Determinants of self-regulated learning skills: the roles of tutors and students

Meral Demirören, Sevgi Turan, and Gülsen Taşdelen Teker
Department of Medical Education and Informatics, Hacettepe University School of Medicine, Ankara, Turkey

Submitted 10 September 2019; accepted in final form 13 January 2020

INTRODUCTION

There is a very large consensus among most medical educators that it is just as important for students to acquire self-regulatory learning (SRL) skills as to increase their knowledge (24). According to Zimmerman (37), this type of learning consists of “self-regulated thoughts, feelings, and actions for attaining academic goals.” Self-regulated skills enable an individual to set goals, plan, use strategies, manage resources, and monitor and evaluate progress during various stages of the learning process (38). SRL emphasizes the learner’s autonomy and control of his or her learning and behavior (20).

Many researchers have shown that there is a relationship between SRL and academic performance (6, 9, 20–23, 25, 26, 35). For this reason, acquiring SRL skills is a key objective of the medical curriculum; various instructional designs, methods, and activities have been proposed and used to accomplish this goal. The method and philosophy of problem-based learning (PBL) is a widely accepted and effective approach that supports SRL skills (1, 2, 7, 13, 28, 32, 34, 36). As the existing literature has described the effect of PBL on SRL, it is essential to carry out further studies to investigate how SRL skills develop during the PBL process and which aspects of the PBL process are important for developing these skills; the findings of the present study can be used to plan and implement effective learning environments.

We know that PBL requires significant changes in the skills and attitudes of both learners and tutors. In PBL processes, both learners and tutor may face difficulties in the process of learners’ transition from being dependent to independent. As the tutor’s role is facilitation, providing guidance instead of solutions, the processes of teaching and learning become a priority in PBL sessions (5), which foster independent learning skills. To help students develop SRL skills, tutors should encourage them to participate actively by questioning, explaining, justifying, and evaluating ideas during the session (10). The tutors guide students in the learning process, pushing them to think deeply and modeling the kinds of questions that students need to ask themselves (8). A tutor, therefore, should be well acquainted with and capable of effectively facilitating PBL sessions (11).

The students play another key role in the PBL process: they learn content, strategies, and self-directed learning skills by solving problems collaboratively (8). Through PBL, students gain responsibility for finding information, coordinating actions and people, setting goals, deciding on appropriate strategies, and monitoring and evaluating understanding (20). According to Risemberg and Zimmerman, as cited by Sungur and Tekkaya (28), students who develop these skills are likely to achieve at higher levels than students who depend on teachers.

Student motivation is another interacting factor that can influence the PBL learning process and the development of SRL skills. Self-efficacy is the most focused motivational element in SRL. Self-efficacy refers to students’ beliefs about their ability to learn or perform effectively. Research has shown that self-regulated learners are self-efficacious when it comes to their ability to master a learning task. Those with a high sense of self-efficacy tend to use cognitive and metacognitive strategies and to persist in difficult or uninteresting tasks (3, 14, 21, 28). In a preliminary part of this study, we investigated the relationship between the self-efficacy and SRL skills of medical students during PBL and found a positive correlation (4).

It is important to consider that PBL is a multifaceted and complex learning environment in which different variables...
interact (8). As summarized above, many studies have examined the relationship between achievement and SRL, the development of SRL in PBL, and the roles of tutors and students in the PBL process, noting the important effect of PBL on SRL. However, few studies have investigated the way in which PBL improves SRL skills or identified the variables in the PBL process that assist in developing SRL skills. The present study has, therefore, explored this gap in the literature, asking the following question: To what extent do the student’s academic achievement, self-efficacy levels, and the tutor’s role predict the acquisition of SRL skills during PBL?

METHODS

Settings

This study was carried out at Ankara University School of Medicine (AUSM), which used an integrated curriculum focused on problem-based, community-based, and competency-based learning. The AUSM medical curriculum is structured as follows: preclinical (years 1–3), clinical (years 4 and 5), and the internship period (year 6). During the preclinical years, the curriculum consists of multidisciplinary “modules.” Each year consists of four modules lasting 8 wk each.

PBL is carried out during the second- and third-year modules. At the beginning of the second year, the students are trained to clarify the roles of learners and tutors in PBL, to undertake the process, and to carry out assessments using interactive small-group teaching techniques. The PBL tutors also attend a 3-day PBL tutoring course.

