Comparing Effects of Different Applications on Pre-Service Teachers: A Meta–Analysis

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Abstract

This study attempts to reveal whether different applications have effects on retention and attitude of pre-service teachers studying in various branches in Turkey through meta- analysis. Studies carried out between 2005 and 2015 in national and international area, 324 (218 articles, 106 theses) were chosen. However, 23 studies (9 retention and 14 attitude) that met inclusion criteria were analyzed by using the MetaWin program. The effect sizes of different applications on retention and attitude were calculated. In terms of retention scores, while Learning Together Technique had the highest effect size ($d= 2,0606$ -a huge level-), the Jigsaw Technique had the lowest one ($d= 0,5461$-a medium level-). In terms of attitude scores, while Transformative Learning Theory had the highest effect size ($d= 1,4760$–a huge level-), Problem Based Learning had the lowest one ($d= 0,0212$- negligible) among the applications included in the study according to the classification of Thalheimer and Cook.

Keywords: different teaching methods, pre-service teachers, meta-analysis, retention, attitude

1. Introduction

In today's era, education is a means of achieving social development and advancement. Fundamental process of education has been explained by Stenhouse (1975) as training (skills acquisition), instruction (information acquisition), initiation (socialization and familiarization with social norms and values), and induction (thinking and problem solving). In most educational systems, teaching process fits well with the background knowledge, the learning goals and the learning style of all learners by ignoring individual differences that exist between them (Ford & Chen, 2001). Accordingly, educators need to involve the participants and to build on their knowledge rather than assume the learners know nothing (McClelland et al., 2001).

Teacher quality has been an area of interest for many years with the recent focus on how much, and under what conditions teachers use effective instruction which impacts student achievement (McCaffrey et al., 2004). In teacher education programs teachers gain (1) subject matter content knowledge, (2) general pedagogical knowledge, (3) knowledge of context and (4) pedagogical content knowledge (Grossman, 1990). Subject matter content knowledge includes the amount and organization of knowledge of the substantive and syntactical structures of the subject (Schwab, 1964). General pedagogical knowledge is the general knowledge about teaching and beliefs that include knowledge about learning and learners, knowledge of the general principles of instruction, knowledge and skills related to classroom management, and knowledge about the purposes of education (Grossman, 1990). Knowledge of context includes teachers' knowledge of alternative instructional methods that meet the needs of their students (Grossman, 1990). For pedagogical content knowledge, it is related to the ways of representing and formulating the subject that makes it comprehensible to students (Shulman, 1986). Although all of the knowledge bases are important to be a successful teacher, pedagogical content which combines the subject matter with the basics of teaching knowledge comes first in separating the expert teacher from the experienced teacher (Kerr, 1981). Accordingly, a successful teacher is an independent thinker who possesses a strong need to accomplish tasks, has a creative teaching style, adapts instruction to student needs, balances teacher talk and student performance, and uses high quality literature and materials (Grant & Drafall, 1991).

Teaching methods which refer to the general principles, pedagogy and management strategies used for classroom instruction depend on what fits you — your educational philosophy, classroom demographic, subject area(s) and school

