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Perceptions of medical faculty students: The effect of problem-based learning on self-regulated learning skills

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ABSTRACT

Objective: Self-regulated learning (SRL) is defined as the entirety of emotions, thoughts, and behaviours that individuals display in order to achieve their goals during the developmental period. Problem-based learning (PBL), used in medical education, is an educational model based on complete and sufficient learning. The aim of the study was to determine the perception of students from a medical faculty that applies the PBL education model on their self-regulation abilities. Investigating whether there is a difference in the students' perception on their self-regulation abilities between the first and third year of PBL education and examining if there is a difference in female and male students regarding their perception on their self-regulation abilities are also among the purposes.

Material and Methods: The 453 students participated in the study, 253 from the first-year students and 200 from the third-year students. The "Self-Regulated Learning Skills of Students" scale was used in the study and the Cronbach's alpha values were between 0.839-0.942.

Results: In the comparison of Self-Regulated Learning Abilities of Students Scale score averages of first-year and third-year students, statistically significant high scores were identified in third-year students compared to first-year students in 4 of the 23 parameters in the scale.

Conclusion: Self-regulation of third-year students' high scores in four parameters can be considered to be related to PBL gains. When the Self-Regulated Learning Abilities of Students Scale score averages were compared according to gender, statistically significant high scores were found in 7 of the 23 parameters in females.

Keywords: Problem Based Learning, Self-regulated, Medical Education, Students' Perception, Gender

INTRODUCTION

Motivation is one of the most important factors of being successful for students (**1**). When the factors affecting motivation are examined, the limitations of traditional education and the importance of the student having an effective and proactive role in the learning process stands out (**2**). In education programs where the students are proactive, the individuals develop their own learning strategies. These strategies establish the concept of self-regulated learning. The concept of self-regulated learning is based on the principle of the individual learning how to learn. Many studies have been conducted on the purpose and development process of self-regulated learning (**3-5**). The concept of self-regulation was first brought up by important education theoreticians such as William James, Lev Vygotsky and Jean Piaget (**6**). Self-regulated learning is defined as "the entirety of emotions, thoughts and behaviours that individuals display in order to achieve their goals during the developmental period" (**5, 7**). Self-regulated learning is defined as a process where the learner is motivationally, behaviourally and cognitively proactive in the learning process (**8**).

Self-regulated learning is considered as a necessary requirement of lifelong learning (**9**). Those who learn with self-regulation have high motivation and can manage their own learning processes. They regulate their own cognitive levels, motivations and behaviours in accordance with their learning goals (**4**).

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They choose the best strategy to achieve their goals, manage time well and can develop new strategies if necessary and apply them during the process. In situations when they are unsuccessful, they analyse the reasons and search for ways to increase their success. They do not see obstacles resulting from the education environment, instructor shortcomings, lack of resources or other various reasons as obstacles for their success and find ways to be successful. They believe in cooperation and think that the right communication with friends will increase their success (**4, 10**).

The instructor's role in self-regulated learning is to help students develop lifelong learning strategies, ensure that the students participate in the learning environment, and guide them in choosing the right goals. Instructors should ensure that the students perform self-evaluations during the evaluation process. They also perform the feedback and grading processes together for the performance evaluation (**11, 12**).

Problem Based Learning is a student-centered learning method. PBL, used in medical training, is an educational model that aspires to help students recognize the problems they might encounter throughout their careers, comprehend their importance and understand their emergence mechanisms, develop their problem-solving abilities and solve their problems. It is an educational model based on complete and sufficient learning, applied with small groups guided by an instructor (**13**). In PBL, a clinical problem or a disease is discussed through a scenario and the goals regarding the subject are identified. Student conduct research using current resources in order to solve the problem and share the information they acquired during their independent studying with their peers in the education environment. They discuss them and reach a conclusion. The purpose of PBL in addition to the students acquiring problem solving abilities is gaining self-regulation abilities, and accessing information, inquiring and critical thinking, debating, communication skills (**13-16**). During the PBL process, the students attain self-learning awareness and learn how to learn (**17**). PBL has learning outcomes such as the students having increased self-learning abilities and learning motivation, problem solving skills (**14, 18-19**).

