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Turkish Primary Education Students' Evaluation Of The Instructional Activities Based On Social Learning Theory: Analysis Of An Experimental Study

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ABSTRACT

This paper reveals the results of instructional activities based on social learning theory to examine the impact on primary education students' scientist views and scientific method knowledge. The study was conducted with three different 7th grade treatment and control groups from primary schools with similar socio-economic statuses. In the treatment group, activities based on social learning theory were used, whereas in the control group the instructional activities taking place in the existing science curriculum were used. In the study by the researcher, is considered another dimension of experimental research is carried out in 2004 (Demirbaş ve Yağbasan, 2006). The scientist and scientific method views of the students at the end of the process were determined using semi-structured questions prepared by the researchers. The data of the study were interpreted using qualitative research techniques. At the end of the study, the instructional activities used in the treatment group were found to help students develop positive attitudes towards scientists, and also to contribute to understanding the basic philosophy of scientific work. Based on the results of this study, appropriate activities for instructional settings were recommended.

Keywords: Social Learning Theory, Modeling, Science and Technology Instruction, Scientist View, Scientific Method.

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INTRODUCTION

One of the aims of science lessons is to develop scientific literacy of students. Here, scientific literacy is used in the meaning of knowing the nature of science, understanding how to obtain knowledge, perceiving that the scientific knowledge depends on known facts and new evidence can change it, distinguishing between scientific evidence and personal view by learning the basic concepts, theories and hypotheses in science. Scientifically literate societies can adapt to developments more easily and lead innovations (YÖK/World Bank Improving National Education Project, 1997 a,b). In order to improve students' success in science classes, many models, methods and techniques are developed and implemented.

Various psychological approaches are developed related with the genesis of learning. In some approaches, active involvement during learning, and taking control of the learning process stand out whereas in others the individual is expected to give appropriate reactions to environmentally controlled stimulations. According to cognitive learning theorists, perception, cognitive processes and the psychological world of the individual form the basis for learning and thinking. Describing the basic concepts such as understanding, comprehension, attention, memory and motivation in learning process is deemed to be important (Kazancı, 1989). Gestalt psychology, Gagne's learning theory, Bruner's learning by discovery theory, Ausubel's meaningful learning theory and Bandura's social learning theories are some examples for cognitive learning theories.

Social learning theory is largely about cognitive learning and it's named as Social Learning Theory or Social Cognitive Theory (Bandura, 1977). The view that humans can learn from other humans dates back to Plato and Aristotle. According to them, education is to offer the students best models. By social learning theory the effects of cognitive learnings were emphasized. The significance of cognitive activities is thought not to be addressed in operant conditioning. In operant conditioning, only the results of the cognitive operations were attempted to be explained with the results of observable behaviors (Bandura, 1969).

According to social learning theory, humans are driven neither by their instincts nor environmental stimuli. The changes in the psychology of the individual emerge as a result of the continuous interaction of personal and environmental determiners. Environment is claimed to change the human behavior. But social environment is made up of humans, therefore

individuals are accepted as students both constituting and being affected from the environment (Bandura, 2001).

In social learning theory, an indirect learning based on others' behaviors and the observation of those behaviors is presumed. According to this learning which is called observational learning humans can attain general and integrated learning patterns without a need for trial and error. According to social learning theory, learning happens by modeling (Bandura, 2001).

According to social learning theory, the basic concepts of modeling and learning are explained with the terms such as modeling, observational learning, imitation, identification and internalization (Bandura, 1971). In social learning theory, the key factor is learning by observing others. In learning settings, the interaction between learner and the teacher will help the learner to improve his/her cognitive functions by observation. The effectiveness of learning depends on learner's skill to apply what's been observed (Yeşilyaprak et al., 2002).

According to social learning theory, learning by modeling happens by the function of knowledge transfer. Observer attains the symbolic representations of the modeled behaviors, which guide through appropriate behaviors. Bandura (1986) states that one does not need to learn everything directly and many things can be learned by observing others. In this regard, particularly the primary education children may be allowed to gain many cognitive, affective, social and psycho-motor behaviors by observing respected and appreciated elders. Teachers may be good educational models for children and teach them creativity, effective learning or studying strategies and problem solving skills.