mission statement (Bluedorn, 2001). In the same vein, teaching methods are generally a set of teaching procedures, usually according to a definite, established, logical, or systematic plan (Valeen & Casado, 2000). It is obvious that there has been a reformative change in teaching methods in recent decades. According to Riding and Raynar (1998), this change is characterized as a quiet revolution. Proposals for educational reform are generally about the assumption that the "train is on the tracks and just needs to go faster" (Goodlad, 1990, p. 270). Furthermore, reform requires a fresh approach to the learner and the methodology (Kratz, 1986; Mackie, 1981). According to McCoy (1985), teaching methods are used to modify student behavior and learning outcomes in the cognitive, affective, and psychomotor domains. Seven essentials in a teaching process were explained by Blair (1984) as time use, diagnosis, direct instruction, and transfer of skills, flexible groupings, positive mind set, and classroom management. Furthermore, Madsen (1990) defined basic elements in teaching process as "knowledge of the subject matter and precisely what students should learn and effective delivery and sequencing of the subject" (p. 43). According to Brophy and Good (1986), student learning is dependent on: (1) quantity and pacing of instruction; (2) opportunities to learn, measured in time or amount of curriculum covered; (3) high expectations of student performance and maximum utilization of class time for academic activities; and (4) engagement of students in academic activities. However, pre-service teachers' beliefs toward teacher education programs influence their experience through screening and reorganizing new knowledge (Kagan, 1992; Pajares, 1992). According to Richardson (1996), "attitudes and beliefs are important concepts in understanding a teacher's thought processes, classroom practices, change, and learning to teach" (p. 113). According to Lortie (1975), pre-service teachers' attitudes about teaching are formed from personal predispositions and they bring their attitudes into teacher preparation programs that function as filters in order to pre-service teachers make sense of knowledge and experiences they encounter. Similarly, Richardson (1996) defined pre-service teachers' attitudes as their personal beliefs influence how they process and learn about effective teaching when teacher candidates are introduced to new information and methodologies during their teacher education program. Prior beliefs and attitudes have special significance in pre-service preparation programs (Feiman-Nemser, 2001). Moreover, pre-service teachers' attitudes are so strong that they cannot be changed and affect students' learning and teaching process (Kagan, 1992) due to being based on past experiences (Richardson, 1996). For Kent and Read (1998), attitudes are related to mental orientation that leads to a stance or a position about something. They contain three parts, the expressions of beliefs (cognitive), the expressions of behavior (affective) and the expressions of behavioral intention (cognitive). Since "pre-service teachers may not know what type of education will best aid them in their future classroom" (Decker & Rimm-Kaufman, 2008, p. 59), pre-service training programs form the ground of their pre-service teachers' education by giving them the necessary classroom survival tools, and encouraging them to stay in the profession" (Quinn, 2011).

Four teaching methods have been identified based on the results of the current study. These include Learning Together Technique, the Jigsaw Technique, Transformative Learning Theory, and Problem Based Learning.

1.1 Learning Together Technique

Cooperative learning, which is such a method of today's education, "comprised the efforts of small groups of students, by assisting each other in learning towards a common goal" (Açıkgöz, 1992, p. 246). According to Bromley and Modlo (1997), cooperative learning contributes to not only increase in the learning motivation of the class but also increase in sharing of meta-cognitive strategies in thinking and learning. Cooperative learning requires five elements which are Positive Interdependence, Individual Accountability, Interpersonal Skills, face-to-face Interaction and Group Processing (Johnson & Johnson, 1994). This method is applied with different techniques such as Learning Together, Student Teams, Group Investigation, Let's Ask and Learn Together, Jigsaw, and the Reading-Writing-Presentation technique (Okur-Akçay & Doymuş, 2012).

The Learning Together (LT) technique was developed by Johnson and Johnson in 1989 (Johnson, Johnson & Holubec, 1998). Important principles In LT are as follows: heterogeneous grouping, positive interdependence, individual accountability, social skills, and group processing (Orprayoon, 2014). In addition, some important properties of this technique include the existence of the group goal, sharing the opinion and materials, work division and the group reward (Özsoy & Yıldız, 2004). When learning together technique is applied, positive interdependence among group members is formed through setting a common goal, applying the same resources, getting the same reward, evaluating the same perspective, and so forth (Orprayoon, 2014). Then, group processing is evaluated in terms of learners' achievement as a group and academic contrasts are formed for further cooperative activity (Johnson & Johnson, 1995).

