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Developing learning stations for the purification of waste water

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Abstract

This research aims at developing course content for high school students based on learning in stations on the issue of waste water purification. Learning stations, which is based on student-centred education, is a method employed especially in Europe in recent years. The method is a way of teaching which involves students actively in the process of learning, provides ample opportunities in using teaching aids and materials, and assures the learnt knowledge to be permanent.

Through lessons observations with a group developing course contents for the course of Environment and Health for schools in the state of Reinland-Pfalz in Germany, the course contents based on the model of learning in stations were examined.

Content development concerning the purification of waste water in Turkey was considered in this study, four stations were agreed on. Target behaviours intended to instil in students in those stations are understanding the occurrence of the natural cycling of water, understanding what is waste water and how it happens, and understanding the biological and mechanical processes of water purification. In order to do so, attractive and enjoyable materials related with real life through which students could have access to knowledge with active participation were designed. Having finished the materials, they were applied to 4 Turkish students living in Germany, and their views concerning the contents were asked for through questions. Their views were analysed via qualitative analysis methods.

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1. Introduction

In consequence of the global threat caused by the harm given to the environment in the 1970s, environmental consciousness became a rising movement. Environment education as a part of general school education was included in school programmes. So as to form behaviours beneficial to the environment, provision of knowledge, skills and positive behaviours relevant to the environment were considered necessary (Eschenhagen, Kattman, Rodi, 1998).

The most important aim of environmental education is the formation of environmental consciousness. According to De Haan Kuckartz (1988), in order for developing a consciousness for the environment, it is necessary for knowledge of environment, attitudes towards the environment, and behaviour against the environment to form a unity.

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What is meant by knowledge of environment is the environmental experience related with bad environment conditions, environmental problems, ecosystem, animals and vegetation – that is to say, experience with nature.

The effect of positive attitudes towards the environment is to consider environmental problems critical and to protect the environment through individual decisions, and thus to guide the improvement (Haan and Kuckartz, 1998).

Sources of knowledge alone are not sufficient in influencing positive environmental behaviour. Knowledge can complement experience, and thus a thought of positive attitude towards environment can be achieved on condition that environmental experiences are associated with sources of knowledge.

Environmental education must start as soon as possible so that values and attitudes can exist in children and the young. If children and the young people feel attracted to or have love of nature, interest will increase and they will make efforts for the things they like (Haan and Kuckartz, 1998). Setting out from research into behaviours, Fuhrer states that behaviours useful to the environment must encourage positive behaviours and that consequences must be visible (Brilling, Kleber; 1999).

The aim of environment education is not to spread news of environmental disasters, the environmental collapse and hopelessness; nor is it to ignore problems or to pretend to see no dangers.

The hopelessness imposed may lead to considering efforts needless, or may result in giving up all efforts.

Therefore, the aim of modern contents for environment education is to create a positive attitude towards life which motivates environment-friendly behaviour through knowledge of environment and emotional interest (Huber, 1991). Nature can be presented as something valuable and to be protected with the help of positive experiences obtained from trials with nature.

Students' activities have priority in the transfer of the modern environment education content. Mental and psychomotor work should be together in behaviours to be instilled (Meyer, 1994).

Thanks to environment education provided with new approaches of teaching, positive attitudes and environment friendly behaviours in students can be assured. Learning stations are also among the innovative approaches of teaching used especially in Europe. The approach is based on active learning and cooperative learning.

Learning stations assure students' grasping a topic faster (Hall and Zentall, 2000). A topic is divided into pieces in learning stations, and each piece is a station. Each station is a centre where students can realise varieties of learning activities. Stations give students ample opportunities to use aids and materials, assure active student participation in the learning process, and thus the learnt knowledge is made permanent.

Whereas education and research regarding environment are emphasised in the world, the issue is neglected in Turkey. It is imperative that an influential environment education be provided so that interest in environmental problems and the level of consciousness might increase. There is a need for a permanent, concrete environmental policy in which the Ministry of Education as well as all the relevant institutions participates.