Each curricular module includes two PBL scenarios. PBL aims to teach basic science in the clinical context. It provides multidimensional integration, involving behavioral, social, and ethical aspects, as well as a biopsychosocial approach to the patient. This approach is considered very important, as it enables students to gain lifelong learning skills.

In PBL, students work in groups of 11 students with a tutor. Each PBL scenario is processed in two or three sessions of 2 h each. Between sessions, students are expected to study independently toward learning objectives defined in the previous session. The PBL process has the following steps:

1. Students in small groups guided by a PBL tutor encounter a clinical problem for the first time, without having done any preliminary work on the problem.
2. By interacting with each other, they share knowledge and experiences relevant to the problem.
3. They develop hypotheses and test mechanisms that could apply to the problem.
4. They determine what they need to learn to progress in solving the problem.
5. To meet specific learning needs, they study independently between PBL sessions.
6. They return to the group to discuss and integrate their newly acquired knowledge and to apply it to the problem.
7. If necessary, they repeat steps 3–6.

Subjects

The participants in this study were third-year students. From a total of 343 students in the third year, data were obtained from 257 students who completed all three scales used in the study. The participation rate was 75%. Students who did not attend the PBL session were unable to participate in the study. Of those who did participate, 55.6% (n = 143) were female and 44.4% (n = 114) were male.

Instruments

This study used the self-regulated learning perception (SRLP) scale, the self-efficacy for PBL scale (SPBL), and the tutor evaluation scale (TES). The achievements of individual students were also measured.

Self-regulated learning perception scale. The SRLP scale, developed by Turan et al. (31, 32), contains 41 items and 4 subscales, rated using a 5-point Likert scale. The subscales are as follows:

- Motivation and action to learn: Students are willing to engage in learning and learn proactively.
- Planning and goal setting: Students formulate their goals and objectives and plan their learning in accordance with these objectives.
- Strategy use and assessment: Students choose and implement appropriate learning strategies to achieve their learning objectives and evaluate their learning outcomes.
- Lack of self-directedness: Students may have problems directing the learning process.

The Cronbach α coefficients for the reliability of the subscales have been reported as 0.88, 0.91, 0.83, and 0.76, respectively (31).

Self-efficacy for PBL scale. SPBL was developed by Onan et al. (15) to measure students’ beliefs about their ability to learn effectively in the PBL context. The scale items were based on the learning activities carried out by learners during the PBL tutorial and rated using a 5-point Likert scale. The scale included 18 items in the following 3 subscales:

- Group interaction: Students work collaboratively and communicate effectively with their group mates and tutors.
- Problem solving: Students discover, analyze, and discuss problems, and determine their own learning deficit in relation to those problems.
- Responsibility: Students take responsibility for their own learning, as well as that of their group mates.

The Cronbach α coefficients for the reliability of the subscales have been reported to be 0.87, 0.76, and 0.71, respectively (15).

Tutor evaluation scale. This scale, which was developed by Turan et al. (33), contains 22 items and 4 dimensions. Items were rated using a 5-point Likert scale ranging from 1 “strongly disagree” to 5 “strongly agree.” The subscales are as follows:

- Supporting the learning process and metacognitive knowledge: The tutor facilitates the learning process to help the students achieve metacognitive skills.
- Conducting PBL: The tutor facilitates learning, in accordance with the scientific problem-solving process, to achieve learning objectives from a scenario.
- Communicating and supporting student autonomy: The tutors foster student autonomy and effective participation in the learning process.
- Assessing and giving feedback: The students reflect on and evaluate the group process and learning, including personal contributions and achievements.

The Cronbach α coefficients for the reliability of the subscales have been reported as being 0.81, 0.89, 0.91, and 0.77, respectively.

Following this research analysis, the reliability coefficients of SRLP, SPBL, TES, and their subscales are presented in Table 1.

