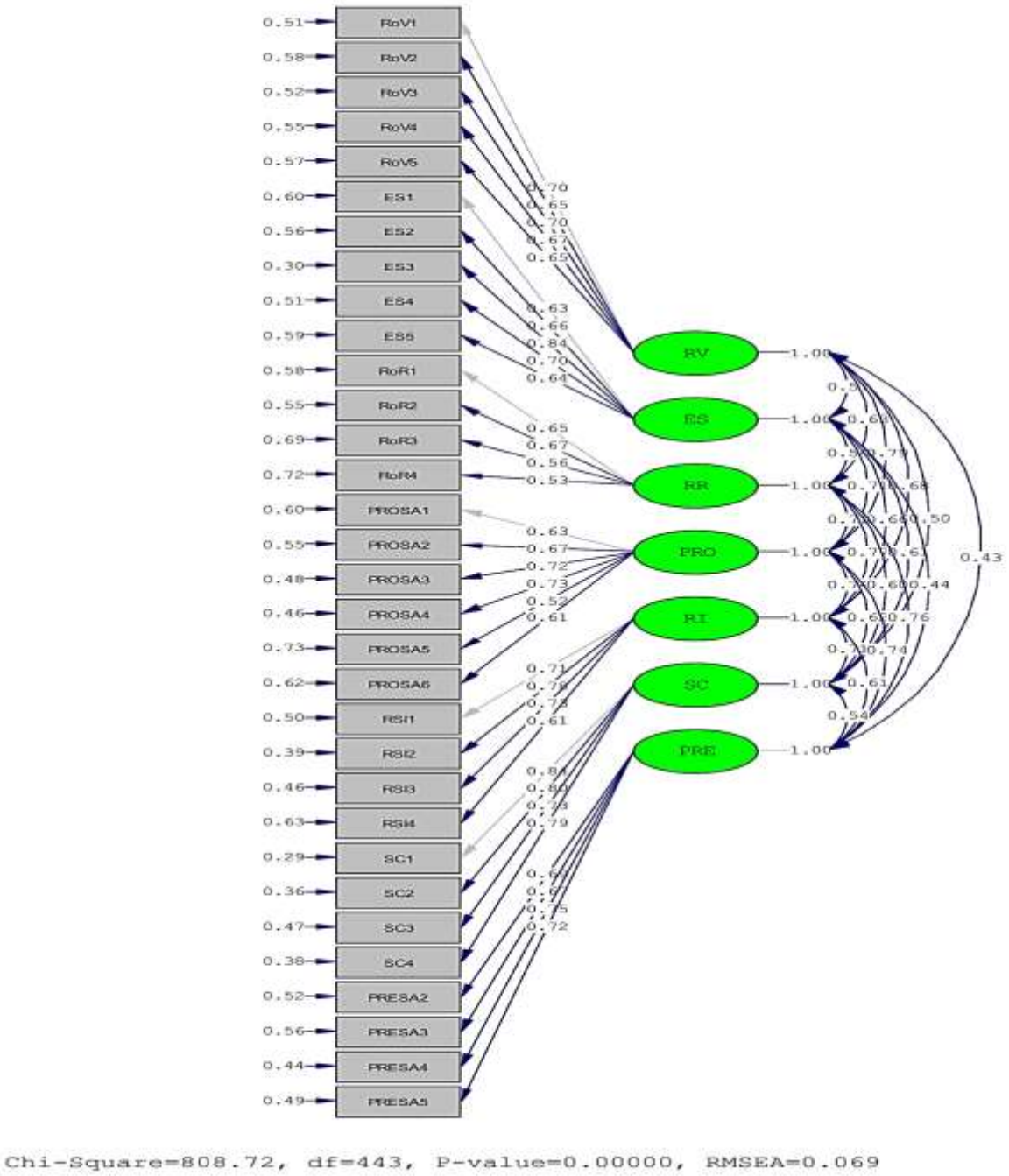

Figure 1. Confirmatory Factor Analysis (CFA) path diagram showing standardized factor loadings, error variances (squared multiple correlations), and correlations among the seven latent factors of the motivational self-regulation strategies model (n = 174).

Discussion

This study psychometrically evaluated and validated a questionnaire measuring motivational self-regulation strategies among health students, based on the standardized instrument developed by Norouzi et al. [24]. The findings indicate that the adapted questionnaire demonstrated satisfactory psychometric properties, including acceptable internal consistency and strong evidence of structural validity. After participants completed the instrument, Cronbach's alpha coefficients for the subscales were as follows: motivation regulation

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(α = 0.803), environmental organization (α = 0.817), relational regulation (α = 0.693), progressive situational awareness (α = 0.893), situational interest regulation (α = 0.789), self-promise (α = 0.866), and proactive situational awareness (α = 0.822). The total scale demonstrated excellent internal consistency (Cronbach's α = 0.939), and all subscales showed acceptable reliability.

CFA was used to examine structural validity. All standardized factor loadings were statistically significant and within an acceptable range, indicating that the scale has construct validity and the hypothesized model fits satisfactorily. The highest correlation emerged between progressive situational awareness and value adjustment (r = 0.79). Progressive situational awareness also correlated strongly with relational regulation and environmental organization (r = 0.71), and situational interest regulation showed strong correlations with relational regulation and environmental organization (r = 0.77). These findings support the stability of the proposed seven-factor structure and its consistency with the instrument developed by Norouzi et al. [24].

