












## Problem-Solving, Creativity, and Social Skills in Medical Sciences Students: A Cross-Sectional Study

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### Abstract:

**Introduction:** Universities bear the responsibility of preparing graduates with the competency to identify essential needs in evolving societal environments and deliver optimal services through the application of diverse problem-solving methodologies. The present study was conducted with the objective of examining the relationship between problem-solving skills, a creative educational climate, and social skills among students at Shahroud University of Medical Sciences (ShMU).

**Methods:** In this cross-sectional study, 260 students from various medical science disciplines were examined in 2025 using questionnaires assessing social skills, creative educational climate, and problem-solving skills. Data were analysed using Chi-square tests and multiple regression analysis.

**Results:** The mean age of the study participants was  $21.7 \pm 2.9$  years. The mean score for creative educational climate was  $176.7 \pm 3.1$  (above average), problem-solving skills was  $55.8 \pm 7.9$  (at average level), and social skills was  $89.8 \pm 17.6$  (at average level). Only 86 participants (33.1%) demonstrated high social skills. Ninety-three participants (35.8%) possessed reliable problem-solving skills. No significant differences were observed in problem-solving skill levels based on gender, faculty, education level, monthly household income, economic activity concurrent with education, father's occupation, or academic semester. In the final multivariable regression model, social skills (standardized beta = 0.29,  $p$ -value < 0.001) and interest in academic major (standardized beta = 0.22,  $p$ -value < 0.001) emerged as the most significant predictors of problem-solving skills.

**Discussion:** Problem-solving skills and social skills mean scores among students were at moderate levels, and social skills demonstrated a significant impact on problem-solving abilities. Approximately two-thirds of students lacked reliable problem-solving skills.

**Conclusion:** It is recommended that substantial improvements in students' problem-solving skills can be achieved through the implementation of targeted interventions, including educational workshops on learning styles and methodologies, problem-solving and Problem-Based Learning (PBL) classes and workshops for both students and faculty, modifications to learning environments and faculty assessment procedures, and social skills training programs.

**Keywords:** Problem-solving skills, Creative educational climate, Social skills, Medical sciences, Medical sciences students, Monthly household income.

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## 1. INTRODUCTION

Higher education systems play a fundamental role in societal development. Higher education bears the responsibility of preparing graduates with the competency to identify essential needs within evolving societal environments and engage in scholarly activities through the application of diverse thinking methodologies while delivering optimal services [1, 2]. Furthermore, in the 21st century, characterized by the rapid expansion of scientific concepts, traditional teaching methods and the passive positioning of learners within educational environments no longer adequately address the educational needs of the current generation [3, 4]. Therefore, for the proper education of learners, they must be encouraged to engage in free, creative, critical, and scientific thinking and reflection. These programs should be organized in such a manner that students are compelled to become actively involved in problem-solving rather than merely storing scientific facts, and are increasingly equipped with thinking and problem-solving skills for appropriate decision-making and resolution of complex societal issues [5, 6].

In this regard, most universities worldwide, including medical science universities, are seeking educational methods that can facilitate the expansion and enhancement of students' clinical decision-making capacities, continuous learning, and self-directed learning capabilities [7]. In Iran, over the past two decades, the importance of environmental and instructional methods' impact on foundational learning among medical science students has received increased attention, and the quality of the educational environment has been recognized as a significant indicator of educational program effectiveness [8, 9]. Results from several studies indicate that students at the country's medical science universities do not possess an adequate level of problem-solving skills and critical thinking, while this constitutes a necessary prerequisite for making optimal and most appropriate decisions during critical moments in healthcare settings. University educational programs have also failed to enhance students' skill levels in these areas to the extent required [10-13].

Problem-solving typically involves formulating novel responses and transcending the simple application of previously learned rules to achieve solutions. Problem-solving skills, in addition to being an important predictor

of an individual's physical and psychological well-being, constitute a crucial factor in making accurate, reliable, and appropriate decisions regarding treatment or care in healthcare services and improving service quality. This skill enables students to learn how to apply knowledge in real and complex situations practically, rather than merely memorizing it [14, 15].