Students’ Academic Achievements

An exam composed of 100 multiple-choice questions, of which 35 were related the PBL objectives, was used to assess progress at the end of the third module. Each student’s academic achievement score was determined by calculating the rate of correct responses to the questions related to the PBL objectives.
### Table 1. Descriptive statistics and reliability coefficients of scales used in this study

| Scales                                      | No. of Items | Cronbach’s α |
|---------------------------------------------|--------------|--------------|
| Self-regulated learning perception scale    | 41           | 0.92         |
| Motivation and action to learn              | 7            | 0.71         |
| Planning and goal setting                   | 8            | 0.86         |
| Strategy use and assessment                 | 19           | 0.91         |
| Lack of self-directedness                   | 7            | 0.72         |
| Self-efficacy for PBL scale                 | 18           | 0.92         |
| Group interaction                           | 9            | 0.87         |
| Problem solving                             | 4            | 0.72         |
| Responsibility                              | 5            | 0.81         |
| Tutor evaluation scale                      | 22           | 0.97         |
| Supporting the learning process and         |              |              |
| metacognitive knowledge                     | 9            | 0.94         |
| Conducting PBL                              | 6            | 0.92         |
| Communicating and supporting student        | 4            | 0.87         |
| autonomy                                    |              |              |
| Assessing and giving feedback               | 3            | 0.91         |

PBL, problem-based learning.

### The Implementation of the Study

The students were informed about the study and asked to give their consent. During the first PBL session of the third module, third-year students applied SRLP and SPBL. The TES was rated after 1 wk of last PBL session. In other words, the students filled out tutor evaluation forms when PBL tutors were not with them. Their academic achievement scores were obtained from the faculty administration.

### Data Analysis

To analyze the collected data, the present study used Pearson’s correlation coefficient and a standard multiple-regression analysis. The relationship between the students’ SRLP, SPBL, TES, and achievement scores was analyzed using the Pearson product-moment correlation. A multiple linear regression was carried out to predict the students’ self-regulated learning abilities, based on their SPBL levels, tutor evaluations, and academic achievement.

The standard multiple-regression analysis was used to predict the factors that influenced student SRLP scores during PBL. The literature provides several different guidelines concerning the number of cases required for multiple regression. Stevens (27) has argued that 15 participants per predictor are needed for a reliable equation in the social sciences. By contrast, Tabachnick and Fidell (29) have developed a formula to calculate the required sample size. In the formula, the sample size is calculated by multiplying the number of independent variables by 8 and adding 50. For the 3 independent variables considered in this study, the required sample size was 74. For either approach, the sample size used in the study was sufficient (n = 257).

Preliminary analyses were conducted to ensure that none of the assumptions of multiple regression, such as normality, linearity, multicollinearity, or homoscedasticity, were violated. Since multiple-regression analyses are very sensitive to outliers (18), 11 values from the data set were distracted after checking outliers. The other assumptions of a multiple-regression analysis, namely multicollinearity, normality, and multicollinearity, were all examined and confirmed for the data set.

In the analyses, the significance level was accepted as 0.05; IBM SPSS 20 software was used.

### Ethical Considerations

The Clinical Research Ethical Committee of Ankara University approved the present study. Before the PBL sessions began, the researchers explained that participation was voluntary and requested written, informed consent, which the participants provided.

### RESULTS

The mean scores were 3.68 for SRLP, 3.94 for SPBL, and 3.83 for TES. The total score for every scale and subscale was higher than 3 (midpoint of the scale) (Table 2).

A Pearson product-moment correlation analysis was used to investigate the relationship between SRLP, SPBL, TES, and achievement. There were significant positive relationships between SRLP and SPBL (r = 0.55; P = 0.000), TES and SRLP (r = 0.26; P = 0.000), and TES and SPBL (r = 0.14; P = 0.029). Although there was no significant relationship between achievement and SRLP (r = 0.11; P = 0.073) and TES (r = −0.03; P = 0.664), there was a significant positive relationship between achievement and SPBL (r = 0.19; P = 0.002) (Table 3).

To carry out a standard multiple-regression analysis, independent variables should show at least some relationship with the dependent variable (preferably above 0.3) (18). Moreover, the correlation between each independent variable should not be too high. The results of the correlation indicated that the relationship between the dependent variable (SRLP) and the two independent variables (SPBL and TES) was sufficient to carry out a multiple regression analysis (0.55 and 0.26, respectively); this was not the case with academic achievement (0.11). The achievement variable was, therefore, removed from the regression equation, and only the other two independent variables were analyzed.