PREVIOUS STUDIES RELATED WITH THIS PAPER

Literature shows that in instructional practices involving applications of scientific methods, students are more successful and start to enjoy science. For example Flick (1990) prepared a curriculum in his work about the change of the views of students about scientists and science. In the context of this curriculum, a number of scientists were invited to classroom setting and the students were enabled to model the works of those scientists in their practices. As a result of the study, the students were determined to develop positive attitudes towards science and scientists. Also Maoz and Rishpon (1990) developed a curriculum rich in participation of scientists and they observed the change in the views of primary education students about scientists and scientific thinking. As a result of the study, improvements

were found in the treatment group in terms of the mentioned properties. There are many works demonstrating the association between instructional activities based on social learning theory and the affective properties (scientific attitude, interest, attitude etc.) and academic success (Cannon & Simpson, 1985; Oruç, 1993; Weinburgh, 1995; Freedman, 1997 etc.). O'Neill and Polman (2004), state that many science curriculum development studies were implemented recently and most of those studies stress the significance of raising the students as "small scientists".

The work of Cannon and Simpson (1985) examined the relationship between success, motivation and attitudes of the students in groups formed according to skills. The science attitudes of the students were found to increase in higher skill groups. Also a high level of association was found between success and attitude towards science. Therefore instructional activities based on social learning theory will have an impact on primary education students' success. Because, there's evidence showing an association between students' success and gained attitudes (Levin, Sabar & Libman, 1991; Oruç, 1993; Weinburgh, 1995; Freedman, 1997; etc.).

In their study, Balkı, Çoban and Aktaş (2003) directed open-ended questions to primary education students. Students were found to describe scientists usually as people doing research. The authors also report that the students found being a scientist difficult and they stated they would deal with discoveries and inventions when they become a scientist. Jones et al. (2000) investigated the student views about science, their out-of-school activities, the science subjects they're interested in and their future profession selections. Male students were found to incline to easier and more lucrative jobs. Moreover, the students were informed about the difficulty of science and the dangers involved within.

The study of Demirbaş (2009), examined the scientist views and scientific attitudes of pre-service science teachers by handling both qualitative and quantitative data. As a result of the study, it was determined that pre-service science teachers did not have quite positive views about scientists. The study concludes by recommendations that science teacher education programs should offer courses that describe scientific methods and practices.

The work of Bodzin and Gehringer (2001) showed that scientists are generally described as white, male, working in a lab, and glassed. In order to alter that view, scientists were invited to classes and the students were allowed to observe real scientists on task. The body of studies in the

literature shows that providing instructional practices to enable the students to change their views about scientists and scientific methods are important.

THE AIM OF THE STUDY

Bringing up individuals equipped with scientific process skills, scientific thinking and approach is a key tenet of science education. The effects of instructional activities based on social learning theory should be examined with the purpose of raising individuals who are interested in science and have positive scientific attitudes. For this aim, the answers for the following subproblems were sought:

1. Were the views of primary education students about scientists affected from education process?

2. Did the primary education students' level of applying in real life their knowledge gained by modeling processes change?

3. Are the knowledge acquired by primary education students by modeling processes related with their future profession selection?

METHOD

The Model of the Research

The study was conducted with a pretest - posttest treatment design with control group. The pretest-posttest treatment design with control groups can be defined as split-plot design or a mixed design and involves two factors; one as repeated measures (pretest-posttest) and the other as subjects in different categories (treatment-control groups) (Büyüköztürk, 2001).

Qualitative methods were used in the study. In qualitative inquiries, generalizations are not intended but rather the topic at hand is elaborated in depth. With this aim, students' scientist views, the feasibility and future reflections of instructional activities based on social learning theory were examined with a fine-grained analysis. There's only one unit of analysis in the study (an individual, a school etc.), thus Holistic Single Case Design was used as the qualitative method of research in this study (Yıldırım & Şimşek, 2008).

