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Problem-Based Learning in Teacher Education: Its Promises and Challenges

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Abstract

Problem-based learning has been in use in the education of medicine, law, and engineering students. The aim of this study is to put forth that PBL could be used equally successful in the education faculties, hence to analyze the effects of problem-based learning on academic achievement and self-regulated learning skills together, and to undertake self-peer assessments that have been long neglected in PBL studies. Senior students (treatment=36, control=21) of Middle East Technical University Faculty of Education Department of Foreign Language Education took part in the study. An achievement test, an open-ended-application exam, a scale on self-regulation in learning, and self-peer assessment forms were developed and used to gather quantitative data. Statistical procedures like independent samples t-test, ANOVA for repeated measures, and Pearson correlation technique were administered to quantitative data. The quantitative results revealed that PBL was effective on students' academic achievements, but it had no significant effects on self-regulated skills. Students were consistent in their self and peer assessments, but their self-assessments were lower than their peer assessments. Suggestions parallel to findings are given in the end.

1. Introduction

These days when information is growing rapidly, there is an ongoing discussion on which teaching-learning process should be followed in the education of students who are capable of managing that bulk of information, participating actively to the learning process, having higher thinking skills and are equipped with lifelong learning skills.

The constructivist teaching-learning approach which has been worded widely in educational settings in recent years focuses on students taking responsibility of their own learning while constructing their own versions of knowledge. Hence, some instructional approaches like case-based learning, inquiry based learning, project based

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learning, and problem-based learning that take constructivism as basis have emerged (D'Angelo, Touchman & Clark, 2009).

The main subject of this study, the problem-based learning (PBL), has been successfully in use in the education medical, law, and engineering students. In this approach, students working in cooperative learning groups study real life problems, where they work on both content and application of knowledge. They have the opportunity to see what and why they are learning and be prepared better to their future careers.

2. The purpose and significance of the study

Some reservations have been held about constructivist learning approaches, problem-based learning included. The role of teachers in this particular approach is to guide students in their learning processes and to facilitate their learning. In addition, students are expected to reconstruct and research the information and take responsibility of their own learning instead of passively receiving it. Some people are reported to have worried that students will not have equal academic development and there will be no controlled learning (Barrows & Tamblyn, 1980; Savery & Duffy, 1995; Schmidt, 1983). However, studies in primary school (Deveci, 2002; Çiftçi, Meydan & Ektem, 2007; Araz, 2007; Karaöz, 2008; Özsarı, 2009), secondary school (Sungur, Tekkaya & Geban, 2006; Özgen & Pesen, 2008; Kuşdemir, 2010), and higher education (Özyalçın Öskay, 2007; Şendağ, 2008; Erdem, 2009) have shown that students are academically successful in problem-based learning settings as those in traditional settings. The analyses of those studies have revealed that (a) most of them cover only a unit and utilize both quantitative and qualitative methodologies, (b) besides academic achievement they also focus on attitudes towards particular courses, and (c) a few of them investigate the influence of PBL on students' retention skills. We thought that those studies lack to state PBL's effects on knowledge and/or higher thinking levels separately. Some other studies have investigated and found positive results about PBL's influence on the development of self-regulation and motivational elements which are expected to improve in those cooperative learning groups handled during the sessions (Dolmans and Schmidt, 1994; Van den Hurk, Wolfhagen, Dolmans & Van der Vleuten, 1999; Sungur & Tekkaya; 2006; Turan, 2009). Besides those studies done in medical education, there are no investigations on self-peer assessments processed during PBL sessions. We thought there is a need to further study self-regulation and self-peer assessments in PBL environments.

Within this respect, the aim of this study is to analyze PBL's influence on students' academic achievements and their self-regulations, and to investigate those self-peer assessments that have been long neglected in related research. For these purposes, answers to the following questions are sought for:

In METU (Middle East Technical University), English teaching department, testing and evaluation course;

1. Is there a significant difference between
    a. the knowledge and comprehension levels of students in control and treatment groups?
    b. the application and higher levels of students in both groups?
2. Is there a significant difference between the self-regulation levels of students in both control and treatment groups?
3. What is the level of relationship among students' self-peer assessments in the treatment group?

3. Methodology

3.1. Method and participants

In this control group pre-post test research that lasted for 15 weeks, one control and one treatment group were observed. The participants were METU English teaching department senior undergraduate students taking the testing and evaluation course in the fall semester of 2010-2011. There were 36 students in the treatment group and 21 in the control one.

3.2. Instrumentation and data analysis

Achievement tests (a multiple-choice knowledge and comprehension achievement test and an open-ended application exam), a scale on self-regulation in learning and self-peer assessment forms were used to gather data.

The "Scale on Self-Regulation in Learning" (SSRL) developed by one of the authors (Erdoğan, 2012) is based on literature review and similar studies (Zimmerman & Martinez-Pons, 1986; Pintrich & De Groot, 1990; Pintrich, Smith, Garcia, & McKeachie, 1991) done, and consists of two main categories: self-regulated learning skills and motivational factors. To better reflect the construct of self-regulation, later those self-regulated learning skills factors were grouped under three dimensions: before study, during study, and after study. The goodness of fit indices obtained for the whole scale are summarized in Table 1. In short, the 67-item scale, which has two sub-scales as self-regulated learning skills/strategies and motivation, explains 64.48% of the variance, and has the Cronbach's alpha of 0.91 for the whole scale. The multiple-choice achievement test consists of 35 items (15 knowledge level and 20 comprehension level items) and has the Cronbach's alpha value of 0.91. The open-ended application exam aims to assess students' behaviors at analysis and higher levels. The self-peer assessment forms were adapted from the study of Das, Mpofu, Dun, & Lanphear (1998). SPSS was utilized to analyze data. Independent samples t-test, variance analysis for repeated measures and Pearson correlations were used during the analyses.

