BMC Medical Education

RESEARCH Open Access

The relationship between self-directed learning ability and clinical competence among nursing students: a cross-sectional descriptive study

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Abstract

Background Self-directed learning is considered a key factor in developing clinical skills, as it enables students to independently acquire the necessary knowledge and competencies. This study aims to determine the relationship between self-directed learning ability and clinical competence in nursing students.

Methods In a cross-sectional descriptive study carried out across the three principal provinces in western Iran, a total of 450 third- and fourth-year undergraduate nursing students were recruited to participate through convenience sampling. Data were collected using demographic questionnaires, the Williamson Self-Rating Scale of Self-Directed Learning (SRSSDL), and the Modified Nursing Competence Scale (NCS) developed by Meretoja. Pearson correlation and multiple linear regression analyses were employed for data analysis.

Results The average age of the students was 22.68 ± 2.59 years. The results indicate that the mean scores for self-directed learning and clinical competence were 240.04 ± 32.14 and 137.94 ± 21.88, respectively, both being above average. Pearson's correlation coefficient results indicated a weak yet significant direct correlation between these two variables.

Conclusion Self-directed learning is important for nursing students. It relates to improving clinical competence. Therefore, it is suggested to implement strategies like conducting educational workshops. Another approach is to change the educational methods used by instructors to enhance this skill.

Keywords Learning, Self-Directed learning, Nursing students, Clinical competence

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Background

Learning is functionally defined as changes in behavior due to experience. We define learning as genetic adaptation, meaning changes in an organism's behavior resulting from its environmental regularities. This practical definition not only addresses the challenges of other definitions but also offers significant benefits for cognitive learning research. One of the key concepts in learning is self-directed learning (SDL) [1]. Living in the knowledge era and performing effectively in today's society requires social capital and 21st-century skills, including readiness for self-directed learning. Self-direction is considered one of the main factors for success in academic education, making it one of the most attractive and important topics in education and learning across various age groups [2, 3]. This method is a continuous process throughout an individual's life, necessitating training and the acquisition of necessary skills [4]. Self-directed learners use various cognitive and metacognitive strategies to control their learning experiences, leading to active participation in the learning process [3]. According to Knowles, self-directed learning is a process in which individuals, with or without assistance from others, identify their learning needs, formulate learning goals, identify and evaluate necessary human and material resources, choose and implement appropriate learning strategies, and evaluate learning outcomes while taking control over their learning [5]. The advantages of self-directed learning include: developing research skills, effective analysis, increased motivation and decisiveness, enhanced choices and autonomy, improved motivation, and lifelong learning development [2]. External factors influencing learners' satisfaction and ability to promote self-directed learning include the impact of educational institutions in creating structured learning environments, conducting relevant training, teaching learning strategies, and resource accessibility. Internal factors involve learning styles that learners choose, which relate to personality traits, motivation, and readiness to take responsibility for individual learning [6]. In recent years, many studies have been conducted on the level of self-directed learning in medical students and the use of various methods (such as blended teaching methods, modules, problem-based learning methods, etc.) to promote self-directed learning in this group of students [7–10]. The level of self-directed learning among students in different countries has been reported at varying levels. For instance, the level of SDL in nursing students in Thailand, Saudi Arabia and Turkey is reported to be high [11–13]. However, in a study conducted in Australia, this level was low [14]. The results of a study conducted in Iran also indicated that the level of SDL among learners is moderate [15]. With the growing trend of rapid and constant changes in medical science and the necessity for students' readiness for lifelong learning, the self-directed learning theory has increasingly been utilized in the context of medical education, particularly in the nursing field, as a requirement. The students of medical sciences universities have actually entered fields with professional training courses, which are necessary for success in this field to have up-to-date knowledge and skills and to be self-directed [16].