PBL was first applied as an education model in 1969, in McMaster University (**20**). In Turkey, it was first applied in Dokuz Eylül University Medical Faculty (DEUMF) in 1997. In DEUMF's curriculum, the PBL sessions are the core of educational activities and the first three years of education is carried out with PBL. The education program of the DEUMF has been prepared according to cognitive and behavioural perspectives. PBL sessions are aimed at structuring new information on students' previous knowledge and using their knowledge in decision making, questioning and problem solving activities. Students learn new things, concepts, use their knowledge, and notice where to use them and better understand, and improve their analysis, synthesis and problem solving skills in PBL sessions. It is aimed to learn basic concepts in medicine in first year, to learn normal structure, function and behaviour in second year, to learn abnormal structure, function and behaviour in third year. Unlike the classical teacher-centered approach, the education program of DEUMF gained importance for them to learn how to use, to assume their self-learning responsibilities and to realize their learning needs (**21**).

Regularly receiving student opinions are quite important in medical education program (**22**). This study was designed with these purposes given below.

1 Determining the perception on self-regulation abilities of students from a medical faculty that applies a PBL education model,

2 Investigating if there is a difference in the students' perception on their self-regulation abilities between the first year of PBL education and at the end of the third year of their education, the term right before clinical education,

3 Evaluating female and male students' perceptions regarding their self-regulation abilities and examining differences if there are any.

MATERIAL and METHODS

The cross-sectional and analytical study was conducted through a survey form given simultaneously at the end of the 2015-2016 academic year to students who completed the DEUMF first-year and third-year programs. Within the scope of the study, 68.8% (253 students) of the First-year students and 62.9% (200 students) of the Third-year students were reached. The total number of students was 453. The survey form consisted of questions involving basic demographic features, open-ended questions and scales that had their validity and reliability studies conducted. The scale used in the study was Self-Regulated Learning Abilities of Students and the Cronbach's alpha values were between 0.839-0.942 (**23**).

Descriptive statistics and the test of significance between two means were used in the evaluation of the data. The research data were analysed using the SPSS 15.0 statistics program. The significance level for all statistical processes was accepted as 0.05. The survey was rated using a 5-point Likert scale. The score averages of the scales were evaluated as 1-2: Low, 3: Moderate, 4-5: High.

Ethical Considerations

The study was approved by Dokuz Eylül University Non-Interventional Research Ethics Committee, Turkey (2015/04-21). Before the PBL sessions began, the researchers explained that participation was voluntary and requested written, informed consent, which the participants provided.

RESULTS

The mean age of the students in the research group was 18.9±0.85 for first-year students, and 21.15±1.30 for third-year students. 44.2% of the research group female, 55.8% male. The students' average values in the Table were evaluated as being between 3.07 and 4.03 out of 5. According to the Table the highest scores were given to the parameters; having the necessary skills for success, being open to new ideas in their learning process, being responsible, deciding on their own learning strategies, respectively. It was determined that the lowest score was given to enjoyment of struggling with difficulties during the learning process (**Table 1**). In the comparison according to gender, it was found that the scores of female students were statistically significantly higher than

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that of male students in terms of the parameters; being responsible, having self-discipline, enjoyment from studying, setting learning necessities and goals, planning the learning process, marking important points while reading texts, summarizing texts and asking for help when there is a problem cannot be solved in the learning process. On the other hand, it was determined that the scores of female students were significantly low on the parameter enjoyment of struggling with difficulties during the learning process (**Table 2**).

In the comparison of Self-Regulated Learning Skills of Students Scale score averages for the first-year and third-year students, the scores of third-year students were determined to be statistically significantly high compared to that of first-year students in terms of the parameters; being responsible, planning the learning process, marking important points while reading texts, monitoring their own development regarding their goals (**Table 3**).

Table 1. Distribution of Self-Regulated Learning Skills Scores for All Medical Students (n=453).