STUDY GROUP AND INSTRUMENTS

The study was conducted with 7th graders from primary schools. The sample of the study consists of 7th grade students (7/A) from Zernişan Vakkas primary school located in Kırşehir Province Center. Total 17 participant students of the study were interviewed and their views before and after the treatment were analyzed. Two different control groups and one treatment group was selected in the study. Three different schools were chosen to minimize the interactions between the control and treatment group students. Since the instructional activities based on social learning theory were implemented in the treatment group and the qualitative study consisted only the students in this group, 17 students were included in the study.

The instructional activities in treatment and 1st control group were implemented by the researcher and those in 2nd control group were implemented by the teacher of that class. In the experiment group, activities based on social learning theory were used, whereas in the control groups the instructional activities taking place in the existing science curriculum were used. Instructional activities in both the treatment and control groups were about the "Expedition through the Internal Structure of Matter" and "Meeting of Force and Motion, Energy" topics in the "Atomic Structure and Periodic Table" unit of 7th grade science textbook.

The data of the inquiry were collected using standardized open ended interview method. Open ended interview is considered as a qualitative method of inquiry. Interviews and papers are analyzed correspondingly and deeply in qualitative researches (Auerbach & Silverstein, 2003). The questions prepared by the researchers included two sections as demographic information and open-ended questions. In demographic information section, gender and grade are asked. In the open-ended questions section there are 6 questions. In this context, the following questions were directed to the students:

1. What are your views about science and scientists?

2. Which of the practices carried out within modeling processes did you like? Explain and give reasons.

3. Do you believe that the studies on modeling processes may contribute to the positive scientific attitudes of students?

4. What is your view about the contribution of the studies on modeling processes to real life affairs?

5. What is your view about the application of the studies on modeling processes in other subject matters?

6. How can they affect the future intentions of the students to work in a science related field? What do you think?

The data drawn from the answers of students to the open ended questions were analyzed and classified by 2 different researchers independently. Later, these groups were compared and brought together. The data were analyzed, frequency distributions were derived and the opinions of the participant students supporting the results of this analysis were added.

ACTIVITIES CARRIED OUT IN TREATMENT GROUP

The following activities were carried out mainly in the treatment group in the context of instructional activities based on social learning theory.

1. The implementation of the study began with giving information to the students about science, scientific method and the works of scientists. For this aim various educational materials and CD's prepared by Ministry of National Education were utilized. Besides, in order to motivate the students, the views that they can imagine themselves as scientists after the study were conveyed.

2. During the instruction, it was made clear that the subjects taught and the events explained were not discovered instantly, but rather progressively by the commitments of scientists. Related scientists' lives, their works, discoveries, failures and their guiding scientific methods were handled in depth and discussed in the class.

3. The lives of scientists were not demonstrated with only abstract instruction, but rather audio-visual elements were emphasized. The pictures of scientists, the figures of their inventions, the pictures of their labs and houses were brought to classroom setting and the students were allowed to see them. Furthermore, the studies of related scientists shown on the TV channel TRT 2 with the names "Science and Life" and "Great Moments in Science and Technology" were shown to students using CD and they're given the opportunity to observe famous scientists working in the laboratory.

4. The activities in the context of the lesson were conducted by the students per se in groups. The problem statements and the hypotheses pertaining to the activities were formed by the students by discussing in groups. (The student activities mentioned in the science curriculum were also implemented with the students of 1st control group that's being instructed by the researcher.)

5. It was thought to be useful in the context of instructional activities, for the students to talk to, meet with and pose questions to the scientists so as to contribute to the scientist image in their minds. For this aim several visits were made to some faculties of universities and the students were given the opportunity to interact with the scientist working in those institutions. This type of activities was also reported in other countries (Smith & Erb, 1986; Maoz & Rishpon, 1990; Mason, Kahle, & Gardner, 1991 etc.)

6. Some faculty members from the universities were invited as visiting instructors and they were requested to share their views with students as a scientist about scientific method and the way scientists work.

7. The students in the treatment group were taken to several activities in which the works of courses in certain faculties were presented and the students were allowed to interact with university students presenting their assignments. Finson and Enochs (1987) stressed the effects of this type of activities on changing affective properties towards science.

