Universal Journal of Educational Research 5(6): 972-988, 2017 http://www.hrpub.org
DOI: 10.13189/ujer.2017.050610

What Does Research Tell Us about Trends in Dissertations on PBL?

Tolga Erdogan

Army NCO Vocational College, National Defense University, Turkey

Copyright©2017 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

Abstract The aim of this study is to investigate the research trends in dissertations on PBL from 2002 to 2015 in Turkey. For this purpose, the master's and doctorate dissertations in the National Thesis Database of Council of Higher Education (CoHE) were selected for rigorous content analysis. The analysis was utilized to classify the type of study, the learning domains, research methods, research designs, research domains, subject groups, group sizes, length of treatments and data collection instruments. For analysis purposes, frequencies and percentages were calculated for each category. Additionally, the results obtained in these dissertations were examined and reported separately with regards to cognitive, affective and conative domains. According to analysis results; science is the most favorable learning domain, quantitative methodology is more utilized as compared to qualitative and quantitative methods, cognition and affect followed by cognition only are the mostly utilized research domains, subject groups are predominantly at elementary education level and secondly from teacher education, studies preferred to have a group size of 41-80, the treatments on PBL research last mostly four to six weeks, and finally majority of the studies use achievement tests and attitude scales as instruments of measurement.

Keywords Problem-based Learning, Content Analysis, Research Trends, PBL Dissertations, Cognition, Affect and Conation

1. Introduction

The Turkish education system, which is under the supervision and control of the Ministry of National Education (MoNE), consists of three levels which make up 12 years of compulsory education: The elementary school education (grades 1-4), the middle school education (grades 5-8), and the high school education (grades 9-12). Students who graduate from high schools have the right to continue to higher education, which is governed by the Council of Higher Education (CoHE) and includes universities, institutes of technology, vocational schools, and other higher education institutions such as military academies and colleges.

Starting in the 2005-2006 Academic Year, constructivist teaching and learning was introduced into elementary and secondary education and curricula were changed accordingly. The main aim was to assure that each pupil's social, psychological and moral development reach to the desired level and to give students a chance to apply what they have learned, to urge them use higher order thinking skills more and to train students as lifelong learners (MoNE, www.meb.gov.tr). With the onset of constructivism in Turkish education system, research started to focus on methodologies such as project-based learning, inquiry-based learning, case-based learning, etc., which embody the principles of constructivist teaching and learning [1].

Problem-based learning (PBL) is one of those constructivist teaching and learning methodologies implemented in schools and investigated in current research in Turkey. Literature review on PBL studies suggests that the majority of PBL research and practice is in higher education, specifically medical education, but recently more research has been published in different disciplines and levels [2, 3]. Outside Turkey, many meta-analyses and reviews [3, 4, 5, 6, 7, 8, 9, 10, 11, 12] have been conducted to analyze the effectiveness of PBL. The only meta-analysis on PBL research in Turkey, which could be accessed by the author as of October 2014, belongs to Üstün [13]. It is quite obvious that more review studies are needed to analyze PBL's appropriateness, its application and practices, its strengths and weaknesses, and its potential influence on today's education [14], specifically in Turkey. Besides, as more disciplines and educational settings (e.g. elementary education, higher education) began experimenting with PBL, it became necessary to review the outcomes reported in these

studies. Therefore, reviewing the research trends in PBL studies may help the researchers in related fields to identify their research interests and designs.

In this respect, this study intends to investigate the research trends in dissertations on PBL from 2002 to 2015 in Turkey. For this particular purpose, the master's and doctorate dissertations in the National Thesis Database of CoHE were selected for analysis. The research questions addressed by this paper include:

1. What type of studies, learning domains, research methods, research designs, research domains, subject groups, group sizes, length of treatments and data collection instruments were used in the selected theses from 2002 to 2015?
2. What were the findings of these studies regarding cognitive, affective and conative domains?

Apart from the research questions above, the author aims to present a critical analysis of the methodologies used and provide implications for further practice and research on PBL in the discussion part.

1.1. Problem-Based Learning (PBL)

PBL is a student-centered, inquiry-based approach, which has its roots in constructivist epistemology [15] and begins with an ill-structured problem with possible multiple solutions. Teachers are facilitators, whereas learners actively construct knowledge by defining learning goals, seeking information to build upon prior knowledge, reflecting on the learning process, and participating actively in cooperative/collaborative learning groups [16, 17, 18]. Barrows [19] identifies the following objectives of problem-based learning:

- Structuring of knowledge for use in clinical contexts,
- The development of an effective clinical reasoning process,
- The development of effective self-directed learning (SDL) skills,
- Increased motivation for learning (p. 481-482).

Among the educational objectives and goals listed above, value is placed on PBL's promotion of learning outcomes in the cognitive, affective, and conative domains. Huitt and Cain [20] define;

- *Cognition* as a reference to the process of coming to know and understand; of encoding, perceiving, storing, processing, and retrieving information. It is generally associated with the question of "what" (e.g., what happened, what is going on now, what is the meaning of that information).
- *Affect* as a reference to the emotional interpretation of perceptions, information, or knowledge. It is generally associated with one's attachment (positive or negative) to people, objects, ideas, etc. and is associated with the question "How do I feel about this knowledge or information?".
- *Conation* as a reference to the connection of knowledge and affect to behavior and is associated with the issue of "why." It is the personal, intentional, planned, deliberate, goal-oriented, or striving component of motivation, the proactive (as opposed to reactive or habitual) aspect of behavior.

The references to cognitive, affective, and conative domains of learning above presents PBL's potential to promote not only what is learned, but also put emphasis on feelings on what is learned and the learning experience itself, together with willingness and desire to learn. Investigating the dissertations with regards to the findings related to these domains would help practitioners and researchers in their studies.

1.2. Review of PBL Research

Review studies on PBL are predominantly in medical education; however, the adoption of this particular method has extended into elementary schools, secondary schools, universities of different disciplines, and professional schools. In his review, Savery [2] gives a list of several studies, which illustrates the multiple contexts where PBL instructional approach is being utilized.

Previous meta-analyses and reviews [4, 5, 6, 7, 8, 9, 10, 11, 13, 12, 3] have focused on various outcomes of PBL instruction.

Albanese and Mitchell [4] categorized and listed the qualitative results of studies in medical education from 1972 to 1993. The main results of this review were that students held more positive views on PBL than traditional instruction and PBL graduates performed as well and sometimes better than traditional graduates on clinical examinations and faculty evaluations. However, PBL students scored lower on basic science examinations in comparison with their conventionally trained counterparts.

More recently, Dochy, Segers, Van den Bossche and Gijbels [7] reviewed studies on PBL beyond the domain of medical education. The results of their meta-analysis suggested that PBL had statistically and practically significant positive effects on students' knowledge application. The findings on knowledge base of students led the authors to conclude that students in PBL performed at least as well as students in conventional learning environments. The last remarkable finding related to the retention period was that students in PBL gained slightly less knowledge, but remembered more of the acquired knowledge.

In their meta-analysis, Gijbels, Dochy, Van den Bossche and Segers [8] investigated the assessment of three levels of the knowledge structure as main independent variable in PBL settings: (a) understanding of concepts, (b) understanding of the principles that link concepts and (c) linking of concepts and principles to conditions and procedures for application. They found that PBL had the most positive effects when the focal constructs being

assessed were at the level of understanding principles that link concepts. The results suggested that the implications of assessment must be considered in examining the effects of PBL and probably in all comparative education research.