Developing self-directed learning among nurses and other health service staff has become a growing priority because this approach can enhance motivation, boost confidence and independence, strengthen learning skills, and develop interpersonal communication skills [17]. The results of studies indicate that self-directed learning can lead to the development of nursing competencies and the enhancement of self-efficacy [18]. In spite of the extraordinary significance of Clinical Competence in nursing as a central issue for patient care, there's no clear and comprehensive definition for it and there are contentions over its definition [19]. Clinical competence refers to the ability of a nurse to integrate knowledge, skills, attitudes, values, and capabilities that are essential for effective performance in a professional setting. It is also defined as a nurse's ability to perform clinical tasks effectively and safely and to fulfill their professional responsibilities effectively. Clinical Competence of nursing is assessed by varied tools such as OSCE (objective structured clinical examination), DOPS (Direct observation of practical skills), Portfolio, CPAT(Clinical Performance Assessment Tool), Clinical Competence Assessment Tool, Nursing Competence Scale and etc [20]. A study by Hakimzadeh et al. assessed nursing students' clinical competence through self-evaluation, the results showed that students rated their clinical competence as slightly above average [21]. Improving clinical competence in nursing students is a topic that has attracted the attention of studies and educational centers in recent years in Iran, as well as other parts of the world [22–24]. It is recommended to explore strategies to enhance clinical competence of nursing students, as it has a direct impact on the health of the community in the future; one of these methods is to develop self-directed learning among nursing students, which will naturally aid in the development of lifelong learning in these students. Some studies conducted on the relationship between self-directed learning and the clinical competence of nurses confirm that self-directed learning has a positive impact on clinical competence [25–27]. Hence, there is reason to believe that SDL might affect nursing student clinical competency. However, there are few evidence-based data related to the relationship between SDL and nursing student clinical competency. Therefore, exploring the relationship between the two focus variances is essential. Since adequate studies on this topic have not been conducted in our country Iran, we decided to undertake the present

study to determine the self-directed learning ability of nursing students and the factors affecting it.

Methods

Design, setting and participants

This descriptive cross-sectional study was conducted at three principal provinces in western Iran (Urmia, Tabriz and Ardebil University of Medical Sciences) during the academic year 2023–2024. All three higher education institutions included in this study were public. The study population included third- and fourth-year undergraduate nursing students at Urmia (178 students), Tabriz (142 students), and Ardabil (130 students) universities of medical sciences, totaling 450 students. We specifically selected third- and fourth-year nursing students for our study because these students have transitioned into the clinical phase of their education, making them the most appropriate population for examining the relationship between self-directed learning ability and clinical competence. At this stage of their training, students actively engage in clinical rotations where they begin to develop essential clinical competencies through direct patient care experiences. The third and fourth years represent a critical period where theoretical knowledge is applied in practice, clinical decision-making skills are cultivated, and professional competencies start to emerge. Moreover, this is when self-directed learning becomes particularly crucial as students must take greater responsibility for their learning in complex clinical environments.

The sampling method used in this study was convenience sampling. Based on the sample size estimation formula in correlational studies [28], with a 95% confidence level, 90% statistical power, and a correlation coefficient of 0.52 [29], the sample $n = \frac{S1^2 \pm S2^2}{(\mu 2 - \mu 1)^2} f(\alpha,\beta)$ was calculated to be 420 participants.

Considering the potential for incomplete questionnaires and sample attrition, 450 participants were included in the study.

Convenience sampling was selected due to several practical considerations: [1] the time-sensitive nature of data collection during the 2023–2024 academic year [2], geographical constraints in accessing multiple clinical training sites across different institutions, and [3] the specific focus on third- and fourth-year students who had acquired direct clinical experience.

Survey instruments

Demographic questionnaire

The demographic information questionnaire includes the following questions: age, gender, overall GPA (Grade Point Average), work experience in the healthcare field, level of competence in providing healthcare services, satisfaction with the nursing field, and academic success.

Self-Rated scale of Self-Directed learning (SRSSDL)

The Self-Rated Scale of Self-Directed Learning (SRSSDL) was developed by Williamson in 2007 [30]. This scale consists of 60 items and uses a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree', with each item valued between 1 and 5. The dimensions of this questionnaire include awareness (12 items), learning strategies (12 items), learning activities (12 items), evaluation (12 items), and interpersonal skills (12 items). The possible minimum score is 60 and the maximum is 300. A score between 60 and 100 indicates a low level of self-directed learning, a score between 100 and 200 indicates a moderate level, and a score above 200 indicates a high level of self-directed learning. The validity and reliability of the Self-Rated Scale of Self-Directed Learning (SRSSDL) were examined in a study by Yousefi and Gordan Shikan. The content and construct validity of this scale were reported to be very favorable. The reliability of this scale, measured using Cronbach's alpha correlation coefficient, was reported as 0.9 in that study [31].