Problem-solving represents the ability to comprehend questions and systematically progress through the stages of their resolution. Problem-based learning is fundamentally an active learning methodology that encompasses five distinct phases: problem focus and identification with a comprehensive problem description (Problem Identification), information gathering and development of alternative solutions (Generate Alternate Solutions), solution testing and decision-making (Decision Making), Implementation, and Evaluation of the outcomes [16-18].

Problem-solving abilities and critical thinking constitute essential competencies required of medical students and are fundamental components in healthcare professions for enhancing the quality of care, improving performance, and generating innovative ideas [19-22]. Our students require competencies that enable them to transcend textbook content and engage in the evaluation and analysis of available information [23]. Therefore, the development of problem-solving skills in a highly technical, scientific, and complex modern society is critically important and constitutes one of the primary objectives of higher education systems. One of the key factors that enhances problem-solving thinking is the establishment of a creative educational environment and atmosphere [17, 24-27].

The educational environment encompasses a constellation of attitudes, emotions, and behaviors that influence innovation, satisfaction, and individual effectiveness [28]. The learning environment possesses multiple dimensions, including curriculum implementation methodologies, faculty attitudes toward learning, the behavioral and organizational culture of the educational institution, and student perspectives regarding faculty. The aforementioned factors collectively create a quality and condition referred to as the educational climate [29]. The creative educational climate represents one of the most significant factors influencing student success and satisfaction, serving as a determinant of behavioral

patterns among students. It profoundly impacts student satisfaction, academic achievement, and social behaviors. Consequently, efforts to obtain feedback from students regarding their perceptions of educational environments and their social skills are essential for reviewing and optimizing the educational milieu [8, 9]. In an efficient educational system, instructional processes must be continuously reviewed in light of contemporary educational approaches, problem-solving skills, and interactive learning methodologies, thereby creating an educational environment where students possess requisite social skills and engage in creative thinking and action [30]. Therefore, it is imperative that awareness programs for faculty members and educational administrators be emphasized and regarded as significant, with consideration given to understanding methods for enhancing creativity manifestation, problem-solving approaches, and promoting social skills among learners [3, 29]. Research findings demonstrate that individuals possessing superior social skills perform creative tasks with greater facility [6, 31].

It can be asserted that the university period represents a life phase during which major transformations, such as social changes and their associated roles, occur in individuals at their most intense possible manifestation [32]. Social skills constitute instruments that enable individuals to establish communication, learn, seek assistance, fulfil their needs through appropriate methods, collaborate and cooperate with others, develop friendships, foster healthy relationships, recognize their strengths and weaknesses within society, practice self-care, and generally interact harmoniously with society [6, 33]. Medical students, given their professional circumstances, require social skills to establish appropriate and effective relationships with clients and patients. Indeed, social skills facilitate their adaptation to the creative process that occurs in creative problem-solving [6, 34], and education can be effective in enhancing individuals' social skills [35]. Results from a study conducted in Iran reported students' social skills levels as moderate [36], while another study in southeastern Iran reported them as low [37]. Another study has addressed the relationship between social skills and problem-solving skills among nursing students [38].

One of the critical information sources for assisting administrators in decision-making regarding public health issues and their correlation with other social matters is the extraction of data from students and the collection of their responses [39]. Problem-solving skills and a creative educational atmosphere have not been studied in Shahroud universities. Therefore, given the significance of this topic and the absence of studies conducted in this field in Shahroud (northeastern Iran), the present study was undertaken to investigate the sociodemographic predictors of problem-solving skills and their relationship with creative educational climate, and social skills among medical sciences students at Shahroud University of Medical Sciences.