In their synthesis Vernon and Blake [12], analyzed all available research from 1970 to 1992. In their comparison of PBL with more traditional methods of medical education, they found that PBL was superior with respect to students' attitudes and opinions about their programs and with respect to measures of students' clinical performance. They also reported that contrary to the previous review findings, the scores of PBL students on various tests of factual and clinical knowledge were not significantly different from the scores of conventionally taught students. However, the conventionally taught students performed significantly better than their PBL counterparts on the National Board of Medical Examiners (NBME) Step 1, which focuses on concepts of basic science that are important to the practice of medicine, with special emphasis on principles and mechanisms underlying health, disease and methods of therapy.

Berkson [5] also searched for evidence of the effectiveness of PBL in medical education. The results showed no distinction between graduates of PBL and traditional instruction, considering problem solving, imparting knowledge, motivation to learn medical science, promoting self-directed learning skills, and student and faculty satisfaction. However, PBL was found to be stressful for both students and faculty.

In their meta-analytic study, Kalaian, Mullan and Kasim [9] indicated that PBL curricula showed higher performance on standardized profession-wide clinical science outcome measures, but lower on basic science outcome measures. Additionally, their findings suggested that schools which had a past history in PBL utilization, which had developed teaching expertise and learning materials for PBL instruction were able to score on basic science outcome measures as high as those schools which followed more traditional methods of instruction.

In his review Colliver [6] examined the educational superiority of PBL in comparison to traditional approaches. He concluded that there was no convincing evidence that PBL improved students' knowledge base or clinical performance. Nevertheless, he stated that PBL might provide a more challenging, motivating, and enjoyable approach to medical education.

In her study, Leary [10] conducted a meta-analysis across all disciplines to examine the extent to which problem-based learning engendered self-directed learning compared to a lecture-based approach. From her synthesis, she showed that PBL promoted conative and affective skills in self-directed learning.

In their review of empirical studies that examined Self-Directed Learning (SDL) and Self-Regulated Learning (SRL) in PBL environments, Loyens, Magda and Rikers [11] gave evidence on PBL's positive influence on the development of SDL and SRL, though the studies showed mixed results. They also concluded that more research was needed to better understand how, when, and why PBL fostered development of SDL and SRL.

In his meta-analysis of Turkish studies, Üstün [13] investigated the effectiveness of PBL on student achievement and motivation in science, together with its influence on attitudes towards science and skills in elementary, secondary and higher educational levels. Additionally he examined the effects of some moderator variables including publication type, research design, teacher effect, researcher effect, country, subject matter, school level, PBL mode, length of treatment, group size, type of questions and assessment instrument on the effectiveness of PBL. The results of 147 effect sizes he calculated from 88 primary studies included in his research clearly showed PBL's superiority over traditional teaching methods on different outcomes. More specifically, PBL had a huge impact with a large effect size of 0.820 on students' achievement in science subjects in different levels and revealed medium effect sizes of 0.566, 0.616, and 0.565 for students' attitude towards science, motivation in science and different kinds of skills respectively. Moreover, he reported that moderator analyses indicated noteworthy impact of publication type, country, subject area, school level and length of treatment on the effectiveness of PBL.

There is also a body of evidence derived from interviews and observations in related research on PBL. In summary, it was suggested that PBL granted students the chance to work on real life problems in their cooperative learning groups and supported student development by enhancing sharing of knowledge; PBL was well received and found useful both by the instructors and students; PBL enhanced the development of self-regulated learning skills of students better than their counterparts receiving traditional instruction; the interactions among students in PBL tutorials contributed substantially to group processes and performance outcomes; the ultimate gains of PBL classes were interaction and access to more information as a result of increased research skills; PBL students' reliance on their instructors' guidance decreased and they focused more on their peers' opinions and contributions; and PBL was influential in the development of group interactions, student self-reliance, research skill development and active participation during the learning process [21, 22, 23, 24, 25, 26, 27, 28, 29]. On the other hand, the workload of PBL tutorials was a common complaint among students and students' statements of uncertainty (what to learn, where to find, how to start etc.) at the beginning of PBL tutorials were some of the challenges noticed [30, 26].

The prior meta-analyses and reviews summarized above clearly suggest that PBL studies mainly focused on cognitive and affective outcomes and there is lack of review on conative outcomes of PBL instruction. Nevertheless, in these analyses, PBL students seemed to have gained better performance than those students with traditional training in knowledge principles and application, problem solving, and

self-directed learning, whereas traditional students' performance in basic knowledge were better than PBL students.

2. Method

This paper examined the dissertations on PBL in the National Thesis Database of CoHE in Turkey. For this purpose, the master's and doctorate dissertations were searched by using "problem-based learning" as a keyword with no time restrictions. A total of 129 dissertations (82 master's, 47 doctorate) were found (as of December 2016), 20 (12 master's, 8 doctorate) of which were not accessible due to restrictions requested by the authors themselves. In line with pre-determined criteria of inclusion, out of the remaining 109 dissertations (70 master's, 39 doctorate), 8 dissertations (6 master's, 2 doctorate) that failed to provide information for the majority of the selected analysis criteria were eliminated by the author and raters unanimously. In the end, 101 dissertations (63 master's, 38 doctorate), were included in the study (the list of dissertations is in Appendix A). They were all downloaded from the database and undergone rigorous content analysis.

Content analysis was chosen as a qualitative method to investigate the research trends in research. Content analysis is defined by Krippendorff [31] as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18). Additionally, Cohen, Manion and Morrison [32] define it as "the process of summarizing and reporting written data – the main contents of data and their messages" (p. 475). They also add that "it defines a strict and systematic set of procedures for the rigorous analysis, examination and verification of the contents of written data." As Krippendorff states it, content analysis is learnable and divorceable from the personal authority of the researcher and it "provides new insights, increases a researcher's understanding of particular phenomena, or informs practical actions" (p. 18). Therefore, the author preferred this scientific tool to investigate research trends in dissertations in order to inform practitioners and the faculty about PBL's practical actions and considerations.

2.1. Data coding and analysis

This study used 101 dissertations derived from the Council of Higher Education National Thesis Database in Turkey that were completed from 2002 to 2015 to examine the research trends in the PBL field. Throughout the process of content analysis, three colleagues with doctorate degrees in educational sciences helped the author in reviewing the dissertations and doing the analyses. The agreement among the raters was calculated as 90.2.

As one of the major purposes of this study, a dissertation classification form (DCF) was developed by the author and assisting colleagues to classify the categories to help identify the research trends. This form was inspired from a previously developed "paper classification form" of Sözbilir and Kutu [33]. After examined by colleagues and experts, the form was implemented on randomly selected 15 dissertations for reliability. The results of this initial trial were discussed to alleviate any disagreements on the items. According to discussions and negotiations, the form was revised again and its final version (see Appendix B) was agreed upon to be used for comprehensive content analysis.

In line with the second research objective, the results obtained in these dissertations were also examined and reported separately with regards to cognitive, affective and conative domains.

For the analysis purposes, by means of the dissertation classification form, all data were recorded on an electronic database and later transferred to SPSS 20. Frequencies and percentages were calculated for each category. These data were later commented and discussed.

