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Procedia - Social and Behavioral Sciences 46 (2012) 5005 – 5009
Procedia
Social and Behavioral Sciences

WCES 2012

# The self-efficacy of pre-service elementary teachers using cooperative learning in science teaching

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**Abstract**

This study examines the self-efficacy of pre-service elementary teachers who employ cooperative learning methods in their science classes. The participants consist of 363 science teachers-in-training, including 288 trainees at the primary school level (grades 1-5, age 6-11) and 75 junior high school trainees (grades 6-8, age 12-15). Data was collected using the Cooperative Learning in Science Education Questionnaire (CLSEQ). Frequencies were calculated to reveal existing tendencies in the participants' use of cooperative learning methods and strategies in science teaching. Practitioners' definitions of the term cooperative learning were also examined using the content analysis approach. In general, the majority of participants believed that it was possible to successfully implement cooperative learning in science teaching environments. Interdepartmentally, pre-service junior high school teachers viewed themselves as more practically trained to carry out cooperative learning in science teaching when compared to their primary teacher counterparts. The implications of this for teacher education concerning this issue are also mentioned.


Keywords: Self-efficacy; cooperative learning; science teaching; pre-service primary teachers

## 1. Introduction

Cooperative learning (CL) has become a prominent aspect of science education in Turkey. Primary science and technology programs in Turkey increasingly demand the employment of CL in order for students to reach the stated objectives of lesson plans. The program in question has been redesigned according to the constructivist approach and has currently been underway since 2004-2005. “Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning” (Johnson & Johnson, 1999, p. 5). This approach has been found to be effective for improving students’ levels of motivation, overall achievement, conceptual understanding, social skills, and attitudes about the subject area (e.g. Atkinson, 2008). Furthermore, Gillies (2008) has also published that junior high school students achieve better results in lessons where their teachers have been formally trained in implementing CL activities within the curriculum. According to the ideas behind expectancy theory, a teacher’s decision to implement an innovative teaching strategy is both related to and determined by: 1) how highly the educator personally values the approach, 2) how successful the teacher expects to be overall, and 3) how high/low the cost of implementing the new method is perceived by the person carrying it out. "Value" refers to educator's estimation of how worthwhile the strategy actually is. "Expecting success" can be

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 doi:10.1016/j.sbspro.2012.06.376

summarized as the degree of the teacher's self-efficacy and perception of harmony between the use of the strategy and its desired outcomes. Self-efficacy has been defined by Bandura (1997) as "…beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p.3). Bandura accepted self-efficacy as the most powerful agent motivating teaching behavior. Abrami, Paoulsen, and Chambers (2004) claimed that expectancy theory can guide researchers in understanding teachers` beliefs and expectancies, including their valuations and cost-related ideas about the application of CL in the classroom. This theory provided the current study with a way to reveal pre-service teachers' opinions about their own self-efficacy when it comes to their personal ability to implement CL in science teaching. Accordingly, the purpose of this study was focused on determining: 1) the level of pre-service primary school teachers' self-efficacy with respect to implementing CL in the science classroom, (2) the level of pre-service junior High School teachers' self-efficacy with respect to implementing CL in the science classroom, and 3) any significant differences or similarities in self-efficacy which might exist between these two groups of educators.

## 2. Methodology

The participants in this study consisted of a total of 363 pre-service science teachers: 288 primary school teachers (PPT) in grades 4-5 (age 10-11) and 75 junior high school science teachers (PJHST) in grades 6-8 (age 12-15). All of the participants were in their third or fourth semester of teacher training at university (220 third-semester; 143 fourth-semester) at the time of the study. These pre-service teachers had taken science methodology courses for their various school levels. All participants were 25-26 years old. Data were collected in a three week period at the end of the Spring semester.

The Cooperative Learning in Science Education Questionnaire (CLSEQ) was constructed by the authors in Turkish. It is comprised of two parts. The first asks pre-service teachers for demographic information (department, grade, gender and age). The second part contains twenty questions, beginning with one dealing with the definition of cooperative learning. The nineteen questions following this are decision-based questions requiring a Yes or No answer. All of the items were developed utilizing two instruments: the Cooperative Learning Implementation Questionnaire (CLIQ) developed by Abrami, Poulsen, and Chambers (2004) and the Cooperative Learning Science Questionnaire (CLSQ) created by Lumpe, Czerniak, and Haney (1998). The questions can be found in Table 1.

Participants' definitions of cooperative learning were analyzed using content analysis. Answers from the Yes/No questions were analyzed with SPSS 17 to generate frequency tables. The answer frequency was examined for each department. Additionally, subjects' answers (PPT and PJHST) were compared using the chi-squared test.

## 3. Results

For a definition of CL, 130 pre-service teachers` answers were included for content analysis. The remaining participants hadn't provided any explanations for their answers. The pre-service teachers who failed to comprehend the collective feature of cooperative learning (reaching a common decision or solution) were categorized as *naïve*. If explanations lacked the basic idea that the purpose of collectivism is to maximize both personal learning and that of the collective group, such answers were defined as *incomplete*. For inclusion in the *complete* category, answers had to include the overall definition of cooperative learning as presented by Johnson and Johnson (1999). According to the final results, 17.3% of PPT provided complete definitions and so did 36.7% of PJHST. At the final tally, 37% of PPT definitions and 20% of PJHST definitions proved themselves to be naïve. The proportion of incomplete answers was similar for both groups (PPT 45.7%, PJHST 43.3%).