1.2 The Jigsaw Technique

The jigsaw technique, originally developed by Elliot Aronson in 1971, has been considered effective as a cooperative learning technique in increasing positive educational outcomes (Mengduo & Xiaoling, 2010). Each student's participation is essential, namely, most of the work is done by the students and learning revolves around interaction with peers (Adams, 2013). Johnson, Johnson and Holubec (1998) put forward five principles for jigsaw strategy as positive

interdependence, face-to-face promotive interaction, individual and group accountability, interpersonal skills, and group processing. Students are divided into groups of 5-6 per each and a subject is allocated equally to the group members, each student is given a section, and each member teaches his/her section to the other members of the group until the subject is understood completely (Göçer, 2010). In achieving of complete learning of a subject matter, each student becomes both a learner and a teacher as well (Kagan, 1992). According to Wong and Driscoll (2008), "jigsaw was developed to enhanced behaviors in the affective domain, such as improving intergroup cross-cultural cooperation in classrooms" (p. 16). However, there can be some obstacles stemming from the presence of dominant or slow students in the group or boredom of bright students in using the jigsaw technique (Adams, 2013). Additionally, discussion of team members should be conducted in a friendly learning environment and be monitored carefully; otherwise, teamwork would be waste of time (Al-Salkhi, 2015).

1.3 Transformative Learning

Transformative learning, which was first introduced in 1975 by Jack Mezirow, helps students examine their experiences in consideration of social issues and then take action to effect broader change (Cummins & Sayers, 1997). Mezirow (1996) asserts that "learning is understood as the process of using a prior interpretation on construe a new or revised interpretation of the meaning of one's experience in order to guide future action" (p. 162). Accordingly, transformative learning is the "process of making meaning of one's experience" (Taylor, 1998, p. 9). According to Kegan (2000), "informative learning changes what we know; transformative learning changes how we know" (p. 50). Mezirow (2003) remarks that "transformative learning may be understood as the epistemology of how adults learn to think for themselves rather than act upon the assimilated beliefs, values, feelings and judgments of others" (p. 1). Moreover, this learning is understood as a uniquely adult form of metacognitive reasoning (Mezirow, 2003) and offers a theory that is abstract and idealized, grounded in the nature of human communication (Taylor, 2007). Since experience is a key element in adult learning, it is through experience that learning occurs and mediated by a (self-) critical and reflective process that will lead the adult to awareness of himself and the world; to his personal and social development; and to the emergence of new and renewed knowledge (Aguiar & Silva, 2011, p. 554). In the same vein, the transformative learning theory sees the experience as a central aspect and it is associated with critical thinking and reflecting on experience (Taylor, 2007), and this theory suggests that adults' assumptions and expectations underlying intentions, values, beliefs, and feelings can be changed only after critical reflection (Mezirow, 1997). According to Imel (1998), adults must learn to think for themselves, not through the eyes of others, and this process requires an evaluation of their own reflection.

Transformative learning's phases include engaging disorienting dilemmas; self-examining feelings of fear, guilt, or shame; assessing assumptions critically; exploring options for new roles; planning a course of action; acquiring knowledge and skills to implement one's plan; and, reintegrating one's life on the basis of conditions dictated by one's new perspectives become more reflective of the process (Mezirow, 2000). In addition, transformative learning has three dimensions: (1) changes in understanding of self; (2) revision of belief systems; and, (3) changes in lifestyle (McComish & Parsons, 2013).

1.4 Problem Based Learning

Problem Based Learning (PBL) is rooted in the "project method" of William Kilpatrick (1918) who asserted that learners should not be provided with answers but rather with experiences in learning to help them create the questions and to seek solutions to questions and problems (Kain, 2003). According to Dewey (1944), problem based model was the connection among doing, thinking, and learning. This learning model mainly focuses on the process of finding tentative solutions for the given problem (Prince & Felder, 2007). PBL has been introduced in the field of medical education for more than 40 years (Barrows, 1996). However, more and more education areas, gradually, apply PBL into their regular teaching processes (Barrows, 2000; Hmelo- Silver, 2004). PBL teaching process includes six steps: (1) Problem scenario; (2) Fact identification; (3) Hypothesis generalization; (4) Knowledge deficiencies identification; (5) New knowledge application; and (6) Process evaluation (Hmelo- Silver, 2004). The core issue of PBL is related to ill-structured problems which "help students learn a set of important concepts, ideas, and techniques" (Gallagher, 1997, p. 338). PBL approach enable students to gain various skills such as knowledge synthesis, critical thinking, research skill, oral presentation ability, and promoted interactions between students and faculty (Hays & Vincent, 2004) by thinking about these problems and solving them professionally. According to Vernon and Blake (1993), compared with traditional approaches, PBL had more benefits for academic achievement, academic progress, student evaluation of programs, and clinical functioning of students.