### Table 3. Correlations of variables

|          | SPBL | TES | Achievement |
|----------|------|-----|-------------|
| SRLP     | 0.55†| 0.26†| 0.11        |
| SPBL     | 0.14*| 0.19†| −0.03       |
| TES      |      |     |             |

| Scales                                      | Means | SD |
|---------------------------------------------|-------|----|
| Self-regulated learning perception scale    | 3.68  | 0.41 |
| Motivation and action to learn              | 3.90  | 0.49 |
| Planning and goal setting                   | 3.81  | 0.59 |
| Strategy use and assessment                 | 3.72  | 0.49 |
| Lack of self-directedness                   | 3.29  | 0.66 |
| Self-efficacy for PBL scale                 | 3.94  | 0.52 |
| Group interaction                           | 3.91  | 0.56 |
| Problem solving                             | 3.89  | 0.56 |
| Responsibility                              | 4.03  | 0.62 |
| Tutor evaluation scale                      | 3.83  | 0.79 |
| Supporting the learning process and         |       |    |
| metacognitive knowledge                     | 3.84  | 0.81 |
| Conducting PBL                              | 3.96  | 0.78 |
| Communicating and supporting student        | 3.80  | 0.91 |
| autonomy                                    |       |    |
| Assessing and giving feedback               | 3.72  | 1.03 |
| Academic achievement                        | 79.3  | 7.2 |

Values are mean (SD) scores; n = 257 students. PBL, problem-based learning.

SPBL, self-efficacy for problem-based learning; SRLP, self-regulated learning perception; TES, tutor evaluation scale. *Correlation is significant at the 0.05 level (2-tailed). †Correlation is significant at the 0.01 level (2-tailed).
Table 4. Results of the standard multiple-regression analysis

| Variable | B   | SE_B | β   | t Value | P Value | Partial β | Part r |
|----------|-----|------|-----|---------|---------|------------|--------|
| Constant | 1.644 | 0.176 | 9.359 | 0.000   |          |            |        |
| SPBL     | 0.428 | 0.040 | 0.545 | 10.732 | 0.000   | 0.559      | 0.540  |
| TES      | 0.096 | 0.026 | 0.186 | 3.657  | 0.000   | 0.224      | 0.184  |

$R = 0.60, R^2 = 0.36, F(2,253) = 70.956, P = 0.000.$ SE_B, standard error of B; SPBL, self-efficacy for problem-based learning; TES, tutor evaluation scale.

The results of the regression analysis showed that SPBL and TES explained 36% of the variance [$R^2 = 0.359, F(2,253) = 70.9, P = 0.000$]. SPBL levels were found to predict students’ self-regulated learning scores ($β = 0.55, P = 0.000$), as did tutor evaluations ($β = 0.19, P = 0.000$) (Table 4).

DISCUSSION

When using PBL to develop SRL skills, the tutor’s role is to provide support, but the students have the primary responsibility for their learning. Therefore, it is also important to motivate students. When the variables were evaluated separately in the present study, the students’ scores were high in all scales (Table 2). The lowest overall SRLP score was on the lack of self-directedness scale. For motivation and action to learn, planning and goal setting, and strategy use and assessment, the scores were higher; however, the lack of self-directedness scores was closer to the midpoint of the scale. An earlier study that investigated the use of SRLP in various medical curricula determined that the SRLP scores of medical students who used a PBL curriculum were higher than those of students in the same school who used a traditional curriculum (33). At the same time, the students in the present study scored below the mean on the lack of self-directedness scale and other SRLP subscales (4, 33). Our findings support studies suggesting that PBL has an effect on the development of SRL skills (1, 2, 7, 13, 28, 32, 34, 36). Students’ beliefs about their capability to learn were widely investigated as a motivational variable in SRL. On the SPBL scale, all of the subscale scores were higher than the midpoint of the scale. Similarly, in a previous study, our laboratory did not find any significant difference between SPBL subscales (4). It was satisfying that third-year students who had used PBL since starting school had higher SPBL results. However, this finding concerns student perceptions and should, therefore, be carefully monitored.

The tutors’ ability to facilitate the process has an impact on the effectiveness of PBL sessions (11). As subject experts, many medical teachers familiar with lecture-based teaching must adapt to the tutoring role to help students develop independent learning skills. On the TES scale, the mean scores of all subscales were higher than the midpoint of the scale. The lowest mean score for a TES subscale was for “assessing and giving feedback.” In a previous tutor evaluation study, conducted in a different medical school, we found statistically significant differences between the TES scores rated by both students and tutors. As in this study, the scores for “assessing and giving feedback” were lower than scores in the other TES subscales. Feedback provides students with information about the quality of their study and helps them to take responsibility for their learning and adjust their learning (40). To assess and give feedback is an essential tutoring role; the tutor must monitor achievements/understandings and share the results clearly with students, to improve their competencies and self-directed learning skills. Tutors should be supported to improve these skills.