## 2. METHODS

In this cross-sectional study conducted in 2025, a total of 260 students from 1700 students who were studying in the various medical sciences disciplines were examined using cluster random sampling methodology. Initially, a comprehensive list of active classes from each of the four schools (School of Medicine, School of Allied Health Sciences, School of Nursing, Midwifery, and School of Public Health) was compiled, specifying the discipline, semester, and number of students per class. Subsequently, based on the average number of students per class, 15 classes with almost 335 students were randomly selected from 60 active classes (with few students across higher education disciplines, each discipline was treated as a single class). Following this selection, research assistants visited each selected class and explained the study objectives, whereupon students who expressed willingness to participate completed the questionnaires. All students were requested to respond to all questions and were provided guidance by research assistants in cases of ambiguity. Considering the presence of students and their willingness to participate in the study, 265 student questionnaires were ultimately distributed during January to March of 2025. Of the 265 questionnaires distributed, 260 participants provided complete responses to all questions. The inclusion criteria for the study comprised: active enrolment status at the time of the study, willingness to participate in the research, and provision of informed consent for study participation. Medical students in their internship period were excluded from this study.

### 2.1. Data Collection Instruments

This study employed three questionnaires. The questionnaires included a series of sociodemographic questions encompassing gender, age, academic discipline, educational level, place of residence, and economic status, as well as specific questions on problem-solving skills, a creative educational climate, and social skills among students.

#### 2.1.1. Problem-Solving Questionnaire

The Persian version of this questionnaire comprises 16 items scored on a five-point Likert scale ranging from 1 to 5 (never, very rarely, sometimes, often, and very often) [40, 41]. Items 8, 11, 12, and 16 are reverse-scored. The minimum possible score is 16, and the maximum is 80. Based on final scores, individuals are categorized into three ranges: 16 to 37 (intuitive), 38 to 58 (unplanned), and 59 to 80 (reliable planned approach). The characteristics and features of individuals in each range are as follows:

a) Individuals scoring between 16 and 37 demonstrate the following characteristics in creative problem-solving. Rather than seeing problems as opportunities for necessary and stimulating change, these individuals tend to view the existence of problems more negatively. Their approach to problem-solving is predominantly intuitive, with limited utilization of systematic and organized methodologies for problem resolution. This intuitive

approach has likely resulted in poor problem-solving experiences in the past. These individuals could achieve greater success through increased practice and implementation of systematic approaches to problem-solving.

b) If individuals obtain scores between 38 and 58, they demonstrate the following characteristics in creative problem-solving. These individuals employ a random and unplanned approach to problem-solving. Sometimes their problem solutions are effective, while at other times they are not. Although these individuals recognize the importance of systematic problem-solving methods and understand what should be done, they do not consistently utilize systematic problem-solving processes. If they endeavour to continuously and consistently employ systematic problem-solving methods, they will perform significantly more successfully in problem resolution.

c) If individuals obtain scores between 59 and 80, they demonstrate the following characteristics in creative problem-solving. They are reliable in problem resolution. They allocate adequate time to understand the nature of problems. They comprehend effective decision-making criteria and make sound choices. Due to their systematic approach to problem-solving, they make well-considered decisions based on temporal requirements. They demonstrate effective planning and implementation capabilities. These individuals, through further development of problem-solving skills, can initiate beneficial innovations within their organizations [41]. The reliability of this questionnaire was assessed in the study by Zare and colleagues using test-retest methodology ( $r = 0.76$ ) and Cronbach's alpha coefficient (Alpha coefficient = 0.88) [41]. In the present study, the Cronbach's alpha coefficient for this questionnaire was calculated as 0.72.

### **2.1.2. Creative Educational Climate Assessment Questionnaire**

The Persian version of this questionnaire comprises 55 items based on Ekvall's ten components. These components include the following:

