



AN EVALUATION TOOL IN SCIENCE AND TECHNOLOGY LESSON: A SAMPLE OF I DIAGRAM

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Abstract

I diagram is an evaluation tool which was enhanced by Philips and German. It is usually used to evaluate activities of science and technology laboratory and students deeply understand experimental researches content scientific process skills by using I diagram. The purpose of this study is to reveal pre-service science teachers' attitude to science and technology laboratory and their opinion about using I diagram in laboratory lessons. In the study mixed method was used. The study was conducted with the participation of 20 pre-service science teachers randomly chosen. The data obtained from semi-constructed interview form and a five point likert scale consists of 18 questions. Data were analyzed with using t-test and content analysis. The result of the study is that pre-service science teachers' attitude to science and technology laboratory is positive and their opinion about using I diagram in laboratory lessons is useful.

Keywords: Science and technology, I diagram, attitude, semi-constructed interview.

INTRODUCTION

Laboratory method which is frequently used in science lessons and supplies permanent learning by active participation of students (Çilenti, 1992) is important to gain scientific process skills. At the same time it has possibility to students by active learning (Algan, 1992). So students will be able to have possibilities to critical thinking, enhancing problem solving skills and working in cooperation in well-structured laboratory lessons. In this direction it is seen important that laboratory lessons must be structured according to understanding of contemporary education. Laboratory environment and impact on student variable mustn't be ignored in the effectiveness of laboratory practices (Uluçınar, Cansaran and Karaca, 2004).

In contemporary education system which is dominated by constructivism active learning and assessment methods have been started to use. In this direction it has been tried to enhance new education methods, material and assessment tools.

According to Sarıkaya et al. (2004) laboratory practical is an important component of science lessons but students can't integrate with course information and observation in laboratory.

Nakhleh (1994) examined laboratory as a learning environment and as a result of his research that students can't structure information in laboratory environment according to constructivist learning theory. As another result of his study in order to structure information, active learning, responsibility and encouragement are important and because of this he drew attention to the importance of V diagram and concept maps. Especially one of the active learning and assessment a tool in laboratory lesson is I diagram.

I diagram is an evaluation tool which was enhanced by Philips and German (2002). It is usually used to evaluate activities of science and technology laboratory and students deeply understand experimental researches content scientific process skills by using I diagram (Philips and German, 2002). It enhances students' higher-order thinking skills and helps students in science research process. I diagrams are usually designed as a two pages. In the first page there is a step of scientific research, in the second page there is information about the study which is conducted. In the first page the left side of the diagram points to theoretical part of the study, right side point to method and results part. In the middle of form of I diagram there are arrows that are followed by students during the research. Left arrows are top-down, right arrows are bottom-up. Students finish study by using these arrows respectively. At the top of the form of I there is research question, in the middle there are pre-information to answer the research question, logical discussion, experimental design, steps of process, data collection, data conversion, results and new information, in the bottom there are scientific steps (defining a natural phenomenon, comparison of natural events and objects, testing hypothesis and understanding of relation with purpose and results). In the second page there is previous information, the question 'why' of research, the dependent and independent variables, possible experimental errors, limitation of the study and integrate to daily life.

METHOD

This study is a research used qualitative and quantitative methods. The universe of the research consists of Ağrı İbrahim Çeçen University Faculty of Education 3th grade science and technology education, the sample of research consists of 20 pre-service teachers randomly chosen. In the research a five point likert scale consists of 18 questions was used to determine students' attitude to science and technology laboratory. Data were analyzed by SPSS 16 and t-test was used whether there is a significant difference between pre-test and post-test about attitude. Before started the study, I diagrams were distributed to the students and necessary information about I diagram were explained. Then it is wanted to the students that an experiment must be designed by using I diagram and fill in the gaps in I diagram. At the end of the research opinion of 7 students randomly chosen about I diagram was evaluated by using semi-constructed interview. Opinions said by the students were noted and recorded by researchers. Analyses of the data obtained were done using content analysis.

FINDINGS

In this part, pre-service science teachers' points that taken from the scale of science and technology laboratory attitude (STLAS) and semi-constructed interview results have given. Pre-service science teachers' attitudes are at Table 1 as a pre and post-test results.

As seen in Table 1 pre-test attitude score of students is 40.30, post-test attitude score of students is 61.70. There is a significant difference between pre-test and post-test ($p < 0.05$). So it can said that I diagram has positive effects on students' attitude to science and technology laboratory.

Table 1. The independent t test analysis results of STLAS pre-test and post-test.