Modified nursing competence scale (NCS)

This tool was developed by Meretoja in 2004 [32]. In this study, we used the modified version of the "Nursing Competence Scale (NCS)". This adapted version was developed by Dehghani et al. (2011). It contains 47 items with a four-point Likert scale (never to always), where each item has a value ranging from 0 to 4. A score of zero means not using that skill, and a score of four means frequent use of that skill. The dimensions of this questionnaire include helping roles and responsibilities (7 items), teaching-coaching (12 items), diagnostic functions (8 items), therapeutic interventions (5 items), and work and job duties (15 items). The score range of the scale is from 46 to 188. The validity and reliability of the Revised Nurse Competence Scale (NCS) were examined by Dehghani and colleagues. The validity of the scale was reported to be acceptable. The reliability of this scale, using the Cronbach's alpha correlation coefficient for the five dimensions, ranged from 0.76 to 0.88 [33].

Statistical analyses

The data analysis was performed utilizing IBM SPSS Statistics software, version 20 (IBM SPSS Statistics, IBM Corp, Armonk, USA). A significance level (alpha) of 0.05 was established to ascertain statistical significance. Sociodemographic characteristics were represented through frequency and percentage for categorical variables, while mean and standard deviation were computed for continuous variables. The data distribution was assessed using the Kolmogorov-Smirnov statistical test, which indicated a normal distribution. Consequently, parametric analyses, including Pearson correlation and multiple linear

Table 1 Frequency distribution table of individual characteristics of students

Variable	Category	Mean ± standard deviation	CI95%
age	-	22.68 ± 2.59	(22.42,22.92)
GPA	-	16.43 ± 1.35	(16.30,16.55)
Variable	**Category**	**frequency (percentage)**	**CI95%**
gender	woman	233(51.80)	(47.2,56.40)
	man	217(48.20)	(43.60,52.80)
work history	yes	166(36.90)	(32.40,41.50)
	no	284(63.10)	(58.50,67.60)
qualification	relatively good	89(19.80)	(16.20,23.40)
	good	253(56.20)	(51.50,60.90)
	very good	108(24.00)	(20.10,28.00)
satisfaction	Completely satisfied	58(12.90)	(9.90,16.00)
	Satisfied	289(64.20)	(59.50,68.90)
	Dissatisfied	74(16.40)	(13.00,19.80)
	Completely dissatisfied	29(6.40)	(4.10,8.80)
success	great	68(15.10)	(11.80,18.50)
	good	325(72.20)	(68.00,76.40)
	weak	47(10.40)	(7.70,13.10)
	very weak	10(2.20)	(0.80,3.70)

Table 2 Frequency distribution of self-directed learning scale and nursing competency scale and their dimensions

Dimensions	Domain	Standard deviation ± mean.	CI95%
Self-directed learning			
Awareness	17–60	48.05 ± 6.91	(23.31,24.59)
learning strategies	15–60	48.22 ± 7.18	(23.12,24.45)
learning activities	16–60	47.56 ± 7.24	(23.77,25.11)
evaluation	14–60	47.69 ± 7.25	(23.63,24.98)
interpersonal skills	16–60	48.51 ± 6.89	(22.85,24.13)
total score	78–300	24.04 ± 32.14	(116.99,122.94)
Nursing Competency			
helping roles and responsibility	7–28	21.35 ± 3.57	(21.02,21.68)
Teaching- coaching	12–48	36.15 ± 6.09	(35.59,36.72)
Diagnostic functions	8–32	23.89 ± 4.51	(23.47,24.31)

regression, were employed to explore the relationships among the variables.

Findings

In this study, 450 third and fourth-year nursing students were included. The age range of the participants was 20–43 years, with an average age of 22.68 ± 2.59 years, of whom 233 (51.8%) were female. Among the students surveyed, 284 (63.1%) had no work experience. An assessment of nursing competence in providing healthcare showed that 253 (56.2%) students had good nursing competence, and only 29 (6.4%) students were completely dissatisfied, and 74 (16.4%) were dissatisfied with their nursing field. Academic success was also assessed, and only 10 (2.2%) students described their academic success as poor, with an average student GPA of 16.43 ± 1.35 (Table 1).

