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Teaching Techniques and Activities for the Education of the Gifted Young Scientist

Meaningful Field Trip in Education of the Renewable Energy Technologies

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ABSTRACT: Renewable energy sources, in terms of countries' obtaining their energy needs from clean and without harming the environment is becoming increasingly important. This situation also requires improving the quality of science education will be given in this field. In this activity, in a field trip to the center for the renewable energy resources technologies, the application of learning cycle model appropriate for constructivist approach is shown. In the example of solar chimney activity according to 5E model, in elaboration step, students, by using their imagination and creativity, put out recommendations and new designs for the efficiency of the application of solar chimney. It is quite important for educators to follow what kind of acquisitions that students will gain and what kind of changes will occur in their perceptions and attitudes towards renewable energy technologies thanks to this activity. Related documents are in attachments. This activity has been very helpful in the education of young scientists on the field of renewable energy sources technologies.

Keywords: renewable energy sources, meaningful field trip, the young scientist

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INTRODUCTION

Turkey has a significant potential of renewable energy sources (solar, wind, water, biomass, etc.) regarding its location (Evrendilek & Ertekin, 2003; Kaygusuz & Sarı, 2003; Kaya, 2006). However, it is behind many countries in terms of the use of the potential of renewable energy resources. This situation can be explained development countries advanced scientific studies in technological development of solar cells. (Kecebas & Yumurtaci, 2011). As it is thought that the issue of energy will become an even more important issue in our future, the training of scientists who work in this field is very important (Tortop, 2010). Unfortunately, high school students' level of awareness of renewable energy sources is quite low in our country. They have also many misconceptions at the point of physical principles related to the working of renewable energy sources Technologies (Tortop, 2012b). Another dimension of the use of renewable energy sources is environmental sensitivity. Growing individuals having environmental awareness is one of the main objectives of education programs (MoE, 2007; BoE, 2013). A few researches on the development of gifted young scientists' attitudes and sensitivity towards the environment are found (Aydın et al., 2011). In this situation Tortop (2012a) carried out a method - mentioned as a meaningful field trip- on gifted students other than traditional methods. In the research on renewable energy sources, it is determined that meaningful field trip has helped gifted students increase their attitudes towards the environment and energy.

Meaningful field trip (MFT), evaluated in constructivism different from traditional field trips, proposed by Karplus (1964) is carried out according to the learning cycle model. Learning cycle model has undergone revision by many researchers. One of these, Bybee (1997), developed 5E learning cycle model. 5E model is composed of Engagement, Exploration, Explanation, Elaboration, Evaluation and its name consists of the initial letters. According to 5E Learning Cycle model, the lesson plan (field trip) example designed by Kisiel (2006). Meaningful Field Trip has gone into literature in this way. Tortop et al., (2007) implemented the meaningful field trip (MFA) about the solar energy and the applications of it. Then in his doctoral study (Tortop, 2010), he put this application into project-based learning model

Figure 1. Teaching the Solar Chimney Applications (SCA) according to 5E Learning Cycle Model (MFT)

Implementation of the Activity

Before starting the activity, it is necessary to create students' special interests (curiosity) regarding the renewable energy resources. Monitoring the changes in students' perceptions of renewable energy resources is important for the effectiveness of the activity. To monitor this change is required to answer open-ended questions and metaphors "renewable energy resources like ……. Because ..... " with the sentence completion and it can be asked to draw a picture about the future and renewable energy resources theme.

This picture can be considered as a test similar to the test Draw-A-Scientist developed by Chambers (1983) (See Appendix 3). In the specified test, standards of a scientist, laboratory equipment, research and information symbols, formulas are created as images, in the test "Draw-A-Scientist-Deal with Renewable Energy Technologies-in the Future" students can put forward images such as applications of renewable energy resources, energy engineers, clean environment, scientific formulas. (In this test, the students' perceptions are revealed about renewable energy resources (biogas, solar energy, wind energy, etc.) technologies, their environmental consequences, studies in this field. This test, as in Draw a Scientist, will vary according to the number of images per person generated on preschool, elementary school, middle school, high school students. However, it can be said that this differentiation can be affected by the attitudes towards renewable energy sources, interest in this field and the education as much as educational level. In addition, the difference in knowledge level of students about renewable energy topic can be monitored. To do this, achievement test can be developed by benefiting from the studies of Goodman (2009) and Tortop (2010). For the changes in students' attitudes on the subject of energy, we can benefit from the attitude scale that Goodman (2009) used.

This activity can be applied in the level of elementary school, middle school and high school by selecting institutions such as universities' research and application center of renewable energy sources, energy institute. In his research Tortop (2010, 2012a) determined Suleyman Demirel University Research and Application Center of Renewable Energy Resources (RACRER). Meaningful field trip technique has been applied on solar chimney which is one of the renewable energy resources applications. Solar chimney is used to generate electricity from solar energy. Black ground absorbs the heat in greenhouse, the heated air rises and it helps to get energy by rotating the turbine at chimney (Schlaich, 1995). Table 2 shows the application steps of the activity. During this activity the students will be given a work sheet (see Appendix 2).