3. Findings

3.1. Research Question 1

Among the 101 studies examined in this research, 63 were master's studies and 38 were doctoral studies (Table 1). The studies on PBL reached their peak through the period from 2007 to 2013 (a total of 83 theses), with the highest number of research completed in the years of 2009 and 2013. By examining the findings, it may be plausible to infer that the number of research decreased after 2013; however 10 of 20 dissertations (2014=5, 2015=5) found in the database but not accessed due to authors' restrictions account for the gap.

Table 1. Frequencies of Study Types from 2002-2015

Year	Type of Study		Grand Total
	Master's	PhD	
2002		1	1
2004	1	1	2
2005		2	2
2006	2	2	4
2007	8	3	11
2008	8	4	12
2009	9	4	13
2010	9	2	11
2011	9	3	12
2012	4	7	11
2013	8	5	13
2014	3	2	5
2015	2	2	4
Grand Total	63	38	101

Analysis show that PBL research was most frequently utilized in the learning domain of science (86%), followed by social studies domain (10%), whereas there were only 2 studies in the domain of arts and 3 studies in the domain of language arts (Table 2).

The findings on research method revealed that quantitative methodology was more prevalent among the dissertations. 51.52% of the studies used quantitative research methodology, whereas 48.5% utilized quantitative and qualitative research methods (Table 3).

It was found that researchers favored experimental design (90.1%) more than the others (Table 4).

The analysis on research domain focused in studies revealed some interesting facts. The most frequently focused research domain was cognition and affect (56.4%), followed by cognition only (27.7%) (Table 5).

Table 2. Frequencies of Learning Domains from 2002-2015

Year	Learning Domain			
	Arts	Language Arts	Science	Social Studies
2002				1
2004			1	1
2005		1	1	
2006			3	1
2007			11	
2008	1		9	2
2009			11	2
2010			11	
2011	1	1	9	1
2012		1	10	
2013			11	2
2014			5	
2015			4	
Grand Total	2	3	86	10

Table 3. Frequencies of Research Methods Utilized from 2002-2015

Year	Research Method	
	Quantitative	Quantitative and Qualitative
2002	1	
2004	1	1
2005	2	
2006	1	3
2007	7	4
2008	7	5
2009	7	6
2010	6	5
2011	7	5
2012	3	8
2013	8	5
2014		5
2015	2	2
Grand Total	52	49

Table 4. Frequencies of Research Designs Utilized in Dissertations from 2002-2015

Year	Research Method			
	Action Research	Experimental	Survey	Case Study
2002		1		
2004		2		
2005		1	1	
2006		4		
2007		11		
2008	1	10	1	
2009		11	2	
2010	1	10		
2011		12		
2012	1	8	1	1
2013		13		
2014		5		
2015		3	1	
Grand Total	3	91	6	1

Table 5. Frequencies of Research Domains Focused in Research from 2002-2015

Year	Research Domain					
	Affect	Cognition	Cognition and Affect	Cognition and Conation	Affect and Conation	Cognition, Affect and Conation
2002			1			
2004		1				1
2005	1		1			
2006			3			1
2007		5	4	1		1
2008	1	2	9			
2009	1	3	7			2
2010		2	8			1
2011	1	6	5			
2012			9			2
2013		5	7	1		
2014		3	1			1
2015		1	2		1	
Grand Total	4	28	57	2	1	9

The findings showed that the most frequently used subject group in the experimental studies were elementary education students (42.6%), followed by teacher education students (31.7%) (Table 6).

Table 6. Frequencies of Subject Group in Research from 2002-2015

Year	Subject Group			
	Elementary Education	Secondary Education	Higher Education	Teacher Education
2002	1			
2004		1	1	
2005			1	1
2006	2	1		1
2007	5	2	1	3
2008	3	4	1	4
2009	5	1	2	5
2010	5	1	1	4
2011	7	1		4
2012	4	1	1	5
2013	7	1	2	3
2014	2	2		1
2015	2		1	1
Grand Total	43	15	11	32

Considering group sizes, the studies on PBL preferred to have group sizes of 41-80 (60.4%), whereas the percentages of studies which used group sizes of 1-40, 81-120, and 120 and above were 17.8%, 11.9% and 12.5%, respectively (see Table 7).

Table 7. Frequencies of Group Sizes Utilized in Research from 2002-2015

Year	Group Size			
	1-40	41-80	81- 120	121 and above
2002		1		
2004		2		
2005		1		1
2006		3	1	
2007	2	4	2	3
2008	4	5	2	1
2009	1	9	1	2
2010	1	10		
2011	1	9	2	
2012	3	5	1	2
2013	4	6	2	1
2014	1	4		
2015	1	2	1	
Grand Total	18	61	12	10

Taking the length of treatments into account, the treatments on PBL research lasted mostly four weeks (17.8%), five weeks (11.9%) and six weeks (16.8%) (Table 8).

Table 8. Frequencies of Length of Treatments in Research from 2002-2015

Year	Length of treatment														
	7 hours	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks	7 weeks	8 weeks	9 weeks	10 weeks	12 weeks	14 weeks	15 weeks	19 weeks	Non-Specified
2002							1								
2004						1					1				
2005			1												1
2006				1		2						1			
2007		1		3	3	2				1					1
2008				4		2	1		1			3			1
2009			1	3	1	2	1		1	1	2				1
2010	1		1		2	4		2	1						
2011			2	4	1	1	1	1	1			1			
2012				2	1	2	1	1	1			2			1
2013			1	1	3		1	3		1	2		1		
2014					1	1		1	1					1	
2015			2					1					1		
Grand Total	1	1	8	18	12	17	6	9	6	3	5	7	2	1	5

The findings of the content analysis showed that there were 37 different types and in total 320 instruments used to collect data for research purposes. It is quite obvious that majority of the studies used achievement tests (30.9%) and attitude scales (18.1%) as instruments of measurement (see Table 9). The instruments categorized under the title "attitude scale" were the ones used to assess students' dispositions towards the course subject in which PBL was implemented (attitude towards chemistry, math, science and technology, etc.).

Table 9. Frequencies of Measurement Instruments Used in Research from 2002-2015

No.	Type of Measures	(*f*)	%
1	Achievement test (Including summative, formative, performance, and application tests)	99	30,9
2	Attitude Scale	58	18,1
3	Interview Forms	35	10,9
4	Scientific Process Skills Test	17	5,3
5	Instruments Specific to PBL (e.g. attitudes towards PBL, group processes and assessment activities in PBL, efficacy)	13	4,1
6	Problem Solving Tests (e.g. Heppner's Problem Solving Inventory)	12	3,8
7	Creative Thinking Tests (e.g. Torrance Test of Creativity)	11	3,4
8	Observation Forms	11	3,4
9	Self-peer and performance Assessment Forms	11	3,4
10	Scales on Motivation (e.g. Motivational Styles Questionnaire, Motivational Strategies in Learning Scale)	8	2,5
11	Critical Thinking Scales (e.g. California Critical Thinking Aptitude Scale)	6	1,9
12	Student Survey (questions on individual studies, group studies, instructors, PBL)	6	1,9
13	Scale on Self-regulated Learning	3	0,9
14	Self-Efficacy Scale	3	0,9
15	Academic Risk Taking Scale	2	0,6
16	Learning Approach Scale	2	0,6
17	Logical Thinking Test	2	0,6
18	Self-directed Learning Readiness Scale	2	0,6
19	Academic Self-Concept	1	0,3
20	Affective Tendencies Scale	1	0,3
21	Behavior Scale	1	0,3
22	Competence Perception Scale	1	0,3
23	Concept Inventory	1	0,3
24	Constructivist Learning Environment Survey	1	0,3
25	Inquiry Learning Skills Perception Scale	1	0,3
26	Mathematical Thinking Scale	1	0,3
27	Pedagogical Content Knowledge Concept Maps	1	0,3
28	Scale on Anxiety in Math	1	0,3
29	Scale on Clinical Reasoning	1	0,3
30	Scale on Learned Helplessness in Math	1	0,3
31	Scale on Locus of Control	1	0,3
32	Scale on Metacognition	1	0,3
33	Science Reasoning Aptitude Test	1	0,3
34	Science Teaching Orientation Test	1	0,3
35	Scientific Structure Creativity Model	1	0,3
36	Student Portfolios	1	0,3
37	Student Understanding Knowledge Test	1	0,3
Grand Total		320	100