Table 1. Percentages of answers for each item for both PPT and PJHST

| Item | % PPT | | % PJHST | |
|---|---|---|---|---|
| | Yes | No | Yes | No |
| Q2. Do you intend to incorporate cooperative learning into your science instruction when you begin your teaching profession? | 99.3 | 0.7 | 96 | 4 |
| Q3. Do you think that cooperative learning is a valuable (efficient) instructional approach in science education? | 99.7 | 0.3 | 100 | - |
| Q4. Do you think that specialized materials are necessary to implement cooperative learning in science education? | 60.5 | 39.5 | 62.5 | 37.3 |
| Q5. Do you think that engaging in cooperative learning enhances students' social skills? | 99.3 | 0.7 | 98.7 | 1.3 |
| Q6. Do you think that using cooperative learning promotes friendship among students? | 98.7 | 1.4 | 100 | - |
| Q7. Is it possible to evaluate students fairly when using cooperative learning in science education? | 49.5 | 50.5 | 56.8 | 43.2 |
| Q8. Do you think that implementing cooperative learning in science education requires a great deal of effort? | 49.6 | 50.4 | 69.3 | 30.7 |
| Q9. Do you think that cooperative learning is appropriate for teaching science? | 97.2 | 2.8 | 98.6 | 1.4 |
| Q10.Do you think that cooperative learning enhances the learning of lower-ability students? | 92.7 | 7.3 | 96 | 4 |
| Q11.Do you prefer trying new approaches in science education when starting your teaching profession? | 88.5 | 11.5 | 90.7 | 9.3 |
| Q12.Do you believe that you will be a very effective teacher? | 95.1 | 4.9 | 89.3 | 10.7 |
| Q13.Do you think that cooperative learning gives too much responsibility to the students? | 60.4 | 39.6 | 50.7 | 49.3 |
| Q14.Do you think that you understand cooperative learning well enough to implement it in your science instruction successfully? | 79.4 | 20.6 | 88 | 12 |
| Q15.Dou you believe that you can implement cooperative learning in science instruction successfully? | 89.9 | 10.1 | 90.7 | 9.3 |
| Q16. Has the amount of cooperative learning training you have received prepared you to implement it in science instruction successfully? | 66.8 | 33.2 | 84 | 16 |
| Q17.Do you think that using cooperative learning is likely to create too many disciplinary problems among the students in science class? | 26.9 | 73.1 | 36 | 64 |
| Q18.Do you think that using cooperative learning will enhance your career advancement in science education? | 88.3 | 11.7 | 100 | - |
| Q19.Has your training in cooperative learning been practical enough for you to implement it in science education successfully when you start your teaching profession? | 35.3 | 64.7 | 60 | 40 |
| Q20. Is cooperative learning appropriate for the grade level at which you will teach science? | 87.2 | 12.8 | 89.3 | 10.7 |

The answer percentages for each question for both PPT and PJHST are given in Table 1. From the table it is easy to see that a vast majority of PPT intend to use CL when they start their teaching profession (Q2). All except one state that CL is a valuable strategy for use in science teaching. On the other hand, more than half of them (60.5%) think that this method requires specialized materials in science education (Q3). A large number of PPT considers CL to be effective for improving interpersonal skills (Q5 and Q6). Half of them believe that it is not possible to evaluate students fairly when using CL (Q7) and that CL requires a great deal of effort (Q8). 97.2% of the test subjects view CL as appropriate for teaching science. Furthermore, a wide range of them think that CL improves lower-ability students' level of learning (92.7%). Of the total participants, 88.5% would try out new teaching approaches in science education when they start their profession, thus indicating that they are open to innovation. From Q12 we see that the participants already possess high levels of self-efficacy when performing their job as a teacher, since 95.1% of them state that they will be effective teachers. Correspondingly, 79.4% of PPT claim that they already understand CL well enough to apply it in science teaching. Paralleling this, 89.9% of them claim that they can successfully implement this method in their instruction. Although 66.8% of them believe that they have sufficient CL training to use it in science instruction, only 35.3% of them find it practical enough to actually carry through on their belief. In addition, 88.3% of the participants state that CL can contribute to their career advancement in science education.

The answers of PJHST also indicate that a large part of them (96%) intend to apply CL in their science classrooms (Q2). Consistently, all of the participants believe that CL is a valuable instructional approach in science education. A total of 62.5% think that specialized materials are required to apply this method in science teaching. A considerably large number of them expresses a belief that CL improves social skills and friendship among learners (Q5 and Q6). More than half of the subjects state that it is possible to evaluate students fairly when using CL in science education (56.8%). Q8 reveals that approximately 70% of PJHST think that implementing CL in science teaching requires a great deal of effort. 98.6% think that CL is appropriate for teaching science. 96% of PJHST agree to the statement that CL enhances the learning levels of lower-ability students (Q10). A total of 90.7% of the participants will try out new approaches when starting their profession. A great number of PJHST believe that they will be effective teachers (89.3%). Half of them state that CL places too much responsibility on the students. A further 90% believe that they are able to successfully implement CL in science instruction. Although the majority of respondents (84%) view the current level of CL training to be sufficient for carrying out science instruction, a much smaller percentage (60%) this proposition practical. Moreover, every one of the PJHST states that CL will contribute to their career advancement in science education.