1.5 Purpose of the Research

This study attempts to reveal whether different applications have effects on retention and attitude of pre-service teachers studying in various branches in Turkey through meta- analysis. In line with this purpose, the following sub-aims have

been included:

Within the scope of the effect sizes *"d"* calculated from the recent research included in this study;

1.   Which application is the most effective on retention of pre-service teachers?

2.   Which application is the least effective on retention of pre-service teachers?

3.   Which application is the most effective on attitude of pre-service teachers?

4.   Which application is the least effective on attitude of pre-service teachers?

2. Method

A meta-analysis method which is the process of using statistical methods to combine the results of different studies and integrate the findings (Glass, 1976) was employed in this study. In meta-analysis studies, the research results are coded by being analyzed quantitatively and the combined analyzed data are used (Lipsey & Wilson 1993).

2.1 Literature Search Procedure

A comprehensive literature search of studies written between 2005 and 2015 was conducted by using national educational databases [Google Scholar, the Higher Education Council National Thesis and Dissertation Center, Ebscohost-Eric (National Academic Network and Information Center), Web of Science, Science Direct (The Turkish Academic Network and Information Center-ULAKBIM)], using different combinations of key words (e.g., different teaching methods (applications) and pre-service (prospective) teachers pre-service, (prospective) teachers and retention, pre-service (prospective) teachers and   attitude, etc.). As a result of the literature search procedures. Over 324potential studies 218 articles, 106 theses) were generated for preliminary review. However, 23 studies (9 retention and 14 attitude) that met inclusion criteria were analyzed by using the MetaWin program.

2.2 Criteria for Inclusion

The following inclusion criteria were established in order to be included in the analysis.

1.   The studies which evaluated different educational applications, including Web Based Active Learning, Multiple Intelligence Theory Based Teaching, The Jigsaw Technique, Problem Based Learning, Project Based Learning, and Learning Together Technique and were used to improve retention and attitude of pre-service teachers were involved in the study.

2.   Only studies that used experimental and control groups were included.

3.   Studies must have reported sample sizes, means and standard deviations, or t-test values, F-test values, or p-values, so that effect sizes could be calculated (Cooper & Hedges, 1994).

4.   Studies could have been performed in Turkey, but the report had to be available in English or Turkish.

5.   Unpublished theses were not included.

6.   Studies had to have taken place from 2005 to 2015.

2.3 Coding of Studies

Studies needed to be coded to identify and examine the relationship between effects and the studies' features. The study features were categorized in three main sections. The first section which was called '*study identity'* included information related to   the number of study, the name of study, the year and place of study, author information, and publication type (published or unpublished). Some information related to course type, grade levels, and the duration of implementation (weeks) were presented in the second section which was called '*study contents'*. Sample sizes, means and standard deviation values used in the meta- analysis calculation were given in the 3rd section of coding called "*study data*".

The study characteristics generates the independent variables of the meta-analysis (Tarım, 2003).While the study characteristics which were coded in the coding form of this review including publication histories (publication type, publication year, author information), duration of implementation and study data (sample sizes, mean and standard deviation values) were the independent variables of this study, the dependent variables were retention and attitude   of pre-service teachers for this meta-analysis.

