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The Effects of Social Constructivist Approach on the Learners' Problem Solving and Metacognitive Levels

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Abstract: Problem statement: Socio-cultural constructivism; stressing the social context, culture and collaborative side of learning, is another kind of constructivism. The social constructivist approach has positive effects on learners. It can be said that in improving problem solving and met cognitive awareness skills, which are amongst basic skills every individual should possess today. The purpose of this study is to investigate whether there is a significant difference in the learners' problem solving skills and met cognitive levels when the authentic task-based social constructivist approach is used in an experimental group and a traditional approach is used in a control group. **Approach:** In the research, semi-experimental design with pretest-posttest control groups has been used. The experimental group was applied, based on the constructivist approach, the authentic task-based collaborative learning process more efficient. On the other hand, the control group was put in learning environments based on the meaningful learning approach. In the research, 89 teacher candidates were included in the experimental group and 48 teacher candidates were included in the control group. The "Problem Solving Scale", developed by Heppner and Peterson and adapted was used for acquiring the data about problem solving skills. "Metacognitive awareness scale", developed was used for acquiring the data about metacognitive levels. **Results:** At the end of the research, it was observed that the difference in the experimental group teacher candidates' problem solving skills and metacognitive levels was higher than the control group and statistically significant. **Conclusion:** According to this finding, it is appropriate to say that the task-based social constructivist approach has positive effects on teacher c candidates' problem solving skills and metacognitive levels.

Key words: Meta Cognitive Awareness Scale (MAS), social constructivism, problem solving, metacognitive awareness, teacher training

INTRODUCTION

Socio-cultural constructivism; stressing the social context, culture and collaborative side of learning, is another kind of constructivism (O'Donnell and King, 1999; McMahon, 1997; Sivan, 1986; Terwel, 1999). Recently, a lot of pedagogues have been regarding the social constructivist approach as a basis to design more effective learning environments (Woo and Reeves, 2007).

Social constructivists often make use of Vygotsky's ideas to explain teach (Palmer, 2005). Vygotsky mostly focused on the effects of social interaction, language and culture on the learning process (Fosnot, 2005; Jonassen *et al*., 1995; Vrasidas, 2000; Woo and Reeves, 2007). According to Vygotsky (1978), the source of metacognitive processes is related to the culture. To him, a child's learning potential develops only if s/he is with the "other knowledgeable individuals". When we are with others, we can succeed much more than when we are alone. Achievements of human beings are substantially resulted from this kind of "cooperative" act (Liang and Gabel, 2005). In social constructivist educational theory, classroom is a learned society. According to social constructivists, learning occurs by means of peer interaction (collaboration), student ownership of the curriculum and educational experiences that are authentic to the students (Azzarito and Ennis, 2003).

As mentioned above, one of the important notions of social constructivist approach is the authentic tasks

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(Brown *et al*., 1989; Woo and Reeves, 2007; Jaworski, 1994). According to this approach, meaningful learning occurs when there are real-world-related authentic tasks and by means of interaction and collaboration between experts and peers. Authentic tasks are described as "Anything students are expected to do, beyond getting input through reading or listening, in order to learn, practice, apply, evaluate, or in any other way respond to curricular content" (Brophy and Alleman, 1991). With these tasks, learners learn to solve the problems that are similar to real world problems (Steffe and Nesher, 1996; Glatthorn, 1994; Murphy, 1997).

Learners take the responsibility of their own learning when performing an authentic task. Also, they have to improve their top-level skills in order to monitor and manage their own learning and performances. When they work collaboratively on authentic tasks, people can improve their point of view, deal with a problem by approaching it from different angles and create meanings or solutions regarding to the shared meanings (Barr and Tagg, 1995; Gruba and Sondergaard, 2001). Records say that students who have been given this kind of education are more successful in the real world, they are not daunted by difficulties and they contribute to recreate the values that determine life (Moallem, 2001; Reeves *et al*., 2002; Savaş, 2007; Savery and Duffy, 1995; Terhart, 2003).

According to the social constructivist approach, it is significant for learners possess top-level knowledge and skills such as problem solving, analysis, synthesis, critical thinking and deep understanding (Steffe and Nesher, 1996; Koc and Demirel, 2007; Murphy, 1997; Terhart, 2003; Tynjala, 1999). Therefore, in a social constructivist learning environment, teachers take on roles helping learners to acquire and improve top-level skills like research, problem solving. However, teacher-centered approach is said to direct students to memorize and fail in producing critical thinkers and problem solvers (Trigwell and Prosser, 1996; Driel *et al*., 1997; citers: Koc and Demirel, 2007).