Challenge (8 questions (1-8)), Freedom (6 questions (9-14)), Idea Support (6 questions (15-20)), Trust/Openness (11 questions (21-31)), Debates (6 questions (32-37)), Conflicts (5 questions (38-42)), Risk Taking (4 questions (43-46)), Idea Time (4 questions (47-50)), Dynamism/Liveliness (3 questions (51-53)), and Playfulness/Humour (2 questions (54-55)). The questionnaire is scored using a 5-point Likert scale: strongly agree = 5, agree = 4, no opinion = 3, disagree = 2, and strongly disagree = 1 [28, 42]. The lower threshold of scores is 55, the moderate threshold is 165, and the upper threshold is 275, where low scores indicate minimal utilization of the creative climate and high scores represent maximum utilization of the creative climate [3]. In the research conducted by Mohebi Amin and colleagues (2013), the face and content validity of this scale was confirmed by university faculty members. Cronbach's alpha coefficient was employed to assess the reliability of the scale, which was reported as 0.81 [42]. In the study by Hosseini and colleagues, an alpha of 0.9 was reported [43]. In the present study, the Cronbach's alpha coefficient was calculated as 0.95.

### **2.1.3. Social Skills Questionnaire**

The Persian version of this questionnaire consists of 39 items and has been validated by Amini [44]. It comprises two subscales: Desirable Social Behaviors (20 questions) and Antisocial Behaviors (19 questions) [36, 45]. The questionnaire is scored using a 6-point Likert scale, including the options: "not true at all" = 0, "very rarely true" = 1, "somewhat true" = 2, "moderately true" = 3, "mostly true" = 4, and "always true" = 5. This questionnaire contains two subscales: the Desirable Social Behaviors subscale with 20 questions (3, 6, 7, 9, 11, 15, 17, 18, 24, 25, 26, 28, 29, 30, 33, 34, 35, 37, 38, 39) and the Antisocial Behaviors subscale with 19 questions (1, 2, 4, 5, 8, 10, 12, 13, 14, 16, 19, 20, 21, 22, 23, 27, 31, 32, 36) [36]. The scoring range of the questionnaire is 0-195 with a mean of 98 [45]. The evaluation method for individual social skills using this questionnaire is as follows: if an individual's score is above the mean, they possess high social skills, and if below the mean, they have low social skills [36]. The validity and reliability of the Persian version of the questionnaire have been confirmed in various studies conducted in Iran [46, 47]. The Cronbach's alpha coefficient for assessing the reliability of the Persian version of the questionnaire has been reported as 0.84. In the present study, the Cronbach's alpha coefficient was calculated as 0.81.

## **2.2. Ethical Considerations and Data Analysis Methods**

The questionnaires were completed through self-administration by trained researchers following an explanation of the study objectives, an introduction of the researcher and principal investigator, and voluntary consent from students to participate in the study. The protocol of this study was approved by the Ethics Committee of Shahrood University of Medical Sciences under code IR.SHMU.REC.1403.166. The questionnaires were anonymous and without identifying marks; participants were free to participate in the study, and informed consent was obtained.

### **2.3. Statistical Analysis**

Following data collection, the data were entered into SPSS version 16 software and analysed. In the univariate analysis, the relationship between qualitative predictor variables and the levels of problem-solving skills, social skills, and educational creative climate was evaluated using the chi-square test. To investigate the relationship between sociodemographic factors and problem-solving skills as the final outcome, a multivariate regression model was used. In this model, all covariates with  $p$ -values less than 0.2 in the univariate model were entered into the multivariable regression model. The significance level was set at 0.05 for all tests.

## **3. RESULTS**

Examination of the study population regarding measured variables revealed that 192 individuals (73.8%) were female, and the remainder were male. The mean age

of study participants was  $21.7 \pm 2.9$  years. The distribution by faculty included 49 students (18.8%) from the School of Public Health, 88 students (33.8%) from the School of Medicine, 53 students (20.4%) from the School of Nursing and Midwifery, and 70 students (26.9%) from the School of Allied Health Sciences. The majority of students were enrolled at the undergraduate level (169 students, 65%), followed by doctorate medical students (85 students, 32.6%), with the remaining students pursuing master's and PhD degrees. The majority of students (255 individuals, 98.1%) were single, and most (244 individuals, 93.8%) were non-native residents. Family income for 18 individuals (6.9%) was less than \$150, while 144 individuals (55.4%) had family incomes above \$300 per month. A total of 55 individuals (21.2%) were employed alongside their studies. The occupation of fathers for 121 individuals (41.5%) was self-employment, with the remainder being employed. A total of 150 individuals (57.7%) were enrolled in semesters 1-4, with the remainder pursuing studies in semester 5 and higher. More than half of the students (150 individuals, 58.5%) expressed a strong interest in their academic discipline. A total of 150 individuals (57.7%) lived in four-member households.