Water is necessary for the maintenance of natural life, and is the most vital element at every stage of life. In contrast to common belief, water is a limited source. Effective use of water sources is one of the crucial issues today. The effective and maintainable use of water sources has not been achieved in the world yet. Turkey also faces a similar problem. The maintainable management of sources of water plays an important role in long term economic improvement (Turkish Environmental Foundation, 2003). The issue of United Nations Environment Day 2003 was determined as "water", the most valuable source in the world. According the results of a survey conducted by World Meteorological Organization with 87 member countries, Turkey is among the 74 countries affected by drought on earth (WMO, 1992). Water management is important in our country, and the issue must be reported to the society through students.

Water Environment Regulation was designed by the UN in late 2000, and there is a need for work with regard to water management in our country, which is in the process of adaptation to the UN. It is necessary that the importance of water, a natural source, should be understood by all layers of the society. This could be possible only through water education. Such an education which starts early as childhood will make us a society sensitive to water. On examining the secondary education syllabus of such courses as Biology (1998), and Environment and Human beings (1992), it is found out that education on diminishing problems concerning waste water and purification of water is not given at satisfactory levels. Hence, the development of a course content where source material relevant to issues of water is also available for use in secondary education schools is aimed in this study. The content is also likely to be used with adults so as to instil consciousness into the society.

2. Method

This research employs qualitative research methods.

2.1. Research group:

The research was conducted with 4 Turkish students living in Heidelberg, Germany in summer 2006.

2.2. Data collection instrument:

Semi-structured questionnaire forms to obtain the views of students joining in lessons of station-based applications were used as vehicles of data collection. The questions on the questionnaire form were prepared in a way so as to obtain the students' views concerning teaching in the stations.

2.3. Developing the stations:

The steps described below were taken in the process of developing the stations:

1. Through lessons observations with a group developing course contents for the course of Environment and Health for schools in the state of Reinland-Pfalz in Germany, the course contents based on the model of learning in stations were examined.

2. Literature review on water issues was performed, and the previously developed teaching materials were examined.

3. Objectives to be instilled were determined in the content. Each objective was thought to represent a station. The objectives were as in the following:

- grasping how the cycling of water occurs in nature,
- grasping what is waste water and how it happens,
- grasping how purification of water happens in nature,
- grasping how biological and mechanical processes of purification occur.

4. Materials for use in stations directed to objectives were developed. In developing the materials, great care was given to design attractive and enjoyable materials related with real life through which students could have access to knowledge with active participation.

2.4. The stations and the teaching of the courses:

At the beginning of the lesson, the students were informed about the teaching of the course, and a framework of time was determined by the researcher who was going to conduct the teaching. Materials needed for each student were put on the table belonging to the relevant station. The tables were arranged in a manner so as to pass from a station to the other. During the lessons, students argued with the teacher's guidance, and were made to find the correct answers.

The first station was the station called "how does the cycling of water occur in nature?" .

The students were given the diagram of cycling of water in nature, and 6 concepts (density, rain, leaking, underground water, surface currents, and evaporation) related to the diagram, as well as 6 cards explaining the concepts. They were asked first to put the concepts in the numbered gaps on the diagram, then to match them to the explanation cards.

The second station was the worksheet titled "the occurrence of waste water". On the worksheet was first short a part explaining what waste water was and how it occurred, and also the picture of a house with water pipes. The students were told to pursue the water pipes running from houses to the sewage system on the streets and to make notes about what polluted water on the worksheet. In addition, they were also asked to explain why rain water was waste water. Following individual work, the students were made to discuss in groups under the teacher's guidance.

The third station was an experiment describing the purification of water in nature. The worksheets on which students were to write the stages of and observations about the experiment were also on the third station table, and they were shared by the students. The students were asked to put some cotton, pebbles, sands and charcoal into a bottle designed specially for experiment purposes, then they were told to place coffee filter on the top of bottle

contents. Afterwards, they were told to pour a glass of previously prepared dirty water onto the filter slowly and to write down their observations on the worksheet after waiting for a while.