Metacognition is an intermediate unit and has an important role of self-insight which is a key to success in learning (Cornoldi, 1997). Metacognition is not a quality that brings success by itself, but it is a path to learning (Bruning *et al*., 1998). Individuals with high levels of metacognitive skills are better at planning, information management, monitoring, debugging and evaluation (Schraw and Dennison, 1994). Metacognitive awareness is important for learning (Anderson and Walker, 1990; Gourgey, 1998; Pintrich and Groot, 1990; Schraw and Moshman, 1995) it affects a lot of components such as acquiring the knowledge, comprehension, recalling and applying (Hartman, 1998).

As mentioned above, it is observed that the social constructivist approach has positive effects on learners. Thus, the purpose of this study is to investigate the effects of the social constructivist approach to the teacher candidates' problem solving skills and metacognitive awareness levels. There are some studies in the literature investigating the effects of a constructivist approach to learners' problem solving and metacognitive skills. In these studies, constructivist approach-based learning environments for experimental groups and traditional approach-based learning environments for control groups were created. At the end of the processes; problem solving skills, attitudes towards lessons and the change in metacognitive levels of the learners in the experimental group were determined to be higher and more significant than of the ones in the control group (Koc and Demirel, 2007; Kaya, 2010; Yurdakul, 2004). In another study carried out by Genc (2007) the effects of the social collaborative learning process on problem solving and skills were investigated. The change in the experimental group students' problem solving skill points was found to be more significant than the control group. Again, literature proves that the social constructivist theory is effective in training teacher candidates (Akar, 2003; Holt-Reynolds, 2000; Jadallah, 1996; Kroll and Laboskey, 1996).

Questions: In this study, it is aimed to investigate the effects of authentic task-based social constructivist learning environments on learners' problem solving skills and metacognitive levels. In this context, answers to the following questions are searched.

Of the learners in the experimental group who are applying authentic task-based social constructivist approach and the learners in the control group who are applying traditional approach:

- Is the amount of change in problem solving skill levels statistically significant?
- Is the amount of change in metacognitive skill levels statistically a significant?

MATERIALS AND METHODS

In the research, semi experimental design with pretest-posttest control groups was used. The research was applied to the teacher candidates who attended to the "Principles and Methods of Instruction" subject in faculty of education in Turkey. 89 teacher candidates were included in the experimental group and 48 teacher candidates were included in the control group.

Table 1: Research design used in the research

Application	Pre-application	During application	Post-process
Experimental Group	*PSS (Pretest) **MAS	-Authentic task -Social constructivist	PSS (Posttest) MAS
Control group	PSS (Pretest) MAS	Traditional (learning approach	PSS (Posttest) MAS

*PSS. Problem solving scale**MAS: Metacognitive awareness scale

Table 2: Research Context of Experimental and Control Group

	Experimental	Control
Approach	-Social constructivist	*Traditional
Teacher role	Scaffold -Planning -Procedural -Motivation -Acquiring higher order skills	*Leader *Information transferor
Role of learner	- Autonomous learner - Social learner - Active learner (Reflector, creative, critical)	*does what is said *takes the passive
Learning Environment	-Authentic task -Collaborative -Democratic -Constructivist -having a goal	*individual study, *teacher-centered activity * discussion
Evaluation	-Authentic, -Alternative -Formative -Portfolio -Peer and self-evaluation	*Traditional *Goal-directed *Summative

Different researchers carried out the activities in both groups. Social constructivist approach-based learning environments with more intense authentic tasks were created for the experimental group. In the learning environments created for the control group, subject-centered curriculum approach and meaningful learning approach were used effectively. This can be seen in the Table 1.

As you see in the Table 2, based on the social constructivist approach, learning environments were created for the experimental group where teachers perform their mediator roles, learners are active, social and autonomous, the authentic tasks are performed and democratic and authentic evaluation styles are used. On the other h and, for the control group, learning environments where the learners are passive, traditional, the teacher gives the information as a leader and goal-oriented evaluation is used as a technique are created.

Data gathering tool: In the research, in order to get the data about problem solving, the ‘’Problem Solving Scale‘’, which was developed by Heppner and Peterson and modified by Taylan (1990), was used. The scale consists of 35 items that describe how people react to their personal and daily-life problems and how they behave. The items of the scale are graded with 6 different alternatives as: (1) strongly disagree (2) partly disagree (3) slightly disagree (4) slightly agree (5) partly agree (6) strongly agree. Alternatives aren’t calculated in scoring. That is, the scoring is performed just for 32 alternatives. These alternatives (1, 2, 3, 4, 11, 13, 14, 15, 17, 21, 25, 26, 30 and 34) are calculated reversely. These are assumed as they represent enough problem solving skills. The lowest score of this scale is 32 and the highest one is 192. Low scores show the effectiveness at problem solving; and high scores show the inability of finding effective solutions to the problems.