Parameters	Mean±SD
Personal expectation regarding academic success	3.75±0.94
Having necessary skills necessary for success	4.03±0.83
Being responsible	3.96±0.85
Having self-discipline	3.78±0.91
Enjoyment from studying	3.18±1.04
Setting learning necessities and goals	3.67±0.90
Planning the learning process	3.66±0.98
Prioritizing what they will study	3.85±0.92
Choosing the best method for learning	3.64±0.93
Deciding on their own learning strategies	3.94±0.85
Marking important points while reading texts	3.90±0.96
Repeating new information	3.51±0.93
Summarizing read texts	3.15±1.08
Using different learning sources	3.48±0.95
Having good time management while studying	3.25±0.91
Monitoring its own development in line with the goals	3.47±0.82
Enjoyment from obtaining information beyond their defined goals	3.50±0.93
Being open to new ideas in their learning processes	4.02±0.80
Willingness to take suggestions from others while learning	3.78±0.91
Enjoyment of struggling with difficulties during the learning process	3.07±1.04
Looking for possible solutions when a problem/difficulty is encountered	3.72±0.83
Asking for help when there is a problem they cannot solve in the learning process	3.63±0.87
Being able to determine their strength and weaknesses by evaluating their own performance	3.80±079

Table 2. Comparing the Students' Self-Regulated Learning Skills Scores According to Gender

Parameters	**Female**	**Male**	**t**	**p**
	Mean±SS	**Mean±SS**		
Personal expectation regarding academic success	3.75±0.91	3.75±0.96	0.002	0.999
Having necessary skills necessary for success	3.98±0.75	4.07±0.89	1.160	0.247
Being responsible	4.09±0.78	3.86±0.89	2.882	0.004
Having self-discipline	3.89±0.82	3.68±0.97	2.580	0.010
Enjoyment from studying	3.32±0.95	3.06±1.09	2.584	0.010
Setting learning necessities and goals	3.76±0.84	3.59±0.94	2.048	0.041
Planning the learning process	3.77±0.91	3.58±1.00	2.013	0.045
Prioritizing what they will study	3.91±0.88	3.79±0.95	1.281	0.201
Choosing the best method for learning	3.58±0.91	3.69±0.95	1.234	0.218
Deciding on their own learning strategies	3.88±0.83	3.98±0.87	1.251	0.211
Marking important points while reading texts	4.07±0.78	3.77±1.06	3.388	0.001
Repeating new information	3.51±0.89	3.51±0.96	0.049	0.961
Summarizing read texts	3.32±0.99	3.01±1.12	3.078	0.002
Using different learning sources	3.47±0.87	3.49±1.01	0.339	0.735
Having good time management while studying	3.26±0.85	3.24±0.95	0.162	0.872
Monitoring its own development in line with the goals	3.47±0.72	3.47±0.88	0.018	0.986
Enjoyment from obtaining information beyond their defined goals	3.43±0.89	3.56±0.96	1.448	0.148
Being open to new ideas in their learning processes	3.96±0.75	4.07±0.85	1.534	0.126
Willingness to take suggestions from others while learning	3.77±0.87	3.78±0.94	0.117	0.907
Enjoyment of struggling with difficulties during the learning process	2.95±0.99	3.17±1.07	2.212	0.027
Looking for possible solutions when a problem/difficulty is encountered	3.68±0.77	3.74±0.86	0.858	0.391
Asking for help when there is a problem they cannot solve in the learning process	3.76±0.81	3.53±0.91	2.745	0.006
Being able to determine their strength and weaknesses by evaluating their own performance	3.84±0.72	3.77±0.85	1.030	0.304

Table 3. Comparing First-year and Third-year Students' Self-Regulated Learning Skills Scores