Aware of the importance of SRL skills in PBL, we examined the relationship between tutoring and students’ learning skills and self-efficacy. We also investigated the correlation between student PBL achievement and these variables. Although many researchers have argued that there is a relationship between achievement and SRL (6, 9, 20–23, 25, 26, 35), we found no significant relationship between SRLP and achievement in PBL (Table 3). There was a weak relationship between SPBL and achievement ($r = 0.19; P ≤ 0.01$) (Table 3). In this study, the participants’ overall academic achievement was higher (mean score = 79.3). The study group did not include any students who had failed in the previous 2 yr. As the study group was, therefore, relatively homogeneous, achievement may not have been a determining variable. Hence, the achievement variable was not included in the regression equation.

We found significant positive relationships between SRLP and SPBL ($r = 0.55; P ≤ 0.01$) and TES ($r = 0.26; P ≤ 0.01$). SPBL and TES were also weakly correlated ($r = 0.14; P ≤ 0.01$) (Table 3). When the students’ self-regulated learning skill scores increased, their self-efficacy levels also rose. The relationship between self-regulation and self-efficacy has been proposed and demonstrated in many general education studies (10, 16, 17, 21, 41, 43). In the preliminary part of this study, we investigated the relationship between self-efficacy and the SRL skills of medical students engaged in PBL, finding a positive correlation (4). This study confirmed that result. Self-regulated learners can transform their preexisting abilities into task-related behavior in different areas by using specific processes. Self-regulatory abilities depend on context and outcomes; new performance tasks can require additional social learning experiences. If learners can systematically adapt their knowledge and performance to new contextual conditions, they can develop self-regulated skills (39). Self-regulation can develop strongly from external (parental and teacher) guidance, as well as from personal autonomy. Culture has been found to be a very important predictor of self-regulation levels and self-regulatory strategies (30). It was reported that self-regulated learning mediates the relationship between the training climate and transfer motivation (12). In our study, the relationship of the tutor’s role as an external guidance with the development of SRL was confirmed.

TES were moderately correlated with SRLP ($r = 0.26; P ≤ 0.01$) and weakly correlated with SPBL ($r = 0.14; P ≤ 0.05$). The tutors’ skills were important in developing the students’ self-regulating learning skills and self-efficacy. When we carried out a regression analysis to predict the relationship between these variables in a PBL context, we found that SPBL levels predicted the students’ self-regulated learning scores ($β = 0.55, P < 0.001$), as did tutor evaluations ($β = 0.19, P < 0.001$) (Table 4). According to the standardized regression coefficients, the most important variable, relative to the SRLP score, was SPBL. This finding supports the results of previous studies, which have found that self-efficacy is important in self-regulated learning (16, 19, 42). However, it also showed the importance of tutoring skills, besides self-efficacy, as we hypothesized.
Conclusion

The findings of the present study show that students use self-regulated learning skills and hold beliefs about their own ability to learn effectively in the PBL context. The study participants also gave higher ratings to their tutors’ facilitation skills in this context. There were positive correlations between SRL, self-efficacy, and the teachers’ tutoring scores. Both tutoring scores of teachers and student self-efficacy were important in improving the students’ self-regulated learning scores.

The study has several limitations. First, the design of the study was cross sectional. Second, the participants of the study were from a single institution. Lastly, the scales were self-reported, with the reliability and validity limitations of all self-reported questionnaires. For a more detailed understanding of the development of SRL in PBL, the research questions explored here should be tested further, in the context of different medical schools. Qualitative data could also provide a deeper understanding of these results.

ACKNOWLEDGMENTS

The authors thank the Hacettepe Üniversitesi Teknokent Teknoloji Transfer Merkezi for the proofreading process.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

M.D. and S.T. conceived and designed research; S.T. performed experiments; G.T.T. analyzed data; M.D., S.T., and G.T.T. interpreted results of the study.

