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The Development of Scenario Game Teaching Material for the Learning of Power Networks at Technology Education in Junior High School

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Abstract: The purpose of this study is to develop the scenario game teaching material for the learning of power networks for the junior high school students. Based on the GBS theory, we developed this teaching material that the games main character is in partnership with the power company to supply power stability in charge area. The result of practices will target the first year students at junior high school, we have been able to verify that this material can be utilized as a teaching tool of power network and attract the interests of students.

Keywords: Scenario game, learning of power networks, GBS theory, junior high school

1. Introduction

The modern society cannot survive without electricity. Learning the power network to support the stable supply of power is an important issue of technology education. In junior high school, subject to learn about the power network and energy technology is in the technology category of the technology and home economics curriculum. Also, this content has been shown in the Course of Study of the technology education (MEXT, 2008). We have already been teaching the materials for the power generating technology and the power consumption, but teaching materials for learning the power network is insufficient. In addition, since there is only a limited time in class, it is difficult also to learn experientially about the power network. So, we thought about the use of scenario game materials in studying simulated real problems. The objective of this study is to develop a scenario game teaching materials for the learning of power networks for the junior high school students.

2. Approach

2.1 Basic design of teaching materials

We were using the GBS theory (Goal-Based Scenario Theory) for the design of scenario game teaching materials. The GBS theory is instructional design theory to design scenario type materials that have been proposed by R.C.SCHANK (1996). In this theory, educators can provide a learning environment in a more realistic context by using the concept of "learn by that failure".

The point of the power network technology is to balance the supply and demand of electricity. Trade-off between environmental load and power generation efficiency and power generation technology may also occur there. Therefore, the students will stabilize the power supply in charge of district employees of the power company. “. Table 1 shows each element of GBS. In the materials, the objective of this study is to understand the importance of balancing the supply and demand to operate

the power company. We also need to have knowledge of power network and power generation technology.

Table 1: Response to GBS theory of teaching materials

Material elements		Power generation, transmission, distribution and consumption of low cost, high efficiency and stability.
Scenario context	Mission	To supply power generation, transmission, distribution and consumption of low cost, high efficiency and stability.
	Cover story	The games main character is in partnership with the power company.
	Role	Judgment by engineer of the power company.
Goal of learning		Understand the knowledge of power network and power generation technology.
Scenario operation		The power company corresponding to the events that occur in complex.
Scenario	Feedback	Stability to the expected cost, efficiency is indicated by the parameter.
	Source of information	Show the knowledge of power network and power generation technology.

2.2 Development of teaching materials

In order to respond to the restriction of the hardware in home and schools, we have developed a teaching material using the TACS for Flash (Takaaki, 2014, Kojima.ea al, 2011). For the materials of their choice, we have set the 3 parameters; stability, environmental load, and cost. It was displayed in 5 step parameter (Fig. 1). The numerical values of the 3 parameters were set based on the cost of power generation and CO_2 emissions of each power generation methods. It is described in the technical arts textbook at junior high school and amount of power generated by the Chubu Electric Power Co.inc in 2013. Also, we have set the event that the demand for power changes for students to allow judgment and selection. (Fig. 2)

For final stage of learning, results are evaluated based on the three-point stability, environmental load, and cost. Then after the awards, students will present a summary of their experience.

Figure 1. State of the parameters.

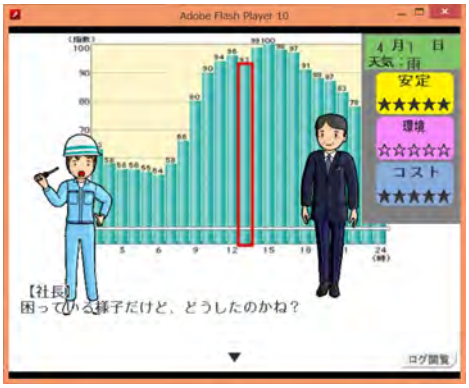

Figure 2. The demand for power changes.

3. Verification of teaching materials

We carried out the teaching materials for 42 first year students at junior high school T (2 class) in prefecture N in December 2013. It was performed in the class of the technical arts and home economics curriculum, class time was 50 minutes. Students do not have the learning of energy in the classroom of the technical