Parameters	First-year Mean±SS	Third-year Mean±SS	t	p
Personal expectation regarding academic success	3.71±0.96	3.79±0.91	0.814	0.416
Having necessary skills necessary for success	3.99±0.86	4.08±0.79	1.006	0.315
Being responsible	3.87±0.85	4.09±0.83	2.761	0.006
Having self-discipline	3.71±0.92	3.85±0.90	1.609	0.108
Enjoyment from studying	3.19±1.03	3.16±1.05	0.252	0.801
Setting learning necessities and goals	3.59±0.92	3.76±0.86	1.941	0.053
Planning the learning process	3.55±1.04	3.81±0.84	2.946	0.003
Prioritizing what they will study	3.77±0.94	3.94±0.89	1.888	0.060
Choosing the best method for learning	3.59±0.95	3.69±0.90	1.182	0.238
Deciding on their own learning strategies	3.89±0.91	3.99±0.77	1.198	0.232
Marking important points while reading texts	3.74±1.01	4.10±0.83	4.019	0.000
Repeating new information	3.48±0.95	3.55±0.91	0.720	0.472
Summarizing read texts	3.08±1.12	3.23±1.01	1.464	0.144
Using different learning sources	3.55±0.97	3.40±0.93	1.633	0.103
Having good time management while studying	3.18±0.93	3.33±0.88	1.729	0.084
Monitoring its own development in line with the goals	3.39±0.83	3.57±0.79	2.313	0.021
Enjoyment from obtaining information beyond their defined goals	3.55±0.92	3.45±0.95	1.142	0.254
Being open to new ideas in their learning processes	4.01±0.80	4.03±0.81	0.237	0.813
Willingness to take suggestions from others while learning	3.78±0.89	3.78±0.94	0.046	0.964
Enjoyment of struggling with difficulties during the learning process	3.12±1.02	3.01±1.05	1.107	0.269
Looking for possible solutions when a problem/difficulty is encountered	3.71±0.86	3.73±0.77	0.288	0.774
Asking for help when there is a problem they cannot solve in the learning process	3.62±0.89	3.65±0.85	0.266	0.790
Being able to determine their strength and weaknesses by evaluating their own performance	3.76±0.81	3.85±0.77	1.173	0.242

DISCUSSION

When the self-regulated learning ability of all students who participated in the study was evaluated, the average values varied between 3.07 and 4.03 out of 5. The average values for First-year students were between 3.08 and 4.01 out of 5 when their Self-Regulated Learning Abilities of Students Scale was examined. The average values of Third-year students varied between 3.01 and 4.10 out of 5.

When the Self-Regulated Learning Abilities of Students Scale score averages of tirst-year and third-year students were compared, third-year students' scores were found to be statistically significantly higher compared to that of first-year students in the parameters; marking important points while reading texts, being responsible, planning the learning process, monitoring their own development in accordance to their goals. Furthermore, a significant development was observed in the parameters; being responsible, planning the learning process, monitoring their own development regarding their goals as the term increased.

SRL includes the cognitive, metacognitive, behavioural, motivational, and emotional/affective aspects of learning (**24**). Learning strategies are divided into Cognitive-Metacognitive sections; it includes elaboration, organization, critical thinking and metacognitive self-regulation, and also time and study environment management, resource management, peer learning and motivation are included as well (**25**).

Many medical educators think that attaining SRL abilities is important for students to regulate their own knowledge (**26, 27**). According to Zimmerman, (28) SRL consists of "self-regulated thoughts, emotions and behaviours of attaining academic goals".

Self-regulated skills enable an individual to set goals, plan, use strategies, manage resources, monitor and evaluate progress during various stages of the learning process (**10**). SRL emphasizes the student's autonomy and control of his or her learning and behaviour (**12**).

In the literature, it is expressed that in PBL, the student knows where to use information and determines their learning autonomously, develops self-regulation and attains the lifelong learning ability (**10, 29**). PBL learning outcomes include, the students being willing to learn and taking responsibility, providing self-regulated learning, gaining understanding, comprehension, analysis and synthesis, associating new and prior information, retention of the knowledge, thinking, inquiring and problem solving abilities in addition to attaining motivation, team work, communication skills and internalizing all of these outcomes in a way they can use in their careers (**14, 30-35**). It is especially important in PBL that the students gain confidence. In this context, the students develop questioning skills, the ability of thinking with various methods and expressing emotions and thoughts. Furthermore, we can also see their development in a social scale such as being a team, team spirit, communication skills, being able to respect others' opinions, empathy and leadership. In addition to all these outcomes, they also develop their self-regulation abilities (**36-39**). PBL allows students to be more proactive, responsible, motivated, inquisitive and questioning in the learning process (**32**).