REFERENCES

1. Ali GW, Ayoub SN. Nurses attitudes toward caring for dying patient in Mansoura University hospitals. J Med Biomed Sci 5: 16–23, 2010.
2. Ali WGM, El Sebai NAM. Effect of problem-based learning on nursing students’ approaches to learning and their self-directed learning abilities. Int J Acad Res 2: 188–195, 2010.
3. Dembo MH, Eaton M. Self-regulation of academic learning in middle-level schools. Elem Sch J 100: 475–490, 2000. doi:10.1007/978-1-4615-3190-6_58.
4. Demirören M, Turan S, Öztuna D. Medical students’ self-efficacy in problem-based learning and its relationship with self-regulated learning. Med Educ Online 21: 30049, 2016. doi:10.3402/meo.v21.30049.
5. Dickie C, Jay L. Innovation in postgraduate teaching: mixed methods to enhance learning and learning about learning. High Educ Res Dev 29: 29–43, 2010. doi:10.1080/07294360903421376.
6. Ekinci, N. Undergraduate Students’ Approaches to Learning and Their Relationships with the Variables of the Teaching-Learning Process (PhD dissertation). Ankara, Turkey: Hacettepe University, Social Sciences Institute, 2008.
7. Gaher H, Mohamed N. Effect of problem-based learning in undergraduate nursing students enrolled in nursing administration course. Int J Acad Res 3: 154–162, 2011.
8. Hmelo-Silver CE, Duncan RG, Chinn CA. Scaffolding and achievement in problem-based and inquiry learning: a response to Kirschner, Sweller, and Clark. Educ Psychol 42: 99–107, 2007. doi:10.1080/00461520700126358.
9. İlhan Beyaztaş D, Senemoglu N. Başarıları öğrencilerin öğrenme yaklaşımları ve öğrenme yaklaşımları etkileyen faktörler [Learning approaches of successful students and factors affecting learning approaches]. Eğitim Bilim 40: 193–216, 2015. doi:10.15390/EB.2015.4214.
10. Kek MYC, Huijser H. The power of problem-based learning in developing critical thinking skills: preparing students for tomorrow’s digital futures in today’s classrooms. High Educ Res Dev 30: 329–341, 2011. doi:10.1080/07294360.2010.501074.
11. Kukkamalla A, Lakshminarayana SK. Developing a facilitation skills training programme for problem-based learning tutors. Med Educ 45: 1152–1153, 2011. doi:10.1111/j.1365-2923.2011.04107.x.
12. Lourenco D, Ferreira AI. Self-regulated learning and training effectiveness. Int J Train Dev 23: 117–134, 2019. doi:10.1111/j.112149.
13. Lycke KH, Grøttum P, Stromso HI. Student learning strategies, mental models and learning outcomes in problem-based and traditional curricula in medicine. Med Teach 28: 717–722, 2006. doi:10.1080/1421988060105645.
14. Neber H, Schommer-Aikins M. Self-regulated science learning with highly gifted students: the role of cognitive, motivational, epistemological, and environmental variables. High Abil Stud 13: 59–74, 2002. doi:10.1080/13598130220132316.
15. Onan A, Turan S, Baştüba NB. Probleme dayalı öğrenmeye yönelik özetleme alışını öğrenme güçlerinin gerçel ve güvenilirlik çalışması. [The study of validity and reliability for the scale of self-efficacy perception of problem-based learning]. Hacettepe Med J 41: 231–239, 2010.
16. Pajares F. Gender and perceived self-efficacy in self-regulated learning. Theory Pract 41: 116–125, 2002. doi:10.1207/s15404211tp4102_8.
17. Pajares F, Schunk DH. Self-beliefs and school success: self-efficacy, self-concept, and school achievement. In: Perception, edited by Riding R, Rayner S. London: Ablex, 2001, 239–266.
18. Pallant J. SPSS Survival Manual: A Step By Step Guide to Data Analysis Using SPSS (6th ed.). London, UK: McGraw-Hill Education, 2016.
19. Papinczak T, Young L, Groves M, Haynes M. Relationships with the Variables of the Teaching-Learning Process Undergraduate Students’ Approaches to Learning and Their Self-Directed Learning Abilities. Adv Health Sci Educ Theory Pract 29: 33–40, 1990. doi:10.1007/BF01421590601105645.
20. Paris SG, Paris AH. Classroom applications of research on self-regulated learning. Educ Psychol 36: 89–101, 2001. doi:10.1007/s10459-006-9036-0.
21. Pintrich PR, De Groot EV. Motivational and self-regulated learning components of classroom academic performance. J Educ Psychol 82: 33–40, 1990. doi:10.1037/0022-0663.82.1.33.
22. Pokay P, Blumenfeld PC. Predicting achievement early and late in the semester: the role of motivation and use of learning strategies. J Educ Psychol 82: 41–50, 1990. doi:10.1037/0022-0663.82.1.41.
23. Ruban L, Reis SM. Patterns of self-regulatory strategy use among low-achieving and high-achieving university students. Roeper Rev 28: 148–156, 2006. doi:10.1080/0731906906105645.
24. Ryan G. Student perceptions about self-directed learning in a professional course implementing problem-based learning. Stud High Educ 18: 53–63, 1993. doi:10.1080/077582093133182458.
25. Sadler-Smith E. Approaches to studying: age, gender and academics performance. Educ Stud 22: 367–379, 1996. doi:10.1007/bf00620306.
26. Senemoglu N. Eğitim Fakültesi Öğrencilerinin Öğrenme Yaklaşımları ve Çalışma Becerileri [College of Education students’ approaches to learning skills]. Eğitim Bilim 36: 65–80, 2011.
27. Stevens J. Applied multivariate statistics for the social sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum, 2006.
28. Sungur S, Tekkaya C. Effects of problem-based learning and traditional instruction on self-regulated learning. J Educ Res 99: 307–320, 2006. doi:10.3200/JOER.99.5.307-320.
29. Tabachnick BG, Fidell LS. Using Multivariate Statistics (6th ed.). Boston, MA: Pearson Education, 2013.
30. Torres PE, Whitebread D, McLellan R. The role of teacher regulatory talk in students’ self-regulation development across cultures. New Dir Child Adolesc Dev 162: 89–114, 2018. doi:10.1016/cad.20259.
31. Turan S. The Relationship Between Attitudes to Problem-Based Learning, Learning Skills and Achievement (PhD dissertation). Ankara, Turkey: Hacettepe University Social Sciences Institute, 2009.
32. Turan S, Demirel O, Sayek I. Metacognitive awareness and self-regulated learning skills of medical students in different medical curricula. Med Teach 31: e477–e483, 2009. doi:10.3109/01421590903193521.
33. Turan S, Elçin M, Odabaşo O, Ward K, Sayek I. Evaluating the role of tutors in problem-based learning sessions. Türkiye Klinikleri J Med Sci 29: 77–83, 2009.
34. van Den Hurk M. The relation between self-regulated strategies and individual study time, prepared participation and achievement in a problem-based curriculum. Active Learn High Educ 7: 155–169, 2006. doi:10.1177/1469787406075044.
35. Watkins D. Correlates of approaches to learning: a cross-cultural meta-analysis. In: Perspectives on Thinking, Learning and Cognitive Styles, edited by Stenberg RJ, Zhang L. Mahwah, NJ: Lawrence Erlbaum, 2001, p. 165–195.
36. Yeung E, Au-Yeung S, Chiu T, Mok N, Lai P. Problem design in problem-based learning: evaluating students’ learning and self-directed learning practice. Innov Educ Teach Int 40: 237–244, 2003. doi:10.1080/1470329032000103762.