From Table 1 we can begin to compare the results for both groups of participants. Answers for each item were analyzed for groups. According to the results, PPT and PJHST differ significantly in their reply to Q8 (Pearson $\chi^2$ (1, 363) = 9.25, p = 0.002). In other words, the number of PJHST who believe that implementing cooperative learning in science education requires a great deal of effort is significantly higher than that of PPT. In addition, the groups show significant differences for their responses to Q16 (Pearson $\chi^2$ (1, 363) = 8.44, p = 0.004). This means that significantly more PJHST believe that the amount of cooperative learning training they have received has actually prepared them to successfully implement CL in the science classroom. Correspondingly, there is also a significant difference between the two groups of teacher trainees for Q19 (Pearson $\chi^2$ (1, 363) = 15.03, p = 0.000). The responses favor PJHST, who view their training on the usage of CL in science education to be of more practicability as compared to their PPT colleagues. Finally, the two groups answered in a significantly different fashion when presented with Q18 (Pearson $\chi^2$ (1, 363) = 9.63, p = 0.002). PJHST answers imply that significantly more students within this group believe that employing CL can enhance their future career advancement in science education.

## 4. Conclusion

The results of this study indicate that the number of naive definitions given by PPT is much higher than those for PJHST. This implies that more students in primary science did not know the real meaning of *cooperation.* These participants primarily defined CL through use of the word "cooperation," but were unable to convince the researchers that their explanations had any exact notion of what CL actually has to do with cooperative work. Similarly, more student teachers at the junior high school level could provide complete definitions of CL than their primary school counterparts. A large proportion of PJHST was aware of the basic elements of CL as defined by Johnson and Johnson (1975). This fact should definitely be taken into account by teacher education programs at universities. Tertiary education should work more carefully on the development of the fundamental CL definition in students, including a better understanding of what CL is by both learner groups.

Both pre-service PPT and PJHST science teachers in this study possess high expectations when it comes to implementing CL in their future profession. Most of the participants: 1) intend to apply CL in their future science lessons, 2) believe that CL is appropriate for teaching science, 3) think that they are already very effective teachers, 4) understand CL well enough to implement it successfully in the classroom, 5) believe that their training up to the present has prepared them well enough to apply CL in their science lessons, 6) view their training in cooperative learning as practical enough to be used in science instruction, and 7) see themselves as capable enough to implement CL successfully. However, PJHST have greater expectations when it comes to application of CL in science teaching than their PPT colleagues. Yet, significantly more pre-service primary science teachers were satisfied with their current training and teaching practices. This suggests that this group might have higher expectations of success, thus implying a belief in a high level of personal self-efficacy when implementing CL. The findings of Abrami et al. (2004) have already revealed that personal perceptions of the quality of training, one's overall understanding of CL, and individual trust that CL is a relatively easy-to-implement method compose the basic trinity of expectations for success among teachers. Therefore, the results of the current study are primarily positive and do not indicate that drastic changes in the infrastructure of teacher education with regard to this aspect are necessary at this point.

The participants valued CL as 1) a valuable approach to science education, 2) an effective tool for improving social skills among pupils, 3) a good way to improving their career advancement chances, and 4) an enhancement for aiding lower-ability students' learning success. Both groups of teacher trainees surveyed highly valued CL for their science teaching, however, PJHST placed more value on CL in terms of their overall career advancement. Keeping this point in mind, current PPT training programs should increase their efforts to increase teachers' personal self-efficacy. Additionally, education programs need to address the fact the large numbers of participants in this study perceive high costs (demands) as an unavoidable entailment of implementing CL. Within the two groups, PJHST perceived implementing CL in science instruction as a more laborious undertaking than PPT. Ishler, Johnson, and Johnson (1998) have suggested that providing technical support for CL users, encouragement through colleagues, and increased levels of support are three factors closely related to teacher expectations of success. This may aid in changing teacher trainees' cost-related beliefs at the start of their teaching profession. Perceived cost problems when using CL methods in the classroom should also be a topic in university seminars for both groups of teachers. Lumpe et al. (1998) has claimed that teachers need to build positive self-efficacy within themselves, so that they tend to use CL more in the classroom. This can be encouraged by observing other teachers and their CL practices. The results of the present study imply that PPT need more practical training and experience when it comes to the implementation of CL in science instruction. Active practice may improve their willingness to use CL, which may also change their perception of its value, their expectations of its success (self-efficacy) and any negative cost-related beliefs. We would suggest that university teacher training programs develop their education programs so that more CL activities and personal experiences with CL are actively propagated, supported and encouraged.

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