PBL is at the center of the education program during the first three years in the medical faculty when the study was conducted. Although the design of our study did not allow for the development of self-regulated learning abilities from first-year to third-year to be directly attributed to PBL, the studies

in the literature emphasize the relationship between these developments and PBL.

In a study conducted in Hong Kong University Medical Faculty, Downing K et al. (40) divided first-year students into two groups and then applied PBL education to one group and traditional education to the other group for a term. The student group that was given traditional education consisted of students who had higher university entrance scores. They investigated self-regulation ability levels at the beginning and at the end of one term. In the beginning phase, the traditional education student group had higher scores, as expected. However, they have found that students taking PBL education had significantly higher self-regulation abilities, even though their university entrance scores were lower, compared to the other group in the evaluation at the end of one term. Similarly, in a study conducted by Sungur S et al. (41), they divided students of the department of biology teaching into two groups and applied PBL to one group and traditional education programs to the other group. It was found that students who had PBL education had significantly high self-regulation abilities. In a study conducted by Demirören M et al. (42) with students (n=257) from a medical faculty where PBL was applied, they found that students used their SRL skills and had beliefs about their ability to learn effectively in the PBL context (42). The results of this study were conducted with medical faculty third-year students and the results of our study revealed similarities.

In a study conducted in a medical faculty applying four different curriculums, Turan S et al. (2009) found that the highest scores were in the medical faculties applying PBL in terms of metacognitive awareness and self-regulated learning skills (43). This study suggests that students who experience a student-centered curriculum, such as PBL during their medical education demonstrate improved metacognitive awareness and self-regulated learning skills (43). According to a study conducted by Matsuyama Y et al. (2019), a contextual change towards student-centered learning encourages SRL even in students who are strongly accustomed to teacher-based learning. In a student-centered context, students can refer to their future 'self' models, create their own learning models and start expressing themselves and looking for various learning strategies (44).

In our study, it is believed that self-regulation ability might be related to some parameters increasing over the years as it is defined in the literature such as; having the necessary abilities for success, being responsible, marking important points while reading texts and being open to new ideas in the learning process.

Another highlight of our study was the relationship of self-regulated learning ability with gender. In our study, when the Self-Regulated Learning Abilities of Students Scale score averages were compared according to gender, it was determined that female students' scores were statistically significantly higher compared to that of male students in the parameters; being responsible, having self-discipline, enjoyment from studying, setting learning necessities and goals, planning the learning process, marking important points while reading texts, summarizing read texts and asking for help when there is a problem they cannot solve in the learning process. On the other hand, scores of female students were significantly low in the enjoyment of struggling with difficulties during the learning process parameter. In the literature, the number of studies investigating the relationship between self-regulated learning ability and gender is limited. Demirören et al. did not find a difference in self-regulated learning abilities according to gender in a study they conducted in a medical faculty in 2016 (45). Yücel O et al. (2016) did not find a significant difference with respect to gender in a study they conducted with Engineering Faculty students where they investigated PBL self-regulation as well (46). It has been noted that female students' scores were high in eight of the 23 parameters of the scale in our study whereas the male students' scores were high in the parameter of the enjoyment of struggling with difficulties.

CONCLUSION

It was determined that self-regulated learning ability scores were generally high in students. The highest scores were given to the "having the necessary abilities for success', "being open to new ideas in the learning process', "being responsible', "deciding on their own learning strategies' parameters respectively whereas the lowest scores were given to the "enjoyment of struggling with difficulties during the learning process'.

When the self-regulated learning ability scores were compared according to gender; female students' scores were higher compared to that of male students in the parameters of "being responsible', "having self-discipline', "enjoyment from studying', "setting learning necessities and goals', "marking important points while reading texts', "summarizing read texts' and "asking for help when there is a problem they cannot solve in the learning process'; but were lower in the parameter of "enjoyment of struggling with difficulties during the learning process'.