Table 2. Teaching the Solar Chimney Applications (SCA) according to 5E Learning Cycle Model (MFT) Tortop (2010)


First Stage (Engagement): The teacher asks the students questions about SCA such as what it is and how SCA works. So, The students will be curious about SCA.


Second Stage (Exploration): The teacher allows students to wander around the Solar Chimney and get into it to investigate and explore the SCA.


Third Stage (Explanation): The students discuss on the working principals of SCA. The teachers correct any misunderstanding about SCA. In addition, in this stage, an expert of SCA also answers questions asked by the students.


Fourth Stage (Elaboration): The Teacher wants students to pass on information to different applications. The teacher asks students "What can be done to make the application more efficient? What can be done to make it work in better conditions?" They engage in discussion. Students make drawings and form new prototypes.

Fifth Stage (Evaluation): The teacher evaluates the knowledge of the students on SCA by giving evaluation questions prepared in advance or by verbally.

Especially, the elaboration stage is the stage in which students produce new ideas in order to increase the efficiency of current SCA. In this stage, young scientists develop their own ideas. Together, they discuss it. They design new applications. By showing their designings to their expert and teacher, they discuss whether they will be efficient or not.

There are different applications at RACRER. For example, clean energy home, biogas plant. Students are asked to calculate; how much does an average house in clean energy house spend daily, how can a house be designed and in which qualities does solar collector and solar panels should be. (See Figure 2). The integrated use of a parabolic collector for maximum productivity in biogas plant where biogas is got from household waste and animals' manure is shown to students (see Figure 3). Students recognize the other applications

Figure 2. Examining of clean energy house and biogas plant by students at S.D.U. (Tortop, 2012a)

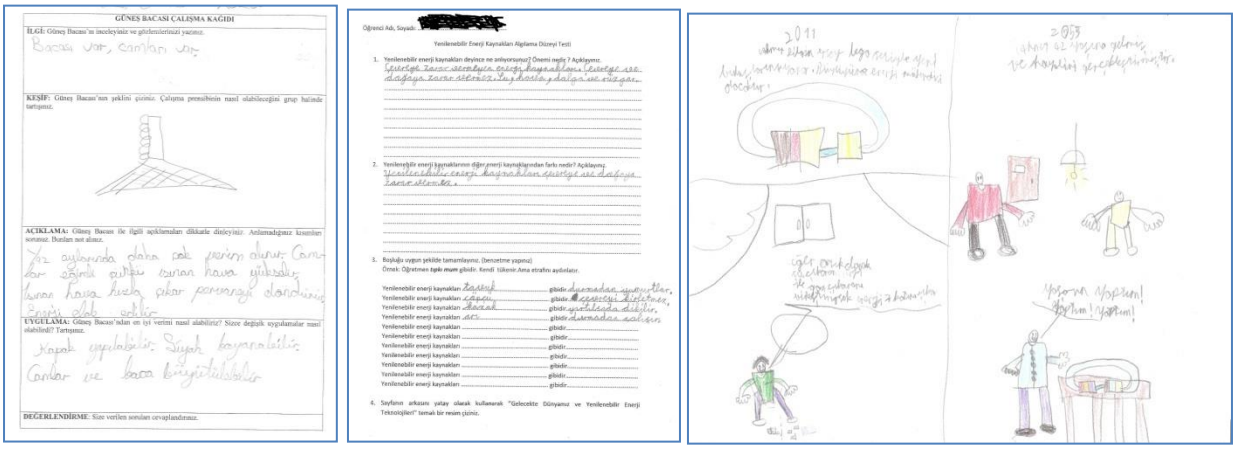

Figure 3. Solar Chimney Activity Worksheet **,** Test of Determining of the Level of Perception on Renewable Energy Resources and "Draw-A-Scientist-Deal with Renewable Energy Technologies-in the Future-Test" Sample

To monitor the effectiveness of the field trip by the instructor, evaluation tools in the appendix about the expected features that students should develop, are used again after the field trip.

CONCLUSION

It is very important to guide gifted students' interests to the fields that may become important in the future. In the process of creating areas of interest, it is very important that young scientists should see the projects that scientists did and have been doing. In the education of young scientists, learning environments in which they can be active, they explore and live the adventure of scientists should be created. In the application of tthe field trip; students' recommendations especially in elaboration stage on disadvantages of current application (SCA) and new designs will do a developing effect to their imagination and creativity. In the meantime, it is important that educators and experts (at renewable energy) have to act very carefully, behave as trigger and supportive to new ideas in pedagogical approach. The topic of renewable energy resources is one of the suitable topics in education of the young scientists to realize the acquisitions. In particular, the application of solar energy - related to different disciplines (multidisciplinary) - is very suitable as our country have a high potential and there are many applications in this field.