The fourth station was called “how does waste water purification station work?” In this station, the figure of a waste water purification station was placed on the table where the students worked. Besides, the students were given a worksheet to work in groups. On the worksheet were rectangles to cut out with texts containing gaps. The students were asked to fill in the gaps by looking at the pictures, to number the rectangles and to cut them out and then to stick them onto the relevant places.

3. Findings

Following the applications, the students were found to enjoy working in stations in general, to understand more easily, and to think they contributed to lessons through active participation.

The questions students were asked and the students’ responses were as in the following:

Question 1: how did you find the lesson entitled purification of waste water in general?

All of the students stated that the lesson was enjoyable, efficient and useful. One of the students said that he associated the issue with daily life and that his interest in water-related issues had increased. Another student said that they could exchange views thanks to group work and acquired permanent knowledge. Some of the views expressed by the students were as what follows:

“... It was very good. We had a useful lesson, activities were enjoyable, I got pleasure from participation in the lesson. Sharing opinions through group work made it possible for me to pick up permanent knowledge.”

“... It was good. It was an efficient and enjoyable lesson. Materials were interesting. They made it possible for me to understand the topic easily.”

Question 2: Have you participated in the lesson activities and made contributions? If you think you have not been able to participate in the lesson, point out the reason.

All the students stated that they had participated in the lesson and made contributions.

“... I was able to participate in the lesson and I made contributions. I was entertained while I was learning...”

Question 3: How did you find the contents of the stations called “the cycling of water in nature”, the occurrence of waste water”, “the filtration of water in nature”, “the station of water purification” ?

In general, the students found the stations easy, understandable and enjoyable .And a student found the station of water purification time taking and difficult.

“... The station of water purification was difficult, and it took a long time. Except for that, all the stations were enjoyable.”

Question 4: what are your recommendations for the betterment of the lesson entitled cleansing of waste water?

A student recommended that waste water purification station should be made easier whereas another stated that they needed more time in stations. The students expressed such views as:

“... The station of waste water purification was difficult; it might be made easier...”

“...longer time may be spent in stations...”

Question 5: What are the gains of such teaching compared to plain teaching on the part of students?

All the students interviewed stated that they understood the lesson when taught in this way, and that it was more interesting. They also pointed out that they were able to associate the topics with daily life and that they managed to participate in the lesson actively. Students’ views concerning teaching in this way were as in the following:

“... This made it possible for me to understand the topic better...”

“...I learnt a more enjoyable way and with more active participation...”

4. Discussion and Recommendations

In several studies, methods and techniques employed were presented as the causes of failure in lessons. Students are passive in classical methods of teaching. In order for learning to be more effective and more permanent, it is firstly necessary to make students more active so that they can receive the knowledge presented. Recent research demonstrated that active methods of learning managed to do this.

Active methods of learning are based on the idea that knowledge can be acquired through students’ experiences and their active participation (Açıköz, 2003). Learning stations are a way of teaching which engage students in

lessons, provide them with ample opportunities to use materials and aids, and assure better comprehension and permanent knowledge.

Students' finding the answers to questions on their own through worksheets assured students' active participation in learning environments.

The fact that the students found the lessons enjoyable showed that their interest in the course increased. Group work during the applications assured sharing of opinions. Students' expressing their deductions and writing them down were influential in the formation and permanence of knowledge.

It was observed that stations that were composed of students' answers made lessons more enjoyable and facilitated easier understanding. Therefore, learning stations to be used in lessons should be constituted in various topics.

This research was performed with 4 students. Studies concerning the effects of learning in stations on students' success, and studies on eliminating errors should be conducted with larger samples.

Teachers should be informed of "learning stations" through in-service training and seminars. More space should be allocated to the topic of learning stations in the teacher training programmes of universities.

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