The mean scores were  $176.7 \pm 3.1$  for creative educational climate,  $55.8 \pm 7.9$  for problem-solving skills, and  $89.8 \pm 17.6$  for social skills. A total of 4 individuals (1.5%) demonstrated low social skills, 170 individuals (65.4%) demonstrated moderate social skills, and 86 individuals (33.1%) possessed high social skills. Regarding problem-solving skills, 3 individuals (1.2%) exhibited intuitive problem-solving, 164 individuals (63.1%) demonstrated unplanned problem-solving, and 93 individuals (35.8%) possessed reliable problem-solving skills. A total of 83 individuals (31.9%) reported the educational environment climate as moderate in terms of

creativity, while 177 individuals (68.1%) reported it as high. The means and standard deviations of selected variables are presented in Table 1.

**Table 1. Mean and standard deviation of age, semester, and social skills, problem-solving, and creative climate and their dimensions.**

Variable	Mean $\pm$ SD	Min	Max
Age	21.7 $\pm$ 2.9	18	52
Semester	5.2 $\pm$ 2.9	1	14
Social skills	89.8 $\pm$ 17.6	0	139
Social behaviors	63.1 $\pm$ 13.2	0	90
Antisocial behaviors	26.7 $\pm$ 12.2	0	66
Problem-solving skills	55.8 $\pm$ 7.9	32	75
Creative educational climate	176.7 $\pm$ 31.1	66	275
Challenge	26.1 $\pm$ 6.0	8	40
Freedom	19.6 $\pm$ 4.9	6	30
Idea support	19.8 $\pm$ 4.7	6	30
Trust /openness	35.4 $\pm$ 8.2	14	55
Debates	21.0 $\pm$ 4.5	6	30
Conflicts	15.8 $\pm$ 3.1	5	25
Risk taking	12.4 $\pm$ 2.5	4	20
Idea time	13.1 $\pm$ 3.3	4	20
Dynamism/liveliness	8.0 $\pm$ 2.6	3	15
Playfulness / humor	5.6 $\pm$ 2.2	2	10

The comparison of problem-solving skills according to socio-demographic variables in Table 2 demonstrated that there were no significant differences in problem-solving skill levels based on gender, faculty, education, monthly household income, economic activity concurrent with education, father's occupation, and academic semester. A significant difference was observed between problem-solving skill levels and interest in their academic discipline ( $p$ -value 0.004).

**Table 2. Examination of the relationship between socio-demographic variables and problem-solving skills, social skills, and educational creative climate.**

Variables	Problem-Solving Skills		Social Skills		Educational Creative Climate	
	Unplanned	Planned	Low	High	Moderate	High
<b>Gender</b>	-	-	-	-	-	-
Female	121(63)	71(37)	136(70.8)	56(29.2)	62(32.3)	130(67.7)
Male	46(67.6)	22(32.4)	38(55.9)	30(44.1)	21(30.9)	47(69.1)
$\chi^2$ ( $p$ -value)	0.47(0.56)	-	5.07(0.02)	-	0.05(0.88)	-
<b>Faculty</b>	-	-	-	-	-	-
Public health	32(65.3)	17(34.7)	36(73.5)	13(26.5)	11(22.4)	38(77.6)
Medicine	56(63.6)	32(36.4)	56(63.6)	32(36.4)	46(52.3)	42(47.7)
Nursing and midwifery	35(66)	18(34)	31(58.5)	22(41.5)	8(15.1)	45(84.9)
Para-medicine	44(62.9)	26(37.1)	51(72.9)	19(27.1)	18(25.7)	5(74.3)
$\chi^2$ ( $p$ -value)	0.17(0.98)	-	4.19(0.24)	-	26.94(<0.001)	-
<b>Education</b>	-	-	-	-	-	-
Bachelor's degree	110(65.1)	59(34.9)	115(68)	54(32)	37(21.9)	132(78.1)
Master's degree and above	57(62.6)	34(37.4)	59(64.8)	32(35.2)	46(50.5)	45(49.5)
$\chi^2$ ( $p$ -value)	0.16(0.69)	-	0.28(0.60)	-	-	22.35(<0.001)
<b>Monthly family income</b>	-	-	-	-	-	-

(Table 2) contd.....