Table 1. Goodness of fit statistics for SSRL.

| | Goodness-of-fit Statistics | | | | | | | | |
	x^2/df	GFI	AGFI	SRMR	RMR	CFI	RMSEA	NFI	IFI
Before Study	4.6	0.95	0.93	0.04	0.10	0.94	0.07	0.93	0.94
During Study	2.7	0.96	0.94	0.04	0.06	0.94	0.04	0.91	0.94
After Study	3.8	0.96	0.94	0.05	0.08	0.97	0.06	0.96	0.97
Motivation	3.1	0.94	0.92	0.05	0.07	0.95	0.05	0.93	0.95

3.3. Research Procedures

The traditional method was followed in the control group, whereas the lessons in the treatment group were implemented according to the principles of problem-based learning methodology. Both groups were given the achievement tests and the scale on self-regulation at the beginning and at the end of the study. Apart from the control group, the students in the treatment group completed their self-peer assessments at the end of each module (there were a total of five modules).

4. Findings and results

Results of variance analyses for repeated measures obtained revealed that both control and treatment groups were equal in their knowledge level achievements, whereas significant differences ($p<0.01$) were found in favor of the treatment group considering students' comprehension and higher level (application, analysis, and synthesis) achievements. Such a result is considered mundane or predictable. Because, instead of passive learning, in PBL students participate in cooperative learning groups where they work on real life problems, hence they have the chance to research more information and see the actual practical results of theoretical constructs, and take the responsibility of their learning eventually. As in the studies found in literature, the real power of PBL can be seen in activities based on application and in real life problems encountered during their occupational experiences (Barrows & Tamblyn, 1980; Savery & Duffy, 1995; Schmidt, Vermeulen & Van Der Molen, 2006).

The analyses considering all dimensions of the scale on self-regulation in learning showed that there was difference between the control and treatment groups. Though the self-regulation levels of students in the treatment group were found higher than those of the students in the control group, except for the task value component of the scale, the differences were not significant ($p>0.05$). The main reason could be that students in both groups already had high self-regulation. The students attending the language teaching department of METU are among the top students in Turkey. Besides, a 15-week application could not be enough to show real development in self-regulation. Just as in their research, Van der Hurk et al (1999) investigated students' progress in their self-regulations through undergraduate grades of 1-4 and found that real development occurred only in the 3rd and 4th grades. It is estimated

that a better and healthier observation of self-regulatory skills development could be made in a study that would last 3-4 years, covering all the classes the students attend during their undergraduate studies.

The Pearson correlations considering the self-peer assessments undertaken during PBL sessions in the treatment group showed that students were consistent in assessing themselves and their peers. Such a finding is parallel to the findings of a study done by Langendyk (2006). However, their self-assessments were lower than their peer assessments. As Violato & Lockyer (2006) show in their study, those students assessing themselves lower than their peers are the ones with high achievement levels. The present study provides no proof explaining which achievement groups (low or high) evaluated themselves lower (or occasionally higher) than their peers. Besides, some other studies (Bergee, 1997; Falchikov & Goldfinch, 2000) reported that peer assessments are more accurate than self-assessments. The reason for this could be that even though students could discriminate good and bad performances, they fail to use the same standards when it comes to evaluate themselves (Ward, Gruppen & Regehr, 2002). At the same time, Eva et al. (2004) and Ward, Gruppen & Regehr (2002) state that self (and peer) assessments could be more accurate and consistent as the students become more experienced with such assessments. These findings could be true for the present study as well. As a result, it can be said that time and patience could contribute substantially to the development of student self-peer assessments.

5. Discussion

In the present study, we sought for the influence PBL has on student achievements, on students' use of self-regulatory learning skills, and we analyzed the self-peer assessments completed at the end of each module processed in the treatment group. The findings present us with the fact that PBL has significant influence on student achievements at knowledge level, comprehension level , and higher levels. While such a result relieves us from our previous concerns that constructivist learning methods like PBL would fail to teach our students the basic knowledge and comprehension level competencies, it also helps us to see the power and influence of PBL methodology on student achievements at application and higher levels. The positive, but not significant effect of PBL on students' use of self-regulatory skills can be dedicated to the nature of such methodologies, where students work in cooperative learning groups, investigate more information, spend more time on directing, observing, and evaluating their own learning, and as a result become more autonomous learners. The insignificant difference between the self-regulations of control and treatment groups could be explained by the students in both groups already being equipped with high self-regulatory skills, and the short period of application reserved to see the changes PBL would have on self-regulation. Though not experienced they were, the students in the treatment group did fairly well and were consistent in their self-peer assessments. Reflecting similar results found in literature, their self-assessments were lower than their peer assessments. Again, more frequent exposure to such assessments would help students become more accurate and consistent in their evaluations and they would learn to successfully apply those standards on their own performance eventually, as they do on the performance of their peers.

As a consequence, the results of this particular study, which investigated the influence of PBL on achievements and self-regulation and analyzed self-peer assessments, show that PBL could equally be utilized successfully in the education of prospective teachers as it is used in medicine and engineering. It is thought that better infrastructure and smaller class size could give better results. Also, the replication of this research in other universities with varying student levels could provide a better chance to observe PBL's real influence on self-regulation.

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