Meta Cognitive Awareness Scale (MAS): The inventory which was developed by Schraw and Dennison (1994) and adapted to Turkish by Akin *et al*. (2007), has a scale of 5-liker type. The original form of MAS consists of eight sub-factors that lay under two main dimensions. Under the first dimension, ‘Knowing about knowing‘’, three factors take part: explanatory information, procedural information and situational information. The second main dimension ‘’The Order of Knowing‘’ has 5 factors such as planning, observing, evaluating, debugging and directing the information. The modification of MAS was applied to 164 students from different departments of Faculty of Education, University of Sakarya. In this study, the inner-consistency has been found as; for the whole inventory 0.95, for explanatory information 0.87, for procedural information 0.83, for situational information 0.80, for planning 0.78, for observing 0.75, for evaluating 0.73, for debugging 0.70 and for directing the information 0.66. High grades of the scale show how high the levels of the related strategies are. and MAS ‘s test-retest reliability consistencies are like this: for the whole scale 0.95, for explanatory information 0.95, for procedural information 0.94, for situational information 0.96, for planning 0.98, for observing 0.94, for evaluating 0.95, for debugging 0.93, for directing the information 0.98.

The analysis of data: The data obtained from problem solving scale have been analyzed with SPSS 16.00 program. The two-factor ANOVA technique has been used to analyze the data for mixed measurement.

RESULTS

According to the results of pretest-posttest of learners in learning environments based on authentic task-based social constructivist approach and traditional approach, the findings of learners’ problem solving skill levels are given below.

In findings in the Table 3, according to the results of pretest, it is shown that the average score of problem solving skills of the experimental group is 129, 22 while it is 136, 87 for the control group. As it is clear from these values, the average score of the control group is higher than the experimental group's. According to the average scores of posttest, it is shown that the average of experimental group is 134, 88 while it is 133, 31 for the control group. Taking into consideration the inequalities in pretests, the two-factor ANOVA test is used to analyze the relevance of change in the problem solving skill scores of the experimental and control groups. The results of two-factor ANOVA technique for mixed measurement are shown in Table 4.

When the findings in the Table 4 were analyzed it was found that there is not a significant difference between the results of pretest and posttest of experimental and control group before and after the application ($F_{(1, 135)} = 1$, 190, $p<0.01$). This finding shows that the average grades of learners in experimental and control groups don't differentiate before and after application. In respect to the basic effect of measurement in the Table 4, it is observed that there is not a significant difference between the average grades of the students who participated in the research without discriminating between the groups (experimental-control) ($F_{(1, 135)} =$,392, $p<0.01$).

Table 3: Problem solving skill of experimental and control group average and standard deviation values

	N	Pretest means	SD	Posttest means	SD
Experimental group	89	129, 22	18, 58	134, 88	17, 74
Control group	48	136, 87	19, 08	133, 31	17, 10
Total	137	131, 90	19, 04	134, 33	17, 47

Table 4: The results of ANOVA for experimental and control group

Source of The variation	Sum of squares	df	Mean square	F	Sig.
Between test subjects	65828,53	136	484, 0333	1,190	277
group	575,431.00	1	575,431.0000		
Error	65253,094.00	135	483,356.0000		
Within subjects	25104, 58	137	183, 2451		
Measurement	68,785.00	1	68,785.0000	392	532
Group *measurement	1326,946.00	1	1326,946.0000	7,556	007
Error	23708,850.00	135	175,621.0000		
Total	90933,11.00	273			

Table 5: Pretest-posttest average and standard deviation values of experimental and control groups' met cognitive levels

	N	Pretest Mean	SD	Posttest mean	SD
Experimental group	89	172, 44	26, 62	185, 14	23, 40
Control group	48	188, 20	21, 45	189, 39	22, 61
Total	137	177, 96	25, 98	186, 63	23, 13

The effects of being in different groups and factors showing the measurement in different times on students' average points were also found meaningful in the Table 4. ($F_{(1,135)} =$ 7, 556, $p<0.01$). This finding shows that the changes in the average points of the learners in experimental group where authentic task oriented social constructivist approach is used is different from the changes in average points of the learners in the control group where traditional approach is used. That is, there is a significant difference in the average points of learners in experimental and control groups according to application. In other words, it can be said that the approach that is applied to the experimental group is more effective. As it can be seen from the graph below, it is seen that there is a change in points of problem solving skill based on the approach applied to the experimental group.