Variables	Problem-Solving Skills		Social Skills		Educational Creative Climate	
	Unplanned	Planned	Low	High	Moderate	High
Below \$150	12(66.7)	6(33.3)	13(72.2)	5(27.8)	4(22.2)	14(77.8)
\$150- \$300	63(64.3)	35(35.7)	62(63.3)	36(36.7)	28(28.6)	70(71.4)
More than \$300	92(63.9)	52(36.1)	99(68.8)	45(31.3)	51(35.4)	93(64.6)
$\chi^2$ (p-value)	0.05(0.97)	-	1.04(0.59)	-	2.10(0.35)	-
<b>Economic activity concurrent with education</b>	-	-	-	-	-	-
No	132(64.4)	73(35.6)	142(69.3)	63(30.7)	69(33.7)	136(66.3)
Yes	35(63.3)	20(36.4)	32(58.2)	23(41.8)	14(25.5)	41(74.5)
$\chi^2$ (p-value)	0.01(0.92)	-	2.41(0.12)	-	1.34(0.25)	-
<b>Father's occupation</b>	-	-	-	-	-	-
Self-employed	81(66.9)	40(33.1)	79(66.3)	42(34.7)	41(33.9)	80(66.1)
Government employee	86(61.9)	53(38.1)	95(68.3)	44(31.7)	42(30.2)	97(69.8)
$\chi^2$ (p-value)	0.72(0.39)	-	0.27(0.60)	-	-	0.40(0.53)
<b>Interest in academic dicipline</b>	-	-	-	-	-	-
Low	16(76.2)	5(23.8)	16(76.2)	5(23.8)	13(61.9)	8(38.1)
Moderate	66(75.9)	21(24.1)	61(70.1)	26(29.9)	31(35.6)	56(64.4)
High	85(55.9)	67(44.1)	97(63.8)	55(36.2)	39(25.7)	113(74.3)
$\chi^2$ (p-value)	11.01(0.004)	-	1.88(0.39)	-	11.98(0.003)	-
<b>Semester</b>	-	-	-	-	-	-
1-4	81(65.9)	42(34.1)	82(66.7)	41(33.3)	26(21.1)	97(78.9)
4-8	70(61.4)	44(38.6)	77(67.5)	37(32.5)	43(37.7)	71(62.3)
>8	16(69.6)	7(30.4)	15(65.2)	8(34.8)	14(60.9)	9(39.1)
$\chi^2$ (p-value)	0.82(0.66)	-	-	0.05(0.97)	-	17.2(<0.001)

**Table 3. Regression model for determining predictors of problem-solving skills in medical sciences students.**

Variables	$\beta$	SE	Standardized Coefficients Beta	t-test	p-value
Social skills	0.13	0.03	0.29	5.02	<0.001
Interest in academic discipline	2.77	0.72	0.22	3.86	<0.001
Constant	39.87	2.47	-	16.17	<0.001

No significant differences were observed between social skill levels according to faculty, educational level, monthly household income, economic activity concurrent with education, father's occupation, interest in their academic discipline, and academic semester. A significant difference was observed between social skill levels and gender, with males demonstrating higher social skills compared to females (Table 2).

The comparison of educational creative climate status according to socio-demographic variables in Table 2 demonstrated that there were no significant relationships between educational creative climate status (moderate and high) and gender, monthly household income, economic activity concurrent with education, or father's occupation. Significant relationships were observed between educational creative climate status and interest in their academic discipline, faculty, education level, and academic semester.