The cross-reference of the findings depicted in Tables 1-9 revealed some more facts and trends about dissertations. Taking the subject groups into account, the majority of master's research (N=34, 53.1%) was conducted with students at elementary education level, whereas the doctoral studies were carried on with teacher candidates (N=21, 56.8%). Science as the predominant learning domain was preferred in 37 of 43 master's studies (86%) and in 27 of 32 doctoral research (84.4%). The most popular subjects grouped under the science category were math (N=21), science teaching (N=15), chemistry (N=14) and science and technology (N=12). In majority, studies conducted in elementary education chose math (N=12), science and technology (N=12) and science teaching (N=9) as the

learning domain, whereas studies completed in teacher education chose physics (N=7) and chemistry (N=7). Considering the length of treatments, 10 of the 18 treatments that lasted 10+ weeks were completed in teacher education, four of the remaining research was held in higher education institutions. As stated before the treatments in master's research mostly lasted 4-6 weeks (in 25 out of 43 studies).

The qualitative findings derived from interviews and observations were too fragmented to include in the present study, hence should be reported in detail somewhere else. However, a surface analysis of those qualitative findings indicated that PBL was reported to increase students' engagement, taking responsibility of their own learning, cooperation and interaction among group members and their self-efficacy in various subjects. The reports also showed that students learned more by doing or working on real life problems, they used higher-order thinking skills more frequently, they searched and shared more sources, hence their research skills developed substantially. On the other hand; difficulty in having access to information, noise in the classroom, confusion in the beginning, having difficulty in adapting to active participation instead of passive learning were some of the challenges noted.

3.2. Research Question 2

The findings of content analysis showed that PBL students did better in achievement tests than their conventional counterparts, except for a few studies (N=12), where no difference was observed between two groups of students. It is important to note that seven of those non-significant findings were obtained in studies at elementary education level, which lasted 3-5 weeks and focused on students' achievements only in one unit (e.g. human and environment, algebraic expositions and equations, concept of area and perimeter). On the other hand, in other research which also lasted 3-5 weeks (N=31), students in PBL classes showed significant progress in their achievements. Nevertheless, the findings of the present study regarding cognitive outcomes of PBL instruction revealed that PBL students were superior to traditional students both in factual and conceptual knowledge and specifically in skills of knowledge application. These findings seem to be in line with those of previous meta-analyses and reviews [7, 8, 12, 13], where PBL students were found to be doing better or equally well as their conventional counterparts.

Regarding the findings on attitudes on course subjects (e.g. chemistry, biology, etc.), in 35 studies out of 58 (60.3%), there was positive influence of PBL instruction on student attitudes, whereas in the remaining studies no significant difference was observed. Among those 23 studies with PBL treatment's no significant influence on attitudes, 16 were master's and 7 were doctoral research; 13 studies were conducted at elementary education level, and science teaching (N=7) and math (N=7) were the learning domains. Overall, as reported in prior reviews on PBL instruction [4, 5], PBL students' attitudes and dispositions towards learning after PBL treatment and student and faculty satisfaction with the instruction were found positive. In those studies examining students' dispositions towards the PBL itself (N=13, PhD=7 and Master's=6), student reports were highly favorable and positive.

The findings regarding other measures revealed mixed results. Considering the more frequently utilized measures, the PBL instruction was found to have significant effect on scientific process skills in 12 out of 17 studies (70.6%), on creative thinking skills in 6 out of 11 studies (54.5%), and on problem solving skills in 8 out of 12 studies (66.7%).

The only studies that investigated conative outcomes of PBL instruction focused on such elements like self-direction/self-regulation, motivational styles and strategies, locus of control, and learning approaches. In 5 out of 8 studies focusing on motivational elements and in two studies examining learning approaches in PBL contexts, the findings demonstrated that PBL instruction had significant influence. While the studies investigating PBL's influence on self-directed learning readiness (one 4-week and one 15-week treatment) showed significant differences, the studies on PBL's effect on students' self-regulatory skills and locus of control reported mixed results. Students' self-regulation levels and their locus of control in PBL contexts were found to be similar to those of students in traditional teaching and learning settings after treatment periods of 12, 14 and 15 weeks; however in a research which lasted 19 weeks at elementary education level, significant positive gains were recorded on students' self-regulated learning scores. The inconclusive and inconsistent results did not provide enough evidence on PBL's positive influence on such elements. Having no concordance with the results of studies by Leary [10] and Loyens, Magda and Rikers [11], these findings confirm the necessity to have more research to get a better picture of PBL's influence on conative elements like self-direction or self-regulation.

4. Discussion

This study aimed to investigate the research trends in studies of PBL from 2002 to 2015 in Turkey. The results of the findings are discussed and commented below.

The content analysis of master's and doctoral dissertations showed that the number of studies on PBL was the highest during the period of 2007-2013. However, this increase in the number of dissertations is considered unexceptional since constructivist approaches were introduced into Turkish education system starting in 2005-2006 Academic Year.

Considering the analyses results of categories under focus, this study indicated that; science was the most favorable learning domain (see Table 2), quantitative method was slightly more utilized as compared to qualitative and quantitative (mixed) methodology (see Table 3), experimental was the dominant design in the dissertations

(see Table 4), cognition and affect followed by cognition only were the mostly utilized research domains (see Table 5), subject groups were predominantly at elementary education level and secondly from teacher education (see Table 6), studies preferred to have the subject group size of 41-80 (see Table 7), the treatments on PBL research lasted mostly four and six weeks (see Table 8), and finally majority of the studies used achievement tests and attitude scales (see Table 9) as instruments of measurement.

These findings with regard to the first research question revealed evidence on several research trends. First, studies generally focused on PBL's effect on cognition and affect, hence they preferred to use achievement tests and attitude scales of various sorts. Second, there was an increase in the utilization of both quantitative and qualitative methods together, although it was slightly lower than quantitative method only. Third, studies at elementary education and teacher education were on the rise. Fourth, it is obvious that science was and potentially will continue being the dominant learning domain in PBL research. Finally, the researchers' preferences for length of treatment in majority ranged from 3 to 9 weeks due to curricular and time constraints.

The findings regarding PBL's influence on cognitive and affective outcomes seemed to be in concordance with the findings obtained in previous meta-analyses and reviews. Supporting the reports of Albanese and Mitchell [4], Dochy et al. [7], Gijbels et al. [8] and Üstün [13], in the present study there is evidence on PBL's significant positive effect on knowledge application, however contrary to previous reviews [5, 6, 9, 12], PBL's meaningful influence on basic knowledge is observed as well. Also, similar to the findings in other reviews [13, 12], this study revealed some affective outcomes like positive attitudes and views towards learning of subjects and specifically on the implementation of PBL.