N	X	S	SD	t	p	
pre test	20	40.30	12.18	2.725	-7.02	.000
post test	20	61.70	8.07	1.79		

Semi-constructed interview was used to learn students' randomly chosen 7 opinions about the process of implementation I diagram and findings obtained from interviews are below:

1. Pre-service teachers' level of knowledge about I diagram

As a result of interview, they don't know any information about I diagram. This stems from not using I diagram in their education lives. For instance one of them said:

"I have never seen I diagram, our teachers didn't give any information about I diagram. I have seen the first time I diagram in this lesson".

2. Pre-service teachers' opinions about effectiveness of I diagram on learning experiment in laboratory lessons

Attitude is positive or negative trend to anything and it is concerned with the effectiveness of education (Petty and Cacioppo, 1996). Because of this, person who wants to learn something first should have positive attitude to the learning subject. It's seen in Table 1 that using I diagram in laboratory has positive effect on students' attitude to the science and technology laboratory. With this result from their opinions said about learning experiment is understood that they grasped and learned more. One of them said:

"Before this practice teacher used to give information about experiment in the laboratory and then he or she experimented and display us, sometimes he or she used to give to us experiment sheet and wanted us to read it as a recipe and practiced them. Because of this we didn't use to think, only practice and watch friends how they do it and finished lesson but we are trying to learn the experiment by via I diagram".

3. Pre-service teachers' opinions relation between using I diagram and active participation

I diagram is an effective evaluation and learning tool that contributes to a better grasps in laboratory experiment and makes students active. During the study, it was observed by researchers that they are more active and they are willing to experiment. One of them said:

"I diagram was given to us and all of us tried to do experiment and benefitted from each other of course. In this process only friends observed experiment take the copy of report from the friends prepared reports or wrote the same report. Because of this they didn't use to be able to learn well. But everyone must write the report in I diagram. Especially The parts asked pre-information and integrate to daily life are nice".

4. Pre-service teachers' opinion about gaining scientific process skills of I diagram

Scientific process skills is basic skills that facilitates learning and ensures the persistence, gains students scientific research methods, students are active on problem solving and producing (Çepni et al., 1997; Temiz, 2001). At the end of study it can be said that students gained scientific process skills with I diagram. For instance one of them said:

"In I diagram because of giving scientific process skills step by step, we experimented and designed as a scientist according to scientific steps so we felt ourselves in scientific process as a scientist".

5. Pre-service teachers' opinion about difference between preparing I diagram report and traditional report

Students are bored to prepare traditional report and they aren't glad with assessment of this report. They think individual assessment can not be made in this reports whereas they prepare individual reports via I diagram so I diagram reports are more objective. One of them said:

"I wish I never wrote a report. Preparing I diagram, experimenting according to steps, answering engrossing questions is more enjoyable than preparing report. This method makes laboratory funnier and we experiment according to purpose. When we prepare a traditional report we pay attention to purpose of experiment, materials, theoretical information, construction of experiment, and results and this is very ordinary. Because of taking the reports from each other assessment is not healthy".

6. Pre-service teachers' opinion about negative aspects of I diagram

As a result of semi-constructed interview, pre-service teachers don't have negative opinion about I diagram and they think I diagram is very useful in laboratory lessons. But some of them think I diagram can't be used in every experiment. One of them said:

"I think it is especially useful in experiments that include scientific process skills but it is not useful in experiment that includes limited skills".

DISCUSSION AND CONCLUSION

In this study that was intended to reveal usage of I diagram in laboratory lessons and pre-service science teachers' opinion about I diagram, before the study students didn't know I diagram, after the study they have positive attitude to I diagram, they think I diagram makes them active in laboratory lessons, gain scientific process skills easier, they are assessed more objective comparison with traditional report.

The way of preparing well disciplined, logical, productive, scientific thinking environment is to ask a lot of questions. One of the most effective ways of creating it, give place to questions frequently. The questions should make students think and be open-ended question (Çepni, 2007). In terms of occurring open-ended questions and encouraging individual learning, I diagram is effective tool that can be used in laboratory lessons.

I diagram have positive and negative aspects. Positive aspects of I diagram is to make students think higher-order thinking skills, to follow every steps by students and teachers easily, to assess objectively and easily, to determine research question, variables and purpose by students, to provide active learning, to enhance psychomotor and cognitive skills and to save time in lessons. Negative aspects of I diagram, if the students are not given information about I diagram, they may be bored in lessons and some of students that can't acquire research skills may live difficulty (Tatar, Korkmaz, Şaşmaz and Ören, 2007).

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