8. Further in the instructional activities, each student was assigned with a scientific project task to assess the students' interests in engaging in a scientific study and to allow them to implement the steps of a scientific task. The students presented their studies after completing their tasks and the subject was discussed with students. Thus, the students found an opportunity to demonstrate in the classroom setting the behaviors and attitudes they viewed and learnt.

FINDINGS

The Findings on the Views of Students about Science and Scientists

The views of students about science and scientists were sought with the interview form comprising open-ended questions conducted before and after the treatment. The results are presented in Table 1 and Table 2.

Table 1. The Views of Treatment Group Students about Science and Scientists

The Previous Views of Students about Science and Scientists	**f***
Making New Inventions	3
Making Many Experiments	7
Very Hard-working	4
I have no Knowledge	6
Being a Scientists is too Difficult	10
Special People	4
They don't Spare Time for Themselves	4

* The number of frequencies does not correspond with the total number of students, because the contents of expressed views were analyzed and coded distinctively and multiple views were given in each code.

When the previous views of students about science and scientists before the treatment are examined, it can be seen that 10 participants stated that being a scientist is very difficult, 7 stated that they do many experiments, and 4 told that scientists are those who do not spare time for themselves, are special and work very hard. Some of the student views are given below:

"Scientists always try to invent something and make new inventions…" (Female-3, 7th grader)

"…scientists always make new inventions." (Male-7, 7th grader)

"…I believe scientists are people doing many experiments and working hard." (Female-2, 7th grader)

"…I used to think that scientists work too hard..." (Female-3, 7th grader)

"…I used to have no idea about scientists and the way they work. I used to know little about what they deal with." (Male-6, 7th grader)

"…I wonder scientists very much and I think I can't be a scientist."

"I used to think that being a scientist is difficult…" (Male-4, 7th grader)

"…they're special people." (Male-2, 7th grader)

"I guess that scientists always work, never rest and have no fun…" (Male-8, 7th grader)

"…I think they spare no time for themselves…" (Female-3, 7th grader)

Table 2. The Final Views of Treatment Group Students about Science and Scientists after Treatment

The Final Views of Students about Science and Scientists	**f***
I can be a scientist.	12
Everyone can be a Scientist.	9
Scientists do not always work, and Spare Time for Themselves…"	11
They Conduct Studies Similar to Our Methods	11
They are Very Clever People.	5
They Live Like Us.	14

*The number of frequencies does not correspond with the number of total number of students, because the contents of expressed views were analyzed and coded distinctively and multiple views were given in each code.

When the data in Table 2 are examined, it can be seen that 14 students view scientists as living lives similar to theirs, 11 students view that scientists do not always work and they spare time for themselves and conduct studies similar to theirs.

When the data in Table 1 and Table 2 are compared, the students are found to have positive views about sciences and scientists after the experimental treatment activities. Some of the student views are given below:

"…After the activities, I thought I can be a scientist." (Female-2, 7th grader)

"After the studies, I wanted to be a scientist…" (Male-1, 7th grader)

"..I saw that everyone can be a Scientist." (Male-7, 7th grader)

"…I learnt what scientists deal with, that they don't always work and can spare time for themselves…" (Male-6, 7th grader)

"…I saw that scientist use methods like the ones we used in the activities…" (Male-4, 7th grader)

"Scientists are clever people and they discover things using these…" (Male-3, 7th grader)

"…scientists live like us" (Male-5, 7th grader)

"However, I finally saw that they live like us and they're not very special people…" (Male-2, 7th grader)

FINDINGS ABOUT APPRECIATED PRACTICES CARRIED OUT WITHIN MODELING PROCESSES ACTIVITIES

The views of treatment group students about the appreciated practices during the modeling processes were explained in Table 3 below.

Table 3. The Appreciated Practices Carried Out Within Modeling Processes

Activities	**f**
Inviting Scientists to Classrooms	5
The Projects Carried Out by Students	3
Visits made to Science Exhibits	4
Visits made to Scientists' Rooms	4
Films of Scientists	3

When Table 3 is examined, it can be seen that the most appreciated activity for the students is inviting scientists to classrooms (5 students). From this point of view, it can be suggested that inviting scientists frequently to classrooms may contribute to students' positive views about science and scientists.