In comparison with previous meta-analyses and reviews, it is clear that PBL research in Turkish dissertations was mainly concerned about cognitive outcomes and secondly affective outcomes. There were just a few studies which focused on conative elements of learning like self-direction, self-regulation, locus of control, and motivational strategies in learning. Leary [10] pointed to the same fact and suggested that more studies should be done in order to get a better picture of PBL's influence on SDL and SRL. The results in the present study regarding the elements of this domain were found inconclusive. The same mixed results on whether PBL fosters self-direction or self-regulation were also reviewed in the study of Loyens, Magda and Rikers [11]. Erdogan and Senemoglu [34] addressed to this issue in their research and stated that different study results on PBL's effect on conative elements such as self-direction/self-regulation could be explained by students already being equipped with such skills and the short period of application reserved to see the changes PBL would have on them. Similarly, in their study investigating students' progress on self-regulation through undergraduate levels of 1-4, Van der Hurk, Wolfhagen, Dolmans and Van der Vleuten [35] found that real development occurred only in the 3rd and 4th grades. It is viable to say that a better and healthier observation of self-directed/self-regulated skills development or the improvement of other conative elements could be made in a study that would last longer than a few months or a year.

The qualitative results of the dissertations revealed overall positive attitudes towards PBL instruction on part of both learners and teachers. In their reviews, Albanese and Mitchell [4] noted the same satisfaction of faculty and students with PBL instructional method. Certainly, an increase in qualitative assessments like interviews could provide faculty and teachers with valuable aspects of PBL use.

So far, the dissertations on PBL showed promising results. 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 search for more information, access different sources, see the actual practical results of theoretical constructs and eventually take the responsibility of their own learning. However, more studies are required before conclusions are drawn about the effectiveness and usefulness of PBL in a variety of disciplines and levels. As in the studies found in literature, the real influence of PBL can be seen in activities based on application and in real life problems encountered during occupational experiences [36, 15, 37]. Therefore, studies on long-term effects of PBL use, which would also cover after school periods, could provide the faculty and teachers with better picture of PBL's real power.

Considering the methodologies used in the dissertations, it is important to note that except for a few medical schools, in none of the studies PBL was the common methodology followed and implemented through all levels and courses. In other words, PBL was implemented and the results were analyzed as part of a research, in which PBL as a constructive methodology was new to both instructors and teachers. Further, a few studies undertaken about Turkish education system has shown that neither teachers nor students were ready enough to accept or adopt the new constructivist approaches, both at theoretical and application level. Teacher training programs and in-service courses were seen insufficient; crowded classes, having difficulty at accessing sources, lack of infrastructure such as laboratories added up the problem; the teachers and students tended to continue using traditional teaching and assessment approaches more frequently [38, 39]. Additionally; Gür, Dilci and Arseven [40] reported that prospective (pre-service) teachers found themselves adequate in terms of theoretical knowledge, but lacked practical knowledge. Student teachers believed that deficiency originated from lack of education including enough training on constructivist applications. Aygören [41] suggested that even school administrators were in need of in-service training on constructivism and constructivist learning environments.

It was found that specific care was given to put the

instructional principles of PBL methodology into action. The courses were designed to begin with the introduction of an ill-structured problem, where teachers acted as facilitators and learners actively constructed knowledge by defining learning goals, seeking information to build upon prior knowledge, reflecting on the learning process, and participating actively in cooperative/ collaborative learning groups [16, 17, 18]. However, under the condition of insufficient infrastructural support (e.g. no tutorial rooms, limited access to information in and out of classes through the Internet, small crowded classes, etc.) and tutors not assigned to tutorial groups especially at elementary and secondary education levels challenged the instructors to develop their own version of PBL. For example, in one of the dissertations, in the absence of specific tutors to each cooperative group in a large class, the researcher described the instructor taking the role of a "floating tutor" [42, p. 40-41]. Barrows [19] also exemplified different versions of PBL methodologies that might vary according to different conditions, settings, learner groups, etc.

Regarding the findings of the present research and those in literature confirm the fact that PBL could be used as an instructional methodology in all disciplines and subject areas, through all levels (from elementary to higher education) as long as the core principles are practiced. However, it is not plausible to expect immediate results from a PBL implementation in the beginning. Also, it is also not viable to expect sudden changes in student roles. Students may need more time and experience as they have been taught passively in controlled and well-structured learning environments. It is deemed important that for the successful application of methods like PBL, infrastructure needs should be met and necessary changes must be incorporated into the curriculum, especially to content and timing. The undergraduate and in-service training of teachers as practitioners on constructivist teaching and learning methodologies including PBL should be granted priority. Finally, it is worth remembering that it is the responsibility of practitioners to ensure the implementation of PBL according to its principles, to provide assistance to students in their transition to more active learning, cooperation and taking responsibility of their own learning.

5. Conclusions

The present study examined the research trends in studies of problem-based learning from 2002 to 2015 in Turkey. For this purpose, 101 master's and doctoral dissertations underwent rigorous content analysis. In short, this study suggested some research trends in PBL dissertations through years. Besides these major considerations, this present research drew attention to analysis of the findings with regard to cognitive, affective, and conative outcomes.

The research has limitations though. First, the current study focused only on PBL dissertations completed between 2002 and 2015 and published in the dissertation database of CoHE in Turkey. Second, for analysis purposes, the study reviewed only the learning domains, research methods, research designs, research domains, subject groups, group sizes, length of treatments, and data collection instruments in these dissertations and analyzed the findings with regards to cognition, affect and conation. Third, the dissertations not accessed due to authors' restrictions and those providing not sufficient data for analysis were kept out of scope.

The findings of this analysis indicated that constructivist learning approaches such as PBL could be used successfully in other disciplines apart from medical education and could be utilized in different levels from primary to higher education. However, a comparative analysis of these findings in Turkey with those results of PBL studies in other countries or comparing the present findings with the results of studies investigating other constructivist methodologies such as project-based learning, case-based learning etc. would assist researchers in their prospective studies and at the same time create a better picture of strengths and challenges of using constructivist teaching and learning applications.

In conclusion; PBL as educational practice continues to have large impacts on all levels of education and across different disciplines. While the results of studies examining the effects of PBL seem to be conclusive regarding students' problem-solving abilities, attitudes and predispositions towards learning, and clinical or occupational skills in application, much more needs to be known about PBL's influence on the acquisition of basic knowledge and some conative elements like self-direction/self-regulation and locus of control.

Appendix A

List of Dissertations Used in the Analyses

No.	Author	Year	Research Topic	Type of Study
1	HANDAN DEVECİ	2002	The effect of problem based learning to attitudes, success and retention in social studies	PhD
2	METİN AÇIKYILDIZ	2004	Investigation of effectiveness of problem-based learning at physical chemistry laboratory experiments	Master's
3	BÜLENT AKSOY	2004	Problem based learning approach in geography teaching	PhD
4	SELAMİ OK	2005	The analysis of an English preparatory program based on the needs assessment of problem-based learning and regular groups in a foreign language-medium institution	PhD
5	SELÇUK ÖZDEMİR	2005	The effects of individual and collaborative problem-based learning using an online synchronized learning tool on critical thinking abilities, academic achievements, and attitudes toward internet use	PhD
6	BERNA CANTÜRK GÜNHAN	2006	An investigation on applicability of problem based learning in the mathematics lesson at the second stage in the elementary education	PhD
7	EDA ERDEM	2006	The effect of problem based learning on learning outcomes, problem solving skills and self-efficiency beliefs of prospective teachers	PhD
8	GÜLSEMİN USLU	2006	The Effect of problem based learning to attitudes, success and level of performance of the students in secondary school mathematics lesson	Master's
9	KORAY TAVUKCU	2006	The effects on the learning outcomes of problem based learning in science instruction	Master's
10	GÜLSÜM ARAZ	2007	The effect of problem-based learning on the elementary school students achievement in genetics	Master's
11	DERYA ÇINAR	2007	The effects of the problem based learning approach on the higher level thinking skills and levels of academic risk taking in primary science education	Master's
12	ÖZGE ÖZYALÇIN OSKAY	2007	Technology assisted problem-based learning applications in chemistry education	PhD
13	RAMİS BAYRAK	2007	Teaching solids by problem based learning	PhD
14	ERDAL TATAR	2007	Effect of problem based learning approach on understanding of the first law of thermodynamics	PhD
15	EROL GÜRPINAR	2007	Instruction technologies in medical education: integration of e-learning and problem based learning	Master's
16	NESLİHAN SİFOĞLU	2007	The Effects of constructivism and problem-based learning on students' success in the teaching the topic heritage' at the 8th grade	Master's
17	MÜGE YURD	2007	The effect of know-want-sample-learn strategy, which is developed by using problem based learning and know-want-learn strategy, towards the 5th grade students' attitudes in science and technology lesson and towards to remove their misconceptions	Master's
18	KEMAL ÖZGEN	2007	The effects of problem based learning approach on learning products in mathematics lesson	Master's
19	TUNCAY ÇAKIR	2007	The effect of problem-based learning method on students' achievement, retention and attitude in teaching the circle subjects that are in math course at seventh grade in elementary school	Master's
20	ERHAN GÜNEŞ	2007	The effects of different types of feedback strategies and attitudes of students towards internet on learning in web-mediated problem-based learning	Master's
21	SELCEN İŞERİ GÖKMEN	2008	Effects of problem based learning on students' environmental attitude through local vs. non local environmental problems	Master's
22	MERAL PAKYÜREK KARAÖZ	2008	The effect of teaching the unit of 'power and motion' in primary school science course using the problem based learning approach on students science process skills, success and attitude	Master's
23	AHMET KUMAŞ	2008	An assessment and implementation of problem based learning in cooperative learning groups in the unit of motion on the earth	Master's
24	SITKI AKIN	2008	Teaching environmental problems caused by stubble fires, ozone layer depletion and vehicles through problem-based learning	Master's
25	ZEYNEP OYA ÜNAL	2008	The effect of problem based learning on competence perception in piano and its teaching	PhD
26	ESRA KANLI	2008	The effect of problem based learning in science & technology instruction on gifted and normal students' achievement, creative thinking and motivation levels	Master's
27	MURAT KOÇAK	2008	The effect of problem based learning to attitudes, success and level of permanence of the students in secondary school geography lessons	Master's

28	SERKAN ŞENDAĞ	2008	The effect of online problem based learning on the pre-service teachers? critical thinking skills and academic achievement	PhD
29	MELİH KOÇAKOĞLU	2008	The effect of problem based learning and motivational styles on students' academic success and attitudes towards biology course	PhD
30	MERAL DEMİRÖREN	2008	Evaluation of clinical reasoning skill of students in PBL-based-integrated medical curriculum	Master's
31	VESİFE HATISARU	2008	The influence of problem-based learning method in the success of the ninth grade math learners and their attitude towards math	Master's
32	FATİH GÜRSUL	2008	The effects of online and face to face problem based learning approaches on student's academic achievement, their attitudes towards mathematics	PhD
33	GÖKHAN SERİN	2009	The effect of problem based learning instruction on 7th grade students' science achievement, attitude toward science and scientific process skills	PhD
34	AHMET ŞAHBAZ	2009	The attitudes of ELT students towards problem based learning in effective communication skills classes	Master's
35	EMİNE ŞALGAM	2009	The effect of problem based learning method on students' academic achievement and their attitude for physics lesson	Master's
36	MUSTAFA SERKAN GÜNBATAR	2009	Effects on creative thinking skills and attitudes of students due to the web mediated problem based learning.	Master's
37	PINAR AKIN	2009	The effects of problem-based learning on students? success in the teaching the topic fractions at the 5th grade	Master's
38	ASLIHAN KARTAL TAŞOĞLU	2009	The effect of problem based learning on students? achievements, scientific process skills and attitudes towards problem solving in physics education	Master's
39	SEVGİ TURAN	2009	The relationship between attitudes to problem-based learning, learning skills and achievement	PhD
40	DİDEM İNEL	2009	The effects of the using of problem based learning method in science and technology course on students? the levels of constructing concepts, academic achievements and enquiry learning skill perceptions	Master's
41	BÜLENT ALAGÖZ	2009	Effect of problem based learning method in promoting environmental consciousness in candidate social studies teachers	PhD
42	AYŞEGÜL ARSLAN	2009	The effect of learning style based on problem on the success of student in studying human and environment unit	Master's
43	TÜLİN ÖZSARI	2009	The effect of cooperative learning method to the fourth grade students' achievement on mathematic learning: Problem based learning (PBL) and student teams- achievement division method (STAD)	Master's
44	HAKAN TEKEDERE	2009	The effect of locus of control in web assisted problem based learning (PBL) on students? success, problem solving skills, and attitudes to learning	PhD
45	MÜKERREM APAÇIK	2009	The effects of problem-based learning method on 9th grade students' achievement in geometry	Master's
46	HASAN HÜSEYİN AKBULUT	2010	Implementation and evaluation of problem based learning on buoyant force and floating concepts	Master's
47	TUĞRUL KAR	2010	The effects of problem-based learning in linear algebra on the academic achievement, problem-solving skills and creativity of students	Master's
48	NEŞE UYGUN	2010	Effect of the problem based learning on the attitudes, academic achievement and retention level of the 5th year ground school pupils in the mathematics course	Master's
49	NAZAN YILDIZ	2010	The effect of experiment applications on the success, attitude and scientific process abilities of the students in the solution of the learning scenarios based on problems in science education	Master's
50	AYŞEGÜL BAYRAM	2010	The effect of problem based learning on overcoming 5th grade students? misconceptions about ?heat and temperature?	Master's
51	MESUT KUŞDEMİR	2010	An analysis of the effect of problem based learning model on the students success, attitude and motivations	Master's
52	CEMAL TOSUN	2010	The effect of problem based learning method on understanding of the solutions and its? physical properties	PhD
53	ELİF ÇELİK	2010	The effect of problem based learning approach in science education on students? academic achievement, attitude, academic risk taking level and retention of knowledge	Master's
54	ESRA BENLİ	2010	The research of the effects of problem based learning to the permanence of information, the academic success of science teacher candidates and their attitudes toward science	Master's
55	AYFER KARADAŞ	2010	Effect of the problem based learning applied to student achievement in biochemistry to "coenzyme" issue	Master's
56	ALPER ALTUNÇEKİÇ	2010	The effect of web supported problem based learning medium upon cognitive and effective learning products: Gazi University Kastamonu Education Example	PhD
57	ALİ TURAN TOZO	2011	The evaluation of the affect on student success and attitude of the subject which is Turkey's geopolitical position and regional problems via problem based learning technique	Master's
58	AYŞE ÇAĞIL KAYIPMAZ	2011	The effects of problem based learning on primary school 5th grade students' attitudes toward reading	Master's

59	BİLAL DEMİR	2011	The application of problem based learning model in numerical analysis course	Master's
60	MEHTAP ESKİ	2011	The effect of problem based learning method to the teaching algebraic expositions and equations in 7th classes of primary education	Master's
61	GÜLNUR ÖZDİL	2011	Effects of problem based learning approach on students? success in teaching the concepts of area and perimeter in seventh grade in primary schools	Master's
62	ADEM AYVACI	2011	The effect of problem-based learning approach on teaching the concept of equation	Master's
63	KANİ ÜLGER	2011	The effect of problem based learning method to creative thinking in visual arts education	PhD
64	ALİME ŞAHİN	2011	To analyze the effect of Problem Based Learning (PBL) Approach on academic success of students in teaching basic electrical circuits in general physics laboratory course	Master's
65	PINAR ÇETİN	2011	The effect of problem based learning applications on learning outcomes of the students in primary education life studies course	Master's
66	HAKAN YILDIRIM	2011	The effect of problem based and project based learning styles on primary school students? successes and attitude	Master's
67	ÖMER FARUK ÖZEKEN	2011	An investigation of effectiveness of problem based learning in teaching acid-base subject	PhD
68	CANAN DİLEK EREN	2011	The effect of problem based learning (PBL) on critical thinking disposition, concept learning and scientific creative thinking skill in science education	PhD
69	SEVİNÇ KAÇAR	2012	The effects of problem based learning method integrated visual arts on students? academic achievements, scientific creativity and attitudes towards science teaching with art activities	Master's
70	MAHİR BİBER	2012	The influence of affective factors on students' mathematical gains in the process of problem based learning	PhD
71	TOLGA ERDOĞAN	2012	The effects of problem-based learning on achievement and self-regulated learning skills	PhD
72	AYHAN MORALAR	2012	The effect of problem-based learning approach on academic success, attitude and motivation in science education	Master's
73	ESEN ERSOY	2012	High-level cognitive thinking skills and the changes in affection acquisitions in the problem-based learning process	PhD
74	ELVAN İNCE AKA	2012	The effect of problem-based learning method used for teaching acids and bases on different variables and students? views on the method	PhD
75	HATİCE BÜYÜKDOKUMACI	2012	Effects of problem based learning on learning products in science and technology lesson for elementary 8th grade	Master's
76	AHMET ELBİSTANLI	2012	Investigation of the effect of problem based learning approach on the achievement, attitude and scientific process skills of 11. grade students through chemical equilibrium subject	Master's
77	DİDEM İNEL	2012	The effects of concept cartoons-assisted problem based learning on students' problem solving skills perceptions, motivation toward science learning and levels of conceptual understanding	PhD
78	PINAR FETTAHLIOĞLU	2012	The usage of argumentation-based and problem-based learning approaches intended for developing the environmental literacy of pre-service science teachers	PhD
79	HASAN ŞAHİN KIZILCIK	2012	A case study on development of heat and temperature concepts in process of problem-based learning	PhD
80	RAMAZAN GÖGÜŞ	2013	Problem based learning teaching science and its effect on students' academic achievement and attitudes	Master's
81	TUĞBA BARAN	2013	The comparison of problem based learning and expository teaching approaches in terms of cognitive learning levels	Master's
82	PINAR ÇELİK	2013	The effect of problem based learning on pre-service teachers' physics course achievement, learning approaches and science process skills	PhD
83	NESLİHAN USTA	2013	The effectiveness of the problem based learning method on secondary school students' mathematics achievement, mathematics self-efficacy and problem solving skills	PhD
84	NİYAZİ SEZER	2013	Teaching of statistical basic concepts by the problem-based learning approach	Master's
85	RUKİYE MERHAMETLİ	2013	Application of the teaching of 'surface tension of liquids' onto problem based learning model (PBL): An experimental study	Master's
86	MEHMET ALUS	2013	The effect of problem based learning method on the academic achievement of secondary school students in math	Master's
87	AYŞE TUĞBA TETİK	2013	The effect of problem-based learning method on the decision-making skills of students at the social studies lesson	Master's
88	MUKADDER BARAN	2013	The effect of context- and problem-based learning on teaching thermodynamics	PhD

89	BÜŞRA KUZEY	2013	Investigation of effectiveness of problem based learning (PBL) model on teaching of the subject of chemical kinetics	Master's
90	MUSTAFA COŞAR	2013	Effects of computer programming studies on academic success, critical thinking skills and programming-based attitudes in problem-based learning environment	PhD
91	ERKAN ÖZCAN	2013	Effects of problem based learning on prospective science teachers' problem solving skills, academic achievements and attitudes	Master's
92	SERDAR SAVAŞ	2013	The effects of the use of problem based learning at seventh grade on students' attitude and achievement in Turkish courses	PhD
93	BURCU ÇOBAN	2014	The effects of problem based learning to success, creativity and transfer skills of the students	Master's
94	TUFAN İNALTEKİN	2014	The impact of problem based learning (PBL) practices on pedagogical content knowledge (PCK) development of pre-service science teachers.	PhD
95	GÜLCAN UYAR	2014	The effects of problem based learning technique on sixth grade students' academic achievement and attitudes toward mathematics course	Master's
96	BELMA ARSLAN TURAN	2014	Effects of problem-based learning on achievement, self-regulated learning skills and academic self-concept	PhD
97	OZAN EMRE DEMİREL	2014	Effects of problem based learning and argumentation based learning on the students' chemistry achievement, their science process skills and science reasoning aptitudes	Master's
98	MUSTAFA ONUR YURDAL	2015	The relationship between faculty of medicine students' attitudes toward problem based learning and self-directed learning readiness	Master's
99	MAKBULE KELEŞ	2015	The effect of problem-based learning method on student' recall level and success in the processing of Science and Technology course	Master's
100	TUĞÇE TUNÇ	2015	The effect of problem based learning on students' academic achievements in the subject of Electrochemistry in Analytical Chemistry course	PhD
101	MERVE OLÇA	2015	The effects of problem based learning method on students' analytical thinking skills, conceptual understandings and attitudes toward science	Master's

Appendix B

Final Version of Dissertation Classification Form (DCF)

Dissertation Identity Tag	
Name	
Author	
Publication Year	
CoHE Publication ID No	
Main Category	**Sub-Categories**
Type of Study	• Master's • Doctorate
Research Learning Domain	• Science (Mathematics, biology, chemistry, physics, life sciences, science and technology, information and communication technologies) • Social Studies (Social sciences, geography, environmental education, classroom management, effective communication skills) • Language Arts • Fine Arts (Visual arts, piano teaching)
Research Method	• Quantitative • Quantitative & Qualitative
Research Design	• _____
Research Domain	• Cognition • Cognition & Conation • Affect • Cognition, Affect & Conation • Cognition & Affect
Subject Group	• Elementary Education • Higher Education • Secondary Education • Teacher Education
Subject Group Size	• 1-40 • 81-120 • 41-80 • 120 and above
Length of Treatment	• _____Weeks
Data Collection Instrument(s)	• _____

REFERENCES

[1] D'Angelo, C. M., Touchman, S., & Clark, D. B. (2009). Constructivism. In E. M. Anderman, & L. H. Anderman (Ed.) Psychology of Classroom Learning: An Encyclopedia. USA: Gale, Cengage Learning.

[2] Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. Interdisciplinary Journal of Problem-based Learning, 1(1), 9-20.

[3] Walker, A., & Leary, H. M. (2009). A problem based learning meta-analysis: Differences across problem types, implementation types, disciplines, and assessment levels. Interdisciplinary Journal of Problem Based Learning, 3(1), 12-43.

[4] Albanese, M.A., Mitchell, S. (1993). Problem-based Learning: A review of literature on its outcomes and implementation issues. Academic Medicine, 68(1), 52–81.

[5] Berkson, L. (1993). Problem-based learning: Have the expectations been met? Academic Medicine, 68(10), 79-88.

[6] Colliver, J. A. (2000). Effectiveness of problem-based learning curricula: Research and theory. Academic Medicine, 75(3), 259–266.

[7] [7] Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: A meta-analysis. Learning and Instruction, 13(5), 533–568.

[8] Gijbels, D., Dochy, F., Van den Bossche, P., & Segers, M. (2005). Effects of problem-based learning: A meta-analysis from the angle of assessment. Review of Educational Research, 75(1), 27-61.

[9] Kalaian, H. A., Mullan, P. B., & Kasim, R. M. (1999). What can studies of problem-based learning tell us? Synthesizing and modelling PBL effects on National Board of Medical Examination Performance: Hierarchical linear modelling meta-analytic approach. Advances in Health Sciences Education, 4(3), 209-221.

[10] Leary, H. M. (2012). Self-Directed Learning in Problem-Based Learning Versus Traditional Lecture-Based Learning: A Meta-Analysis. Unpublished doctoral thesis, Utah State University.

[11] Loyens, S. M. M., Magda, J., & Rikers, R. M. J. P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. Educational Psychology Review, 20(4), 411–427.

[12] Vernon, D. T., & Blake, R. L. (1993). Does problem-based learning work? A meta analysis of evaluative research. Academic Medicine, 68(7), 550-563.

[13] Üstün, U. (2012). To What Extent is Problem-Based Learning Effective as Compared to Traditional Teaching in Science Education? A Meta-Analysis Study. Unpublished doctoral thesis, Middle East Technical University.

[14] Strobel, J., & van Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-analyses comparing PBL to conventional classrooms. Interdisciplinary Journal of Problem-Based Learning, 3(1), 44-58.

[15] Savery, J. R., & Duffy, T. M. (1995). Problem-based learning: An instructional model and its constructivist framework. Educational Technology, 35(5), 31-38.

[16] Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. New Directions for Teaching and Learning, 68, 3-12.

[17] Barrows, H. S. (1998). The essentials of problem-based learning. Journal of Dental Education, 62(9), 630-633.

[18] Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16(3), 235-266.

[19] Barrows, H. S. (1986). A taxonomy of problem-based learning methods. Medical Education, 20(6), 481-486.

[20] Huitt, W., & Cain, S. (2005). An overview of the conative domain. Retrieved October 2012, http://teach.valdosta.edu/whuitt/brilstar/chapters/conative.doc.

[21] Das Carlo, M., Swadi, H., & Mpofu, D. (2003). Medical student perceptions of factors affecting productivity of problem-based learning tutorial groups: Does culture influence the outcome? Teaching and Learning in Medicine, 15(1), 59–64.

[22] Dickie, C., & Jay, L. (2010). Innovation in postgraduate teaching: Mixed methods to enhance learning and learning about learning. Higher Education Research & Development, 29(1), 29-43.

[23] Downing, K., Kwong, T., Chan, S.-W., Lam, T.-F., & Downing, W. K. (2009). Problem-based learning and development of metacognition. Higher Education, 57(5), 609-621.

[24] Elsie, M., Francis, B., & Gonzaga, M. A. (2009). Attitudes and perceptions of students and teachers about problem based learning in radiography curriculum at Makerere University, Uganda. European Journal of Radiography, 1(4), 156-162.

[25] Gibbings, P., Lidstone, J., & Bruce, C. (2015). Students' experience of problem-based learning in virtual space. Higher Education Research & Development, 34(1), 74-88.

[26] Kivela, J., & Kivela, R. J. (2005). Student perceptions of an embedded problem-based learning instructional approach in a hospitality undergraduate programme. International Journal of Hospitality Management, 24(3), 437–464.

[27] Kumar, M., & Kogut, G. (2006). Students' perceptions of problem-based learning. Teacher Development, 10(1), 105-116.

[28] Pepper, C. (2010). 'There's a lot of learning going on but NOT much teaching!': Student perceptions of problem-based Learning in science. Higher Education Research & Development, 29(6), 693-707.

[29] Rissi, J.R. (2010). Efficacy of problem based learning in a high school science classroom. Unpublished master's thesis, Michigan State University.

[30] Galand, B., Bentein, B., Bourgeois, K., & Frenay, E. M. (2005). The effect of a PBL curriculum on students' motivation and self-regulation. Retrieved October 2016, https://halshs.archives-ouvertes.fr/halshs-00603489.

[31] Krippendorff, K. (2004). Content Analysis: An Introduction to Its Methodology (2nd ed.). Thousand Oaks, CA: Sage

[32] Cohen, L., Manion, L., & Morrison, K. (2007). Research Methods in Education, (6th Edition). London and New York: Taylor & Francis Group or Routledge.

[33] Sözbilir, M., & Kutu, H. (2008). Development and current status of science education research in Turkey. Essays in Education [Special Issue], 1-22.

[34] Erdogan, T., & Senemoglu, N. (2014). Problem-based learning in teacher education: Its promises and challenges. Procedia-Social and Behavioral Sciences, 116, 459-463.

[35] Van den Hurk, M. M., Wolfhagen, I. H. A. P., Dolmans, D. J. H. M. & Van der Vleuten, C. P. M. (1999). The impact of student-generated learning issues on individual study time and academic achievement. Medical Education, 33(11), 808–814.

[36] Barrows, H. S. & Tamblyn, R. M. (1980). Problem-Based Learning: An Approach to Medical Education. New York: Springer Publishing.

[37] Schmidt, H. G., Vermeulen, L. & Van Der Molen, H. T. (2006). Long-term effects of problem-based learning: a comparison of competencies acquired by graduates of a problem-based and a conventional medical school. Medical Education, 40(6), 562-567.

[38] Kaya, A. (2008). A comparison of the classroom management approaches of the class teachers implementing constructivist learning approach and those of the branch teachers not implementing this approach (A case study in Gaziantep). Unpublished doctoral thesis, İnönü University.

[39] Özsevgeç, T., & Karamustafaoğlu, S. (2010). Pre-service student teachers' profiles of the measurement-assessment approaches. Journal of Turkish Educational Sciences, 8(2), 333-354.

[40] Gür, T., Dilci, T., & Arseven, A. (2009). The opinions of pre-service teachers in transition from traditional approach to constructivism: A discourse analysis. Dergi Karadeniz, 17. Accessed May 2017, http://dergipark.ulakbim.gov.tr/.

[41] Aygören, F. (2009). Evaluating the constructivist learning environments by the views of the primary school teachers and school administrators (Sample of Çine). Unpublished master's thesis, Adnan Menderes University.

[42] Duch, B. J. (2001). Models for Problem-Based Instruction in Undergraduate Courses. In B. J. Duch, S. E. Groh, & D. E. Allen (Ed.) The Power of Problem-Based Learning: A Practical "How to" for Teaching Undergraduate Courses in Any Discipline (pp. 39-45). Virginia, USA: Stylus Publishing.