Most medical education research underscores the role of the educational environment in strengthening student motivation. Motivation is a complex and dynamic phenomenon influenced by multiple interacting factors [25]. These findings have two important implications. First, improving students' academic motivation requires attention to multiple contributing factors; ignoring or downplaying any element, including the student's own role, is a strategic mistake. Second, while many parameters affect learner motivation—several of them beyond the reach of educational authorities— these challenges should not discourage efforts to improve student motivation. In complex systems, even small, well-timed interventions can generate sizable effects [26]. Motivational self-regulation strategies represent one practical approach through which students can actively maintain their motivation.

Simple linear regression revealed significant negative associations between age and three strategies: value adjustment, progressive situational awareness, and proactive situational awareness. For each additional year, value adjustment scores dropped by 0.24 (p = 0.030), progressive situational awareness scores by 0.27 (p = 0.042), and proactive situational awareness scores by 0.35 (p = 0.020). The situational interest regulation strategy showed a nonsignificant negative trend (β = −0.08, p = 0.502). Gegenfurtner and Vauras [27] and Pelikan et al. [28] examined age-related differences in the link between learning motivation and transfer in adult continuing education. Their findings indicated that older students displayed higher motivation than younger students. In that study, age was analysed as a dichotomous variable, and the authors found that older students scored significantly higher in cognitive interest ($p < 0.01$). Higher scores on items such as "learning just to learn" and "seeking knowledge for its own sake" suggested that older students possess an intrinsic motivation for knowledge that sets them apart from younger students [29].

The social nature of motivation and age-related patterns of motivational maintenance or decline can be shaped by the social educational context, as the social environment is a critical motivational variable [30–32]. Socioemotional selectivity theory, for instance, posits that older individuals are not necessarily less motivated; rather, they channel their motivational resources toward personally meaningful and socially rewarding behaviours [33, 34]. Older adults often direct their motivational resources toward emotionally meaningful goals and interpersonal relationships.

For the other demographic variables (gender, marital status, residence, year of entry, and field of study), Mann–Whitney and Kruskal–Wallis tests detected no significant differences in mean strategy scores. The context-specific age-related decline observed in our sample highlights the distinct motivational demands of the health faculty environment compared with general adult education settings.

Outcome expectations represent one factor that can influence student motivation and learning within the framework of motivational self-regulation strategies [35, 36]. Academic burnout is another influence on students' academic performance [37]. Educational environments can shape learners' behaviour and emotions under intense psychological pressure [35, 37]. As learners pursue achievement goals in academic settings, they face multiple challenges, including burnout [38]. Environmental factors, especially the social environment, carry considerable weight across social-cognitive theories, achievement goal theories, and expectancy-value theories. Meaningful relationships have been documented between self-regulated learning and academic performance [39, 40], and between achievement goals and performance [41, 42]. Despite the strong structural validity demonstrated here, several psychometric issues remain to be addressed. Convergent and discriminant validity of the subscales were not tested against external instruments. Measurement invariance

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across years of entry and gender was also not examined. These analyses are needed to confirm the instrument's stability across all student subgroups and should be addressed in future studies. It must mentioned that self-esteem is among the factors that can lower student motivation [43]. Beyond formal classroom communication, informal interactions outside the classroom appear to strengthen educator–student relationships. Through such exchanges, students can share concerns and problems with their teachers, fostering feelings of being valued and sustaining motivation [44]. Active teaching methods, instructors' enthusiasm, and adequate educational and laboratory facilities likewise enhance students' academic motivation [45]. Educational attrition depends on many demographic factors and can be addressed through motivational self-regulation strategies [46]. This study showed that health students use seven strategies to regulate their academic motivation. Several limitations warrant mention. First, because no other validated motivational self-regulation questionnaire exists for the health field in Iran, comparison with a parallel instrument was not possible. Second, the psychometric properties were examined solely among health students, so generalisation requires caution. Future research should validate this scale in other populations, including non-medical science students and other learner groups. From a practical perspective, the instrument has several potential applications. It can be used for needs assessments to identify students with low motivation, integrated into academic advising to help counsellors provide targeted support, and employed as a useful outcome measure for programme evaluation to gauge how curricular changes or teaching interventions affect student engagement over time.

Conclusion

This study produced a 33-item instrument with adequate validity and reliability evidence for measuring motivational self-regulation strategies in health education. The findings suggest that health students use a variety of such strategies to maintain their motivation throughout the demanding health education curriculum.

Although health students and students from other disciplines overlap considerably in the strategies they use, the way each strategy is implemented varies markedly by field of study.

Health education researchers can use the instrument developed here to examine motivational self-regulation strategy use among health students and to develop and evaluate interventions designed to improve student motivation and engagement.

Ethical considerations

The study protocol was approved by the Ethics Committee of VUMS (IR.VUMS.REC.2022.006). Before participation, all students received comprehensive information about the study goals, the ethical charter, and their rights via an online link. Written electronic informed consent was obtained from all participants; they were required to read the consent form and select the "I agree" option before accessing the questionnaire. To ensure confidentiality and anonymity, no personal identifiers were collected. Participants were explicitly informed of their right to withdraw from the study at any stage without penalty. All collected data were stored securely in password-protected digital files, accessible only to the primary researchers, and used strictly for educational research purposes.

Artificial intelligence utilization for article writing

This article was not prepared using any artificial intelligence tools.

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Conflict of interest statement

The authors report no conflicts of interest.

Author contributions

FM contributed to the study concept and design and supervised the project; AN provided methodological consultation and critical review; HR collected the data, performed the statistical analysis, and drafted the manuscript; AY offered statistical advice; and NEA and KR critically revised the manuscript. All authors approved the final version.

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Data availability statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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