The average total score of the Self-Directed Learning Scale and its dimensions was calculated. The average score for self-directed learning was 240.04 ± 32.14. This included awareness, strategic learning, learning activities, evaluation, and interpersonal skills, with the average scores of these dimensions calculated as well. The average total score of the Modified Nursing Competence Scale and its dimensions were also calculated. The average score of the modified nursing competence scale was 137.94 ± 21.88. The average scores for its dimensions assisting, teaching and guidance, diagnostic, therapeutic, and occupational were calculated and reported in Table 2.

To examine the effect of independent variables (demographic and other collected variables) on the average score of the self-directed learning scale for nursing students, a multiple linear regression model using the backward method was employed. Before fitting the model, the assumptions of the linear regression model, including independence, normal distribution, and homoscedasticity of residuals, were evaluated. The Durbin-Watson test was used to examine the independence of residuals. The results indicated that the assumption of residual independence is met (Durbin-Watson test = 1.85). The unstandardized residuals were plotted against the unstandardized predicted values. The analysis revealed no clear pattern or heteroscedasticity, confirming that the residuals exhibit homogeneity of variance. The normality of the scores on the Self-Directed Learning Scale was evaluated, and the results confirmed that the distribution of the variable is normal($p > 0.05$).

The subsequent fitting of the linear regression model and the results obtained from the final model indicated that having work experience has a significant direct relationship with the average score of the self-directed learning scale ($\beta = 0.14$, $p = 0.004$). Very good clinical competence also has a significant direct relationship with the average score of the self-directed learning scale ($\beta = 0.22$, $p < 0.001$). Among those dissatisfied with the nursing field, there is a significant inverse relationship with the average score of the self-directed learning scale ($\beta = -0.10$, $p = 0.035$). Weak academic success has a significant inverse relationship with the average score of the self-directed learning scale ($\beta = -0.14$, $p < 0.001$). Very poor academic success has a significant inverse relationship with the average score of the self-directed learning scale ($\beta = -0.23$, $p = 0.001$). The results were reported in Table 3.

To examine the effect of demographic variables and other collected variables on the average score of the

Table 3 Relationship between individual characteristics and self-directed learning scale based on linear regression model

Variable	Category	β	S.E	Test statistics	CI95%	P_Value
Experience in health care Reference category (none)	has	0.14	2.99	2.92	(3.17,15.04)	*0.004
Nursing competence in providing health care Reference category (relatively good)	very good	0.22	3.47	4.52	(9.96, 23.67)	*<0.001
Satisfaction with nursing Reference category (completely satisfied)	Dissatisfied	−0.10	5.92	−2.11	(−22.81,−1.46)	*0.035
Being academically successful Reference category (excellent)	weak	−0.14	4.64	−5.48	(−29.34,−6.88)	*<0.001
Being academically successful Reference category (excellent)	very weak	−0.23	9.88	−3.20	(−23.92,−14.59)	*0.001

*$p < 0.05$

Table 4 Correlation between individual characteristics with nursing competence scale based on linear regression model

Variable	Category	β	S.E	Test statistics	CI95%	P_Value
Experience in health care Reference category (none)	has	−0.15	2.10	−3.19	(−10.87,−2.58)	*0.001
Nursing competence in providing health care Reference category (relatively good)	very good	0.18	2.45	3.89	(0.59,9.64)	*<0.001
Being academically successful reference category (very poor)	weak	−0.18	3.23	−3.78	(−10.08,−0.24)	*<0.001

*Asterisk indicates a statisticaly significant difference at $p \leq 0.001$

adjusted nursing competence scale for nursing students, a multiple linear regression model using the backward method was used. Before fitting the model, the assumptions of the linear regression model, including independence, normal distribution, and homoscedasticity of residuals, were evaluated. All three assumptions were validated.

Durbin-Watson test was used to examine the independence of residuals. The results indicated that the assumption of residual independence is met (Durbin-Watson test = 1.68). The unstandardized residuals were plotted against the unstandardized predicted values. The analysis revealed no clear pattern or heteroscedasticity, confirming that the residuals exhibit homogeneity of variance. The normality of the scores on the Self-Directed Learning Scale was evaluated, and the results confirmed that the distribution of the variable is normal($p > 0.05$).

The subsequent fitting of the linear regression model and the results obtained from the final model indicated that having work experience in healthcare has a significant inverse relationship with the average score of clinical competence (β = −0.15, $p = 0.001$). Good nursing competence in providing healthcare has a significant direct relationship with the average score of clinical competence (β = 0.18, $p < 0.001$). Weak academic success has a significant inverse relationship with the average score of clinical competence (β = −0.18, $p < 0.001$). The results were reported in Table 4.

