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Constructivism in Laboratory: (G-E) Model

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SYPNOSIS

Introduction

Constructivism is based on the premise that learning is a process of constructing meaning through interactions between individuals and environment (Jonassen, 1991; Wheatley, 1991). The roots of constructivism traces back to the ideas of Giambattista Vico, an 18th century Italian philosopher, who said, "*human beings can know only what they themselves have made*" (Henriques, 1997). Immanuel Kant further expanded this idea by stating "*Human reason can grasp only what she herself has produced according to her own design*" (Fosnot, 1999). Modern constructivist Jean Piaget uses a definition emphasizing the idea that *learning occurs as a result of active experiences between the person and the objects around him* (Taylor et al., 1997). According to Piagetian constructivism, *learning is not a transmission of knowledge to the person's mind but a strong interaction between person and learning environment* (Fosnot, 1999). According to social constructivist Vygotsky, *learning occurs in an environment through social interactions* (Matthews, 1992). Definitions of constructivism are generally based on interactions of learner with his environment.

According to constructivist theories four possible situations could occur when a learner enters into a new learning environment:

- If new knowledge does not contradict existing knowledge, he would adapt the new knowledge.

Thus, the existing true or false knowledge and ideas are reinforced. However, a cognitive conflict occurs in learner's mind if new knowledge contradicts prior knowledge, and one of the following situations occur:

- If the learner dissatisfies with currently existing concepts and feels a need to restructure his ideas, he tries to accommodate them,
- If the learner has a tendency of receiving knowledge from an authority, he goes on with the same habit and waits for the true answer from the authority instead of reconstructing knowledge,
- The learner realizes the limitation of existing knowledge, but does not make any effort to accommodate them (Çepni et al. 2000).

Purpose of the study:

This study was planned for two main purposes:

1. To develop the theoretical basis of a constructivist laboratory model, which could be practiced in physics laboratories.
2. To assess and evaluate the effectiveness of the model in college physics laboratories

Method

After a thorough examination of related literature about laboratory models having constructive features by document analysis method, theoretical structure of a model, which is called *Constructivist Laboratory Model* [Guided-Examination (G-E)], was developed and carried out.

Sample was selected randomly from the student teachers of a elementary science education department in spring semester of school year 2002-2003. The sample was consisted of 101 students: 50 students in experimental group, and 51students in control group.

A pre-test was used to measure students' knowledge level before the application. Experimental group performed laboratory experiments based on constructive laboratory model while control group performed their experiments based on traditional verification model. After completion of the study, an achievement test and a practice exam were employed to the sample. Six experiments were performed in 3 weeks. The whole study, with the pre-test, post-test, and practice exam, was completed in 6 weeks. Comparisons of the groups were made by using t-test statistics.

Results

1- According to t-test results for pre-test [t (50,51)=. 313, $p>0.05$] there was not a significant difference between the groups prior to the study.
2- According to t test results for post-test [t (50,50)=4.195, $p<0.05$] and practice test [t (48,50)=5.681, $p<0.05$] significant differences in favour of the experimental group were found.
3- According to the results, constructivist laboratory model seems to be a more effective learning model compared to traditional experimental applications.

Discussion

The beginning knowledge levels of the groups were accepted equal according to pre-test results. According to the results of the examination undertaken at the end of the study, a significant difference was found in favour of the experimental group. This result suggests that G_E constructivist laboratory model can increase students' success in college physics laboratory courses.

Suggestions

1. In order to implement the G-E laboratory model effectively, teacher education programs should devote more time for laboratory experiments. A fundamental physics laboratory course independent from the fundamental physics course should take place in the curriculum.
2. Physical conditions of the faculty laboratories should be improved. Number of staff responsible from laboratory experiments should be increased so that one staff member

could manage each experiment. Research assistants should be trained by means of regular seminars about laboratory experiments.

3. Senior students who get adequate training could assist in laboratories, as guides when number of laboratory staff is not sufficient.
4. Questions posed to students should encourage them to think and to discuss, and to increase communication, instead of requiring students to provide general definitions.
5. Teacher educators should encourage students, to use experimenting, inquiry, and critical thinking skills, when constructing their knowledge.