When the self-regulated learning ability scores of first-year and third-year students were compared; it was understood that third-year students evaluated themselves more positively compared to first-year students in the parameters, "being responsible', "planning the learning process', "marking important points while reading texts', "monitoring their own development in accordance with their goals'. As a conclusion, it was found that the perceptions of students regarding their self-regulated learning abilities were positive and their scores were above moderate levels.

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REFERENCES

1. Linnenbrink EA, Pintrich PR. The role of self-efficacy beliefs in student engagement and learning in classroom. Reading and Writing Quarterly. 2003;19:119-137.
2. Boekaerts M. Being concerned with well-being and with learning. Educational Psychologist. 1993;28:149-167.
3. Boekaerts M. The adaptable learning process: initiating and maintaining behavioural change. Applied Psychology: An International Review. 1992;41:377-97.
4. Pintrich PR. Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. Journal of Educational Psychology. 2000;92:544-555.
5. Zimmerman BJ. Attaining self-regulation: A social-cognitive perspective. In Boekaerts M, Pintrich P, Zeidner M (Eds.) Handbook of self regulated: theory, research and applications. San Diego, CA: Academic, 2000,13-39.
6. Fox E, Riconscente M. Metacognition and self-regulation in James, Piaget, and Vygotsky. Educational Psychology Review. 2008; 20:373-89.
7. Zimmerman BJ. Theories of self regulated learning and academic achievement: an overview and analysis. In: Zimmerman BJ, Schunk DH. (edt.). Self Regulated Learning and Academic Achievement: Theoretical Perspectives. 2nd ed. USA, Mahwah, NJ: Erlbaum, 2001,1-37.
8. Zimmerman BJ. Becoming a self-regulated learner: Which are the key subprocesses? Contemp Educ Psychol. 1986;11(4):307-13.
9. Roth A, Ogrin S, Schmitz B. Assessing self-regulated learning in higher education: a systematic literature review of self-report instruments. Educational Assessment, Evaluation and Accountability. 2016;28:225-50.
10. Zimmerman BJ. Becoming a self-regulated learner: an overview. Theory Into Practice. 2002; 41:64-70.
11. Butler D. Individualizing instruction in self-regulated learning. Theory Into Practice. 2002;41:81-92.
12. Paris SG, Paris AH. Classroom Applications of Research on Self-Regulated Learning. Educational Psychologist. 2001;36(2), 89-101.
13. Norman GR, Schmidth HG. Effectiveness of problem-based learning curricula: theory, practice and paper darts. Medical Education. 2000; 34:721-28.
14. Bate E, Hommes J, Duvivier R, Taylor DCM. Problem-based learning (PBL): Getting the most out of your students – their roles and responsibilities: AMEE Guide No. 84 Medical Teacher. 2014;36:1-12.
15. Prince KJAH, Van Eijs PWLJ, Boshuizen HPA, Van der Vleuten CPM, Scherpbier AJ. General competencies of problem-based learning (PBL) and non-PBL graduates. Medical Education. 2005;39:394–401.
16. Ward JD, Lee CL. A review of problem-based learning. Journal of Family and Consumer Sciences Education. 2002;20:16-26.
17. Thomas RE. Problem-based learning: measurable outcomes. Medical Education. 1997;31:320-29.
18. Albanese MA, Mitchell SA. Problem-based learning: a review of literature on its outcomes and implementation issues. Academic Medicine. 1993; 68:52-75.
19. Choon M, Gwee E. Problem-based learning: a strategic learning system design for the education of healthcare professionals in the 21st century. Kaohsiung Journal Of Medical Sciences. 2009; 25:231-39.
20. Neville AJ, Norman GR. PBL in the undergraduate MD program at McMaster University: three iterations in three decade. Academic Medicine. 2007; 82:370-74.
21. Musal B. Problem-based Learning and Task-based Learning Curriculum Revision Experience of a Turkish Medical Faculty. Creative Education. 2013;4:116-19.