In the final regression model, variables including educational creative climate, social skills, age, gender, faculty, education level, monthly household income, having economic activity alongside education, father's occupation, interest in academic discipline, academic

semester, and household size were entered into the model. Ultimately, social skills and interest in academic discipline remained in the model as the most important predictors of problem-solving skills (Table 3).

**4. DISCUSSION**

The mean score for problem-solving skills was 55.8 ± 7.9. The majority of participants (64.3%) did not possess adequate problem-solving skills. In another study using a different questionnaire with a score range of 32 to 192, the mean problem-solving score was 72.4 ± 20.1, 92.2 ± 19.5, and 17.7% demonstrated moderate to satisfactory problem-solving skills [48, 49]. The low level of problem-solving skills is consistent with our findings. In this study and another Iranian study, the mean score of problem-solving skills is higher than our study's mean estimation [12, 49]. In other studies, conducted in Turkey using different questionnaires with score ranges of 35 to 210, mean problem-solving skill scores of 89.9 ± 17.3 and 88.4 ± 18.8 were reported, which differ from our results [14, 38]. However, regarding the low level of problem-solving skills observed across the aforementioned studies, the present study is consistent. In another study conducted in

Iran using a different questionnaire with a score range of 35 to 210, the mean problem-solving skills score was reported as  $138.0 \pm 25.4$ , which is over the mean score of our results [50]. Although differences in research environments, different instruments for measuring problem-solving skills, and social and cultural conditions of research settings may account for the variation in results, it appears that the status of problem-solving skills in all studies does not demonstrate a satisfactory condition, which is consistent across all similar studies. As previously mentioned, problem-based learning is a student-centred educational strategy in which students collaboratively analyse educational problems and reflect on their experiences. Given the scores obtained by students, it appears that the status of problem-solving skills is not satisfactory and requires greater efforts for improvement.

The mean score for educational creative climate was  $176.68 \pm 3.14$ . In another study conducted in eastern Iran, using a completely similar questionnaire, the mean educational creative climate score was reported as  $176.5 \pm 29.7$ , which is similar to the results of the present study [3]. A total of 83 participants (31.9%) reported the educational environment climate as moderate in terms of creativity, and 177 participants (68.2%) reported it as high. In other studies, the status of the university's educational climate in terms of creativity was reported as satisfactory by the majority of students [51-53], which is consistent with our results. In another study conducted on one of Iran's medical sciences universities' students using a different questionnaire with a score range of 28-140, the mean educational creative climate was  $72.81 \pm 11.72$ , and the status of the educational creative climate was reported as moderate, which is not consistent with our results [54-57].

Improving the quality of the educational creative environment and the effectiveness of educational programs leads to increased student learning capacity, enhanced interest in learning, better learning outcomes, improved academic achievement, and increased sense of well-being among students [56]. Although differences in the instruments used, diverse educational, cultural, and social environments, and variations in study samples, types of disciplines, and universities studied may account for the differences in results. Diversity in teaching methods, specific modifications to curriculum, faculty utilization of new and innovative teaching strategies, and continuous employment of creative teaching approaches can contribute to improving the educational environment.

The mean score for social skills was  $89.8 \pm 17.6$ . The scores of most students were at a moderate level of social skills. In a study conducted in Turkey using a different questionnaire with a score range of 90-450, the mean social skills score was  $280.3 \pm 2.7$  [38]. In another study using a 40-item questionnaire with a score range of 40-120, the mean social skills score was  $45.3 \pm 8.0$  and was reported as low, which is not consistent with our results [34]. In another study using a questionnaire completely similar to our study, the mean social skills

score was 99.21 and reported as moderate, which is similar to the present study [36]. Social skills encompass learned and socially acceptable behaviours that facilitate mutual communication and result in positive responses while avoiding negative ones. These behaviours not only enable the initiation and continuation of mutual and positive relationships with others, but also create the ability to achieve goals and communicate with others, causing individuals to behave in a manner that others perceive as competent and self-efficacious [34, 58]. Given the moderate score of students' social skills, there is a need for greater attention to this issue, and conducting educational workshops on lifestyle and social skills could help further improve the situation.

A significant relationship was observed between problem-solving skill levels and interest in academic discipline. In a study conducted in Turkey, no significant associations were observed between problem-solving skills and age, marital status, work experience, or education level, which is consistent with our results [21]. In a study conducted in Iran, no significant relationship was observed between problem-solving skills and gender, which is consistent with our findings [59].

No significant differences were observed between educational creative climate levels according to gender, monthly household income, economic activity concurrent with education, and father's occupation. In another study conducted in Iran, no significant relationship was observed between gender and educational creative climate, which is consistent with our results [55]. In studies conducted in Iran, relationships existed between educational creative climate and gender and age, which are not consistent with our results regarding age [53, 54, 56]. In the present study, significant relationships were observed between educational creative climate levels and interest in academic discipline, faculty, education, and academic semester. In another study conducted using a different instrument with a score range of 0-200, a significant relationship was observed between educational creative climate and academic semester, which is consistent with our results [56].

In the final regression model, social skills and interest in academic discipline were the most important predictors of problem-solving skills. In a study conducted in Iran, a significant relationship existed between educational creative climate and problem-solving skills, which is not consistent with our results [60]. Results from studies conducted in Indonesia and Turkey reported relationships between social skills and problem-solving skills, which are consistent with our findings [6, 14, 38]. Another study conducted in Turkey on nursing students revealed that problem-solving skills are an important prerequisite for the level of social skills [61]. It appears that modifications to the learning environment and assessment procedures implemented by faculty members may create conditions conducive to students' inclination toward problem-solving approaches. Therefore, it is recommended that learning styles and methodologies be taught to both students and university faculty during educational and continuing

education programs. In designing curriculum and educational content for medical sciences students, problem-solving styles should be considered in addition to learning and study approaches [59].

## 5. STUDY LIMITATIONS

This study had several limitations. We employed a cross-sectional research design to examine the relationships between variables. This analytical approach restricts the ability to make causal inferences, and definitive conclusions regarding factors influencing problem-solving cannot be drawn with high certainty. Furthermore, the study sample comprised students enrolled at Shahroud University of Medical Sciences (affiliated with the Ministry of Health, Treatment, and Medical Education); therefore, the generalizability of findings to students at other universities under the supervision of the Ministry of Science and Islamic Azad University is limited due to the restriction of the study to a single university. Finally, all questionnaires were completed as self-reports, which can lead to self-report bias. The robust study design, comprehensive coverage of all faculties within the medical sciences university, appropriate sample size, and utilization of standardized questionnaires constitute the strengths of this investigation.

## CONCLUSION

Problem-solving and social skills among students were at a moderate level, with social skills demonstrating an influence on problem-solving abilities. Approximately two-thirds of students did not possess reliable problem-solving skills. Therefore, it is recommended that interventions such as conducting educational workshops on learning styles and methodologies, organizing problem-solving and Problem-Based Learning (PBL) classes and workshops for both students and faculty, implementing modifications to the learning environment and faculty assessment procedures, and providing instruction in social skills and lifestyle management to students could substantially contribute to the enhancement of their problem-solving capabilities.

## AUTHORS' CONTRIBUTIONS

The authors confirm contribution to the paper as follows: M.A., A.K.: Study conception and design; M.R.G., H.R., M.S., R.R.: Data collection; M.A., A.K.: Analysis and interpretation of results; E.S., F.S., N.S., M.A., E.S.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

## LIST OF ABBREVIATIONS

S.E. = Standard Deviation

Sh.M.U. = Shahroud University of Medical Sciences

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study received approval from the Ethics Review Board of Shahroud University of Medical Sciences, Iran under the reference code IR.SHMU.REC.1403.166.

## HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

## CONSENT FOR PUBLICATION

Informed consent was obtained from all subjects after explaining the goals of study.

## STANDARDS OF REPORTING

STROBE guidelines were followed.

## AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available on request the corresponding author [A.K].

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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