The correlation between the total score of the self-directed learning scale and the dimensions of clinical competence was examined using Pearson correlation. A weak significant direct correlation was observed between the total score of the self-directed learning scale and all dimensions of clinical competence (Table 5).

Table 5 Correlations between dimensions of self-directed learning scale and nursing competency

Dimensions of self-directed learning scale	Nursing competency
Consciousness	$r = 0.33$ $P < 0.001$
Learning strategy	$r = 0.34$ $P < 0.001$
Learning activities	$r = 0.39$ $P < 0.001$
evaluation	$r = 0.39$ $P < 0.001$
Interpersonal skills	$r = 0.35$ $P < 0.001$

The correlation between the total score of clinical competence and the dimensions of the self-directed learning scale was examined using Pearson correlation. A weak significant direct correlation was observed between the total score of clinical competence and all dimensions of the self-directed learning scale (Table 6).

Discussion

The present study aimed to investigate the relationship between self-directed learning ability and clinical competence among third and fourth-year nursing students. The results showed that according to students' self-assessment, they possess a high level of self-directed learning and clinical competence. The findings of the study conducted by Hakimzadeh et al., which assessed the clinical competence of nursing students in Sabzevar, align with

Table 6 Correlation between dimensions of nursing competency scale and self-directed learning abilities

dimensions of nursing competency scale	Self-directed learning total score
helping roles and responsibility	$r=0.37$ $P<0.001$
Teaching- coaching	$r=0.41$ $P<0.001$
Diagnostic functions	$r=0.33$ $P<0.001$
Therapeutic interventions	$r=0.29$ $P<0.001$
work and job duties	$r=0.34$ $P<0.001$

the results of this study, as students in their research also rated their clinical competence above average [21]. In this study last year's nursing students were also examined too. Similarly, the study by Ahmadi et al. evaluating the level of self-directed learning readiness in nursing students at Shahid Beheshti University of Medical Sciences found that students have a relatively high level of readiness for self-directed learning [34]. The findings of the present study indicate a weak but significant direct correlation between the total score of the self-directed learning scale and all dimensions of clinical competence, as well as a weak significant direct correlation between the total clinical competence score and all dimensions of the self-directed learning scale. These findings align with studies conducted by Yang et al. [27] Kwon [5], and Vasli et al. [26] which also confirmed the statistically significant relationship between self-directed learning and clinical competence among nursing students. These studies were also conducted on internship nursing students, but the sample size, conditions, and instruments used were different, which could be the reason for the difference in the level of correlation with the present study. In the present study, a direct and weak correlation was identified, while in the aforementioned studies, a direct and strong correlation was identified.Kwon's study revealed that a tendency towards critical thinking, satisfaction with clinical experience, gender, and self-directed learning positively influence the clinical competence of nursing student [5]. Furthermore, the results of the present study demonstrated that the mean score of the self-directed learning scale has a significant direct relationship with work experience and conversely, a significant inverse relationship with dissatisfaction with the nursing field, as well as weak and very weak academic performance. The relationship between work experience and the mean score of the self-directed learning scale is also stated in the literature. It is expected that the level of readiness for self-directed learning improves with increasing academic semesters, as students in higher semesters have more clinical experience and decision-making power, allowing them to discuss and share their opinions in specific clinical situations [35]. On the other hand, a significant inverse relationship was found between individuals dissatisfied with the nursing field and the mean score of the self-directed learning scale. These findings align with the research by Sun Chi Lee et al., which suggests a positive impact of satisfaction with the nursing field on nursing professional values, and considers self-directed learning an effective educational method for enhancing professional nursing values among nursing students [36]. In general, the direct relationship between self-directed learning and satisfaction with the nursing profession is a topic mentioned in various studies [37, 38]. With regards to the academic status of students and self-directed learning, the results of the present study indicated a significant inverse relationship between weak and very weak academic status and self-directed learning. Comparative international studies have also shown that the higher the learners achieve self-directed learning ability, the better their academic progress, leading to higher levels of satisfaction with the nursing program and their self-evaluation competencies [29, 39, 40]. However, a study by Ningrum et al. (2018) reported a weak and non-significant positive relationship among medical students [41]. additionally, having work experience in the healthcare field has a significant inverse relationship with the average clinical competence score. Choi's study shows that with increased clinical experiences, nursing students' level of clinical competence rises, which contrasts with the findings of the present study [42]. It seems in Iran, some staff in healthcare centers gradually engage in routine care, and this behavior is transferred to students. Therefore, with the increase in clinical experiences, we sometimes witness a decline in clinical competence among senior nursing students, although this is not generalizable to all cases, and more studies are needed in this regard. the findings of the present study indicate that the average clinical competence score has a significant inverse relationship with poor academic status among nursing students; in other words, students with weaker academic performance have lower clinical competence. A systematic review study indicated that work experience, work environment, theoretical knowledge and level of education, marital status, clinical education, job satisfaction, job stress, and critical thinking are among the factors affecting the clinical competence of nurses [43]. Regarding the factors influencing the clinical competence of nursing students, a tendency for clinical thinking, problem-solving ability, and overall satisfaction with the field were identified as an important factors. It is suggested that effective educational programs be developed to enhance the clinical competence of nursing students [44].