FINDINGS ON THE IMPACT OF ACTIVITIES OF MODELING PROCESSES ON STUDENTS' DEVELOPMENT OF POSITIVE ATTITUDE TOWARDS SCIENCE

The views of treatment group students on impact of activities of modeling processes on students' development of positive attitudes towards science are given in Table 4.

Table 4. Student Views about The Effect of Activities Carried Out in Modeling Processes on Other Students' Development of Positive Attitudes Towards Science

Positive View Effects	**f**
It makes science classes entertaining.	13
It should also be applied in other subject matters.	15
Contributes to Research Interest.	7
Teaches How to Carry Out Scientific Research.	8
Raises Students' Interest on The Class and the Subject Matter.	10
Affects the Self-confidence of the Individual in the Subject Matter.	6

When the data in Table 4 are examined, it can be seen that the majority of students (15) found applying the activities implemented in the context of modeling processes to other classes as necessary. Though, 13 students stated that instructional activities involving modeling processes will help other students enjoy science, and 10 students told that these activities will increase interest toward the subject matter. Therefore instructional activities involving modeling processes may be suggested for other classes. Some of the student views are given below:

"Enables other students to develop positive views about science classes and increase their research interests."(Male-1, 7th grader)

"…You showed the challenges encountered by scientists. This has an impact raising interest on the class and the subject matter." (Male-2, 7th grader)

"… If applied in other classes, they could also enjoy the lesson.". (Male-6, 7th grader)

"I think it will also contribute to other students." (Female1, 7th grader)

"It should also be applied in other groups.". (Male-2, 7th grader)

"I started to think about the why of the events around me…" (Male-3, 7th grader)

"When applied to other students, the scientific works and the life styles of scientists may be conveyed." (Male-5, 7th grader)

"All students would like to have entertaining lessons and the activities we carried out was very entertaining. So students will show more interest to classes." (Male-7, 7th grader)

"One can model the works of scientists and understand that every challenge can be overcome and therefore the success increases.". (Male-4, 7th grader)

FINDINGS ON THE CONTRIBUTION OF PRACTICES ON MODELING PROCESSES TO REAL LIFE AFFAIRS

The views of treatment group students on impact of activities of modeling processes on real life are given in Table 5.

Table 5. Student Views on the Contribution of Activities Carried Out Related With Modeling Processes to Real Life Affairs

Students Views	**f**
I Understand the Environment Better.	6
I Can View Events Critically.	4
I Approach Events as a Scientist.	4
I Relate What I've Learnt with the Events around.	5

When the data in Table 5 are examined, it can be seen that the treatment group students are more engaged in understanding the environment (6 students) and they can relate the subjects they've learnt with the events around (5 students) after the instructional activities involving modeling processes. Also when student views are examined, it can be seen that there's a shift in students' views about the events in the environment. Therefore, it can be deduced that instructional activities related with modeling processes may contribute to the students' skills of reflecting and inquiring the "why" of events. Some of the student views are given below:

"I wonder how the things around work and I observe. I know now how the bulb at home gives light…" (Male-8, 7th grader)

"My point of view has changed. I am wearing glasses now and I inquired the reason. Moreover we're identical twins with my brother and I learnt the reason by inquiring…" (Male-9, 7th grader)

"My point of view has changed, my problem solving skills has changed and now I can approach problems like a scientist…" (Male-4, 7th grader)

"Now I can better understand how things work after the ring project I've completed...". (Male-1, 7th grader)

"I can relate the subjects I've learnt about natural events and I can make observation…". (Male-5, 7th grader)

FINDINGS ON THE APPLICATION OF PRACTICES RELATED WITH MODELING PROCESSES TO OTHER SUBJECT MATTERS

The views of treatment group students on application of activities of modeling processes in other subject matters are given in Table 6.