The findings on the meta cognitive levels according to the pretest-posttest results of the learners in an authentic task-based social constructivist approach-based environment and in a traditional approach-based environment are given below.

While the average of meta cognitive level scores of the learners in experimental group was 172, 44 according to the pretest results, it was calculated as 185, 14 in posttest as shown in the Table 5. Also, the meta cognitive points of the control group increased to 189, 39 in the posttest while it was 188, 20 in the pretest. It can be seen from both the pretest and posttest points that the control group has higher points than the experimental group. According to these findings, there is an increase in the average points of both the experimental and the control group students. As related to whether the changes observed in experimental and control group students' points indicate a significant difference, two-way ANOVA results given in the Table 6 below.

When the findings in the Table 6 are examined, it can be seen that there is a significant difference ($F_{(1,135)} = 6,976$, $p<0.01$) between the pretest and posttest results of the experimental and control group before and after application. This finding shows that the average points of the students in experimental and control groups differentiated regardless of measurement difference (before and after application).It can also be seen from the Table 6 that, in relation to the main effect of measurement, there is a significant difference between the average points of the students involved in the research before and after the test regardless of group difference (experimental-control) ($F_{(1,135)} = 11,494$, $p<0.01$)

Table 6: ANOVA results of the experimental and control groups

Source of the variation	Sum of Squares	df	Mean Square	F	Sig.
Between test subjects	127176,5	136	935,1213	6,976	009
group	6248,911	1	6248,911		
Error	120927,549	135	895,760		
Within subjects	40436,48	137	295,1568		
Measurement	3010,375	1	3010,375	11,494	001
Group *measurement	2069,251	1	2069,251	7,901	006
Error	35356,858	135	261,903		
Total	167613	273			

It has also been found significant that being within different groups in the Table 6 and the factors that show measurement in different times also had a common effect on the students' average points ($F(1,135) = 7,901$, $p<0.01$). This finding shows that the change in learners' average points in the experimental group, in which authentic task-based social constructivist approach is used, is different from the change in learners' average points in the control group where traditional approach is used. That means, average points of the students in experimental and control groups indicate a significant difference with regard to the applications carried out. In other words, it can be said that the approach applied to the experimental group is more effective.

DISCUSSION

In this study, the effect of social constructivist approach, which is effective in teacher training, on the learners' problem-solving and metacognitive awareness levels are analyzed. Social constructivist approach mainly of authentic tasks is applied to the experimental group where experimental design is used, whereas traditional approach is applied to the control group.

Problem solving, which enables individuals to generate their own knowledge in order to create solutions when they come across a problem, is an important thinking skill (Kaya, 2010). Problem solving is also defined as high-level cognitive skills that create alternative solutions through mental filters when encountered by problems or obscurity (Kaya, 2010). Problem solving paves the way for students' discovering and improving their own competencies and meeting their needs. For the acquisition of problem solving skills, it is necessary that methods applied in learning environments are based on improvement of these skills and the teacher, the operator of learning activities, has these skills along with involving the learners with real-world problems. The findings obtained in this study indicate that learning environments based on social constructivist approach can contribute to the development of problem solving skills.

When the fact that metacognitive awareness is an intermediate feature for learning (Cornoldi, 1997; Bruning *et al*., 1998) is taken into account, based on this finding it can be considered that authentic task-based social constructivist approach may have an indirect effect on increasing success.

Besides, the finding directed to significant effect of authentic task-based social constructivist learning environments upon metacognitive awareness levels of teacher candidates is consistent with the findings in Yurdakul (2004) study. In the above mentioned study, it has been found that whereas there is no differentiation in metacognitive awareness levels of the students in the control group where traditional approach was used, metacognitive awareness levels of the students in the experimental group, in which constructivist approach was used, has significantly increased. Parallel findings obtained in this study as well strengthen the finding directed to the effect of constructivist approach on metacognitive awareness levels.

CONCLUSION

The data obtained from the first research question about whether social constructivist approach affects learners' levels of problem solving skills has shown that the change in problem solving levels of the experimental group is higher and more significant than the control group.

In this research, the effect of authentic task-based social constructivist learning environments on metacognitive levels of teacher candidates has also been studied. It has been signified that authentic task-based social constructivist approach is effective in increasing metacognitive awareness levels.

As a consequence, it can be said that in improving problem solving and metacognitive awareness skills, which are amongst basic skills every individual should possess today, authentic task-based social constructivist learning environments are effective.

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