37. Zimmerman BJ. Academic studying and the development of personal skill: a self-regulatory perspective. Educ Psychol 33: 73–86, 1998. doi:10.1080/00461520.1998.9653292.

38. Zimmerman BJ. Becoming a self-regulated learner: an overview. Theory Pract 41: 64–70, 2002. doi:10.1207/s15430421tp4102_2.

39. Zimmerman BJ. From cognitive modeling to self-regulation: a social cognitive career path. Educ Psychol 48: 135–147, 2013. doi:10.1080/00461520.2013.794676.

40. Zimmerman BJ. Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. Am Educ Res J 45: 166–183, 2008. doi:10.3102/0002831207312909.

41. Zimmerman BJ. Self-efficacy: an essential motive to learn. Contemp Educ Psychol 25: 82–91, 2000. doi:10.1006/ceps.1999.1016.

42. Zimmerman BJ, Bandura A, Martinez-Pons M. Self-motivation for academic attainment: the role of self efficacy beliefs and personal goal setting. Am Educ Res J 29: 663–676, 1992. doi:10.3102/00028312029003663.

43. Zimmerman BJ, Martinez-Pons M. Student differences in self-regulated learning: relating grade, sex, and giftedness to self-efficacy and strategy use. J Educ Psychol 82: 51–59, 1990. doi:10.1037/0022-0663.82.1.51.