22. Musal B, Taskiran C, Kelson A. Opinions of Tutors and Students about Effectiveness of PBL in Dokuz Eylul University School of Medicine. Medical Education Online. 2003,8:1.
23. Velipaşaoğlu S, Musal B. Scale Development Studies Related to the Process, Running and Gains of Problem-Based Learning, Tıp Eğitimi Dünyası. 2017;48:5-28.
24. Panadero E. A Review of Self-regulated Learning: Six Models and Four Directions for Research. Frontiers Psychology. 2017 eCollection 2017,28;8:422 (1-28).
25. Zimmerman BJ. Investigating Self-Regulation and Motivation: Historical Background,Methodological Developments,and Future Prospects. American Educational Research Journal. 2008,45(1):166-83.
26. Demirören M, Turan S, Tasdelen Teker G. Determinants of self-regulated learning skills: the roles of tutors and students. Adv Physiol Educ. 2020,44:93-8.
27. Ryan G. Student perceptions about self-directed learning in a professional course implementing problem-based learning. Stud High Educ. 1993,18:53-63.
28. Zimmerman BJ. Academic studying and the development of personal skill: a self-regulatory perspective. Educ Psychol. 1998,33:73-86.
29. Hmelo-Silver CE. Problem-based learning: what and how do students learn? Educational Psychology Review. 2004;16:235-66.
30. Carrera LI, Tellez TE, D'Ottavio AE. Implementing a problem-based learning curriculum in an Argentinean Medical School: implications for developing countries. Academic Medicine. 2003; 78:798-801.
31. Davis MH, Harden RM. AMEE Medical Education Guide No. 15: Problem-based learning: a practical guide. Medical Teacher. 1999;21:130-40.
32. Dolmans DHJM, Wolfhagen IHAP, Vleuten CPMV. Motivational and cognitive processes influencing tutorials group. Academic Medicine. 1998;73:22-4.
33. Karimi R. Interface between problem-based learning and a learner-centered paradigm. Advances in Medical Education and Practice. 2011;2:117-25.
34. Nandi PL, Chan JNF, Chan CPK, Chan P, Chan LPK. Undergraduate medical education: comparison of problem-based learning and conventional teaching. Hong Kong Medical Journal. 2000;6:301-06.
35. Shankar PR, Nandy A. Student feedback on problem-based learning processes. Australasian Medical Journal. 2014;7:522-29.
36. Barrows HS. A taxonomy of problem-based learning methods. Medical Education. 1986;20:481-86.
37. Dolmans D, Schmidt H. The advantages of problem-based curricula. Postgraduate Medical Journal. 1996;72:535-38.
38. Khoshnevisasl P, Sadeghzadeh M, Mazloomzadeh S, Feshareki RH, Ahmadiafshar A. Comparison of problem-based learning with lecture-based learning. Iranian Red Crescent Medical Journal. 2014;16:1-4.
39. Morales-Mann ET, Kaitell CA. Problem-based learning in a new Canadian curriculum. Journal of Advanced Nursing. 2001;33:13-9.
40. Downing K, Kwong T, Chan S, Lam T, Downing W. Problem-based learning and the development of metacognition. Higher Education. 2009;57:609-21.

41. Sungur S, Tekkaya C. Effects of problem-based learning and traditional instruction on self-regulated learning. The Journal of Educational Research. 2006;99:307-17.

42. Demirören M, Turan S, Tasdelen Teker G. Determinants of self-regulated learning skills: the roles of tutors and students. Adv Physiol Educ. 2020,44:93-8.

43. Turan S, Demirel Ö, Sayek İ. Metacognitive awareness and self-regulated learning skills of medical students in different medical curricula, Medical Teacher. 2009,31:10,e477-e483, DOI: 10.3109/01421590903193521.

44. Matsuyama Y, Nakaya M, Okazaki H, Lebowitz AJ, Leppink J, Vleuten CV. Does changing from a teacher-centered to a learner-centered context promote selfregulated learning: a qualitative study in a Japanese undergraduate setting. BMC Medical Education. 2019,19:152.

45. Demirören M, Turan S, Öztuna D. Medical students' self-efficacy in problem-based learning and its relationship with self-regulated learning. Medical Education Online. 2016;21:1-9.

46. Yucel O, Karahoca D, Karahoca A. The effects of problem based learning on cognitive flexibility, self-regulation skills and students' achievements. Global Journal of Information Technology. 2016;6:86-93.