REFERENCES

Acikgoz C. (2011). Renewable energy education in Turkey. *Renewable Energy, 36,* 606–611.

Aydin, F., Coskun, M., Kaya, H., & Erdonmez, İ. (2011). Gifted students' attitude towards environment: A case study from Turkey. *African Journal of Agricultural Research*, *6*(7),1876-1883.

BoE, (2013). The Ministry of Education Board of Education. Retrieved from: http://ttkb.meb.gov.tr on 04.05.2013.

Bybee, R. W. (1997). *Achieving scientific literacy: From purposes to practices*. Portsmouth, NH: Heinemann

Chambers, D.W. (1983). Stereotypic Images of the Scientist: The Draw-A-Scientist Test. *Science Education, 67*(2). 255-265.

Evrendilek F., & Ertekin C. (2003). Assessing the potential of renewable energy sources in Turkey *Renewable Energy;28*, 2303–2315.

Goodman, D.W., (2009). *Effects of an informal energy exhibit on knowledge and attitudes of fourth and fifth grade students*. Doctoral thesis. Prudue University Graduate School.

Kaya D. (2006). Renewable Energy Policies in Turkey. *Renewable Sustainable Energy Review, 10*, 152–163.

Kaygusuz K., & Sari A. (2003). Renewable Energy Potential and Utilization in Turkey. *Energy Convers Manage, 44*, 459–478

Kecebas A., & Yumurtaci M. (2011). Renewable energy and its university level education in Turkey. *Energy Education Science and Technology Part B-Social and Educational Studies. 3,* 143-152.

Kisiel. J. (2006). More than lions and tigers and bears-creating meaningful field trip lessons. *Science Activities Classroom Projects And Curriculum Ideas*, *43*(2), 7-10.

MoE, (2007). Ministry of Education, Turkish Republic. Directive for Science and Art Center. Retrieved from: meb.gov.tr/html/2593_0.html on 04.05.2013.

RACRER, (2013). Research and Application Center of Renewable Energy Resources Retrieved from: www.yekarum.sdu.edu.tr on 14.05.2013

Schlaich, J., (1995). *The solar chimney: Electricity from the sun*. C. Maurer, Geislingen, Germany.

Tortop, H. S., Bezir, N. C., Ozek, N. and Uzunkavak, M. (2007). The field trip about solar energy and applications of the effect of students' attitude and achievement. *International conference on environment: survival and sustainability*, 19-24 February 2007, Near East University, Nicosia-Northern Cyprus.

Tortop H.S. (2010). *The applicatıon of project based learning model supported by prepared according to constructivist approach the field trip to the solar energy and its usage areas*. Doctoral thesis. Suleyman Demirel University. Isparta, Turkey

Tortop, H.S. (2012a). Meaningful field trip (MFT) of gifted students about renewable energy resources, *AIBU Journal of Education, 12* (1), 181-196.

Tortop, H.S. (2012b). Awareness and misconceptions of high school students about renewable energy resources and applications: Turkey case. *Energy Education Science and Technology Part B: Social and Educational Studies, 4*(3), 1829-18.

Appendix 1. Evaluation questions for Solar Chimney Application

Evaluation questions for Solar Chimney Application

1. Briefly explain the working principle of Solar Chimneys
2. What does the change in the width of the greenhouse area of Solar Chimneys affect?
3. What is the reason of black ground?
4. What does the change in the height of the chimney affect?
5. According to you, how could a more practical and convenient application be?
6. What effects might the trees (S.D.U. – RACRER) have?
7. In which months, do you expect, does the electricity generation with solar chimney get more?
8. Which region of Turkey can yield more from Solar Chimney?
9. What time of day do you expect the production of electricity get more? Why?

Thanks

Appendix 2. Solar Chimney Activity Worksheet

Solar Chimney Activity Worksheet
Engagement : Examine the Solar Chimney and write your observations.
Exploration: Draw the shape of the Solar Chimney. As a group, discuss how its working principle might be.
Explanation: Listen carefully to the explanations about the Solar Chimney. Ask questions about parts you do not understand. Please take note of them.

Elaboration: How can we get the most yield from the Solar Chimney? According to you, How could different applications have been? Discuss.
Evaluation : Answer the evaluation questions which it given

Appendix 3. Test of Determining of the Level of Perception on Renewable Energy Resources

Test of Determining of the Level of Perception on Renewable Energy Resources

1. What do you understand from renewable energy resources? What is their significance? Please explain.
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2. What is the difference between renewable energy resources and other energy sources? Please explain.
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3. Fill in the blanks.

   Example : A teacher like *candle*. Because, he exhausted but light around.

   A renewable energy resources like ……. Because ……
   ……...
   A renewable energy resources like ……. Because ……
   ……...
   A renewable energy resources like ……. Because ……
   ……...

4. Future-Scientist-Renewable Energy Resources Technologies-Draw-Test. Draw a picture themed Renewable Energy Technologies using the back of the page horizontally.