Table 6. Student Views about Application of Activities Carried Out Related With Modeling Processes in Other Subject Matters

Student Views	**f**
Yes	13
No	4

When the data in Table 6 are examined, it can be seen that 13 students found applying this kind of activities to other classes as necessary and 4 students stated that this kind of activities are not appropriate for other subject matters. Application of the instructional activities related with modeling processes to other classes (mathematics, social sciences and so on) may help students know scientists and learn scientific methods of scientists. Some of the student views are given below:

"… It can be applied to other subjects, I'd like to know about their works too." (Male-7, 7th grader)

"Other subjects should give place to this kind of activities, for example mathematics subject. However, I think science is more appropriate." (Female-4, 7th grader)

"It lends no contribution. There are no scientists in other subjects. Nevertheless, it should be well determined." (Female-1, 7th grader)

FINDINGS ON FUTURE INTENTIONS OF STUDENTS TO WORK IN A SCIENCE RELATED FIELD

The views of students about their future intentions to work in a science related field are given in Table 7.

Table 7. Student Views on Their Future Intentions to Work in a Science Related Field

Student Views	f
Yes	15
No	2

When the data in Table 7 are examined, it can be seen that 15 students intend to work in a science related field in the future. Two of the students found themselves more successful in other classes and they stated that they intend to work in other fields. Some of the student views are given below:

"I'd like to. It seems enjoyable and exhilarating. I like listening to the instructions." (Male-9, 7th grader)

"I'd like to. An enjoyable and lovely lesson. I didn't use to like it this much." (Male-6, 7th grader)

"I'd choose science field in the high school and would like to work in this field from now on. Because science classes are fun, we both do experiments and give lectures. The life styles of scientists really impressed me." (Female-4, 7th grader)

"Since I find myself more successful in social sciences, I better work in those fields." (Female-1, 7th grader)

RESULTS AND DISCUSSION

In this part of the paper, the results of the study were examined in terms of subproblems of the study and studies showing similarities with these results were discussed.

Before this study, students' views about science and scientists were found to be mainly negative. The students were found to describe scientists usually as *working hard, doing many experiments and doing a hard job* (Table 1). However, Students' views about science and scientists were found to change after the

treatment. They stated that they'd like to be scientists, everyone can be a scientist and scientists carry out tasks similar to theirs (Table 2). Therefore, it can be concluded that practices on modeling processes may contribute to development of students' views about science and scientists.

In their work about the effect of students' modeling of scientists on their attitudes towards science and scientists, Smith and Erb (1986) reported that the scientific attitudes of treatment group of students were more positive than those of the control group. Again Demirbaş and Yağbasan (2008; 2007; 2006) showed in their experimental studies that instructional approaches based on modeling processes have positive effects on students' scientific attitudes, academic identity and academic successes. This result is in line with the results in literature that inviting scientists to classrooms is an appreciated activity for the students (Table 3). From this point of view, it can be claimed that the contributions of living scientists (faculty members, doctors and scientists) to classrooms may help students learn science by living. For example Flick (1990) prepared a curriculum in his work about the change of the views of students about scientists and science.

As a result of the study, the students' perceptions towards science and scientists were observed to increase. O'Neill and Polman (2004), state that many science curriculum development studies were implemented recently and most of those studies stress the significance of raising the students as "small scientists". The results of the above study align with the results of our paper. The students stated that studies on modeling processes may contribute to other students' development of positive views about science (Table 4). With this aim students stated that this type of activities should be implemented in other classes. Additionally, it was found that activities about the students' modeling processes contribute to real life affairs, and after the treatment the students were found to understand the environment better, have a critical view, and may relate what they've learnt to the events around (Table 5). The students stated that the implemented activities make a great contribution to science and technology class, and implementing this type of activities in other classes will also be beneficial (Table 6). They also expressed that modeling processes based on social learning theory would increase interest in working in a science related field and they would like to make studies in this field (Table 7). The following recommendations can be made based on the findings of the study:

- Instructional activities based on social learning theories should find place in different levels of education and classroom practices, and their effectiveness should be investigated.

- Lives of scientists should be addressed in science classes. By this way the students may be helped to enjoy science.
- Experimental tools of scientists and visits to places where the experimental contrivances of old ages are exhibited will most likely draw students' interests. For this aim, field visits should be covered in curriculum. In case it's difficult to conduct the mentioned practices, at least the photos of the exhibited experimental tools and contrivances should be demonstrated to the students.

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