Limitations

Given that the present study was conducted in the northwestern cities of the country and self-directed learning is context-dependent, generalization to other areas or universities is limited. Furthermore, because the study results are based on students' self-reports. They may not accurately reflect actual levels of self-directed learning and clinical competence, indicating a need for future studies that do not rely on self-reporting. Additionally, the large number of questions in the questionnaires caused participant fatigue, which was unfortunately beyond the researcher's control.

Another limitation is that the sampling technique was more convenient rather than randomized sampling. Such a sampling technique might affect representativeness. Furthermore, convenient pieces impose difficulty in estimating the sampling error. Convenient sampling was a quick and easy way to select participants for the study, but it has its drawbacks.

Conclusion

the results of this study indicate that nursing students have high average scores in self-directed learning and clinical competence, with a weak but significant direct correlation between these two variables. In other words, greater self-directed learning among nursing students corresponds to an increase in clinical competence. The results also indicated a significant direct relationship between the average score of the self-directed learning scale and having work experience, and conversely, a significant inverse relationship with dissatisfaction with the nursing field, as well as poor and very poor academic performance.

In order to enhance clinical competence in nursing students, self-directed learning, which is of main importance, should be considered by professors and administrators in nursing schools. Adding SDL components to the nursing curricula is essential also nursing professors need to teach SDL skills to students through training courses. The results of this study can be used to improve the quality of education and improve the clinical competence of nursing students also improve teaching methods of nursing professors through the use of problem based and student-centered curriculum. Given that an inverse relationship was observed between clinical experience and satisfaction with the profession and poor educational performance with self-directed learning and clinical competence, it is necessary continuously consider measures to develop self-directed learning and, consequently, lifelong learning and improve students' satisfaction with the profession during their studies.

Abbreviations

SRSSDL	Self-Rated Scale of Self-Directed Learning
NCS	Nursing Competence Scale
SDL	self-directed learning
GPA	Grade Point Average

Acknowledgements

The authors extend their gratitude to all the nursing students who took part in this study.

Authors' contributions

Generally R.B.,F.B. and F.H. conceived the idea and designed the study. S.A. performed data collection. F.H. and F.B. performed the statistical analysis and interpretation. R.B., F.B., S.B. and F.H. drafted the manuscript. F.B., F.H. and R.B. reviewed the manuscript. F.H. critically revised the manuscript. All authors have read and approved the final manuscript.

Funding

This study was financially supported by Urmia University of Medical Sciences. The funding part had no role in the design of the study, the collection, analysis and interpretation of the data, or in writing the manuscript.

Data availability

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

Declarations

Ethics approval and consent to participate

This study was approved by the Medical Ethics Committee of Urmia University of Medical Sciences (IR.UMSU.REC.1402.002). The study followed accepted ethical standards, as outlined in the Declaration of Helsinki. From March to June 2023, eligible faculty members were approached to participate in the study. Prior to their involvement, the purpose of the study and instructions for completing the questionnaire were explained to them, and informed consent was obtained from all participants. To ensure confidentiality, the survey was conducted anonymously, safeguarding the privacy of the respondents. Informed consent was obtained from all individual participants included in the study.

Competing interests

The authors declare no competing interests.

Consent for publication

Not applicable.

Received: 9 February 2025 / Accepted: 30 September 2025
Published online: 28 October 2025

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