2.4 Effect Size Calculations and Statistical Analyses

The data were analyzed statistically using the MetaWin program. The effect sizes of different applications on retention and attitude were calculated according to Hedges'd formula (Hedges & Olkin, 1985), defined as the standardized mean difference between the two groups (Cooper & Hedges, 1989).

3. Results

Among studies carried out between 2005 and 2015 in national area, 324 of them, 218 from articles, and 106 from theses, were chosen. However, 23 studies that met inclusion criteria were analyzed by using the MetaWin program. Of the 23 studies, 9 were related to retention (4 articles, 2 PhD theses, and 3 master's theses) and 14 were related to attitude (2 articles, 6PhD theses, and 6 master's theses). A total sample size of 1204 pre-service teachers were retained for the analysis. While 225 of them were in the experimental group, 220 in the control group in terms of retention, 383were in the experimental group, 376 were in the control group in terms of attitude. The study identity and effect size values of the studies included in this review in terms of retention are presented in Table 1.

Table 1. The study identity and effect size values of the studies included in this review in terms of retention

Author Name/ Year	Applications used in this study	Branches of Pre- Service Teachers	d Value
Arıkan Y. D. (2007)	Web Based Active Learning	Computer Education And Instructional Technologies	0,7155
Can Gözüm, A. İ. (2011)	Multiple Intelligence Theory Based Teaching	Science Pre-Service Teachers	1,2578
Uzun, F. (2013)	Context-Based Approach	Science Pre-Service Teachers	0,6900
Cengiz, C. (2014)	Reflective Diaries	Science Pre-Service Teachers	1,2909
Harurluoğlu, Y., Kaya, E. (2011)	Learning Cycle Model	Science Pre-Service Teachers	1,4169
Kardaş, M. N. (2013)	Learning Together Technique	Primary School Teaching	2,0606
Bayram, K. (2012))	Use of Animation	Primary School Teaching	1,3044
Maden, S. (2011)	The Jigsaw Technique	Turkish Pre-Service Teachers	0,5461
Kızıltaş, E, Gündoğdu, K. (2011)	Project Based Learning Approach	Preschool Pre-Service Teachers	0,7842

Table 1 shows that, in terms of retention scores, while Learning Together Technique had the highest effect size (d =2,0606 -a huge level-) in primary school pre-service teachers, the Jigsaw Technique had the lowest one (d= 0,5461-a medium level-) in pre-service teachers studying in the department of Turkish Education. In addition, Learning Cycle Model (d= 1,4169); Use of Animation (d=1,3044); Reflective Dairies (d=1,2909); and Multiple Intelligence and Theory Based Teaching (d= 1,2578) techniques have   a   very large effect size. While Project Based Learning approach (d= 0,7842) and Web Based Active Learning (d= 0,7155) have a large effect size, Context Based approach (d= 0,6900) has a medium effect size according to the classification of Thalheimer and Cook (2002) which suggest that --0,15≤ is a negligible effect size, 0,15≤ is a small effect size, 0,40≤is a medium effect size, 0,75≤ is a large effect size, 1,10≤ is a very large effect size, and 1,45≤ is a huge effect size.

The study identity and effect size values of the studies included in this review in terms of attitude are presented in Table 2.

According to the results given in Table 2, in terms of attitude scores, while Transformative Learning Theory had the highest effect size (d= 1,4760 – a huge level-) in Biology pre-service teachers, Problem Based Learning had the lowest one (d= -0,3949- negligible) in Science pre-service teachers among the applications included in the study. Additionally, Project Based Learning (d= -0,3678) has a negligible effect size (-0,15≤) as well.   Learning Cycle Model (d= 0,0212); Computer Aided Education (d= 0,0242); and Web Based Active Learning (0,1394) have a small effect size, (0,15≤). Blended Learning Method (d= 0,3934); and Reflective Thinking Based Learning Activities (d= 0,2097) have a medium effect size (0,40≤). Constructivist Approach (d= 0,5563); Scenario-Based Learning (d= 0,5839); Metacognitive Strategies (d= 0,6065); and Scientific Events (d= 0,7479) have a large effect size (0,75≤). Guess- Observe- Explain" (GOE) Method (d= 1,0249) has a very large effect size (1,10≤) according to the classification of Thalheimer and Cook (2002).

Table 2. The study identity and effect size values of the studies included in this review in terms of attitude

Author Name/ Year	Applications used in this study	Branches of Pre-Service Teachers	d Values
Veznedaroğlu, M. H (2005)	Scenario-Based Learning	Computer Education And Instructional Technologies	0,5839
Arıkan Y. D. (2007)	Web Based Active Learning	Computer Education And Instructional Technologies	0,1394
Atılboz, N. G. (2007)	Learning Cycle Model	Biology Pre-Service Teachers	0,0212
Uzel, N. (2008)	Scientific Events	Biology Pre-Service Teachers	0,7479
Çimen, O. (2013)	Transformative Learning Theory	Biology Pre-Service Teachers	1,4760
Gökmen, A. (2008)	Computer Aided Education	Science Pre-Service Teachers	0,0242
Bilen, K. (2009)	"Guess- Observe- Explain" (GOE) Method	Science Pre-Service Teachers	1,0249
Benli, E. (2010)	Problem Based Learning	Science Pre-Service Teachers	-0,3949
Harurluoğlu, Y. (2011)	Learning Cycle Model	Science Pre-Service Teachers	0,3245
Acar, E. N. (2011)	Project Based Learning	Science Pre-Service Teachers	-0,3678
Güler, B., ve Şahin, M. (2014)	Blended Learning Method	Science Pre-Service Teachers	0,3934
Altunsoy, S. (2012)	Metacognitive Strategies	Science and Technology Pre-service Teachers	0,6065
Tican, C. (2013)	Reflective Thinking-Based Learning Activities	Turkish Pre-Service Teachers	0,2097
Oğuz, A. (2008)	Constructivist Approach	Primary School Education and Social Studies Education	0,5563

4. Discussion

In this study, the effect sizes of the 23 studies comprising different teaching applications were included in meta-analysis in terms of their effects on retention and attitude of pre-service teachers studying various branches of education faculties in Turkey.

The effect of learning together technique of the cooperative learning model on retention had a value of 2, 0606 which meant that retention was the highest in learning together technique among the other teaching applications included in the study such as web based active learning, multiple intelligence theory based teaching, context-based approach, reflective diaries, learning cycle model, learning together technique, use of animation, the jigsaw technique and project based learning approach. This finding is consistent with the results of other national and international studies (e.g., Bulut, 2009; Dishon & O'Leary, 1984; Ghaith, 2003; Johnson et al., 1981; Johnson, Johnson & Holubec, 1986; Johnson & Johnson, 1990; Okur Akçay & Doymuş, 2012; Orprayoon, 2014; Özsoy & Yıldız, 2004; Slavin, 1983; Slavin, 1991; Tran, 2014). According to Johnson, Johnson and Holubec (1986), cooperative learning activities enhance the accuracy of long term retention. Current findings are also consistent with the results of the meta-analysis study on the effectiveness of learning together technique conducted by the researchers (Kumar & Helgeson, 2000; Johnson, Johnson & Stanne, 2000). When Kumar and Helgeson (2000) conducted a meta-analysis on the effectiveness of cooperative learning strategies, their study revealed that learning together technique promoted the greatest effect followed by academic controversy, student-team achievement divisions, teams–game–tournaments, group investigation, jigsaw, and team assisted individualization. They also found that learning together technique had the greatest effect among the other techniques in comparison of the impact of cooperative learning lessons with individualistic learning.

In the current meta-analytic study, the Jigsaw technique was found to be the least effective on retention scores of pre-service teachers. In a similar vein, Tomblin and Davis (1985) found Jigsaw technique to be less effective. Likewise, in Okebukola's (1985) study, Jigsaw was also less effective than teams-games-tournament and student teams/achievement divisions techniques. In the same vein, Newmann and Thompson (1987) hypothesized that the Jigsaw treatments were relatively less effective than the other techniques because they did not meet the criteria that Slavin (1983, 1989) has emphasized about cooperative learning techniques which are related to being group work toward a goal that can be achieved only through cooperation and students' individually contributions to the achievement of group goal. Acccording to Slavin (1989) who reviewed and concluded a larger set of cooperative learning studies, Jigsaw is academically the least effective of the well-known cooperative learning techniques. On the other hand, in a study conducted by Maden (2011) who compared the effects of Jigsaw I technique and traditional teaching method on Turkish pre-service teachers' academic achievement and retention scores, the results revealed that no significant difference was observed between experiment and control groups in favor of Jigsaw I technique. However, some studies conducted by Barrett (2005), Ernst and Byra (1998), Gömleksiz (2007), Huang (2000), and Şahin (2010) revealed Jigsaw technique to be more effective than traditional methods.

This study also revealed that in terms of attitude scores, Transformative learning theory had the highest effect size

(d=1,4760–a huge level-). Similarly, some studies found transformative learning most effective in fostering learning (e.g., Brock, 2010; Brock, Florescu & Teran, 2012; King, 2002; Liodaki & Karalis, 2013; Mezirow, 1997; Ukpokodu, 2007). According to Mezirow (2003), Transformative learning involves critical reflection of assumptions that may occur either in group interaction or independently. Therefore, pre-service teachers' age, collaboration, family support and critical incidents will promote Transformative learning and bring about new ways of defining their worlds and understanding (Mezirow, 1997).

Consistent with the result of the current study which revealed that problem based learning had the least effective method on Science pre-service teachers' attitude scores, Albanese and Mitchell (1993) concluded that problem-based instructional approaches are less effective in teaching basic science content. Similarly, according to Johnston, Schooling and Leung (2009), problem based learning was less effective at imparting knowledge than usual teaching consisting of a lecture followed by a group tutorial. In addition, most studies have shown that there were no statistically significant differences in learner performance of problem based learning compared to students receiving lecture-based instruction (Albanese & Mitchell, 1993; Albano et al., 1996; Blake, Hosokawa & Riley, 2000; Kaufman & Mann, 1988). In a meta-analytic study comparing the impact of problem based learning and lecture–discussion instruction conducted by Culver (2000), it was concluded that there was "no convincing evidence that problem based learning improves knowledge base and clinical performance" (p. 259). In the same vein, according to Newman (2003), "existing overviews of the field do not provide high quality evidence with which to provide robust answers to questions about the effectiveness of problem based learning" (p. 5). On the other hand, Kirschner, Sweller and Clark (2006) have found that problem based learning is less effective and less efficient than guided instructional approaches used in teacher-centered and other more traditional educational activities. However, this statement has been subject to debate (Hmelo-Silver et al., 2007; Schmidt et al., 2007), it is obvious that the value of problem based learning is under discussion and context-dependent (Jansson et al., 2015).

Consequently, the impact of a certain classroom instructional approach on pre-service teachers' retention and attitude scores is outweighed by teachers' preferences or the nature of the interactions occurring in the classrooms. According to Grossman (1990), pre-service teachers tend to have predispositions toward specific subject matter—beliefs about the nature of a subject, how it should be taught and learned, the significance of the subject, and the teacher's role in the subject instruction. Furthermore, it should be noted, in this respect, that pre-service teachers view teaching as a skill involving a process of transmitting knowledge and dispensing information (Kincheloe, 2003) and they display a tendency to "judge the quality of everything encountered on grounds of perceived practicality... [and] are drawn powerfully to the discrete and utilitarian" (Goodlad, 1990, p. 225). Therefore, in teacher education, providing appropriate selection of teaching methods within their social and cultural context, teachers will enable students to develop and refine the process of learning to teach.

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(The references marked with an asterisk (*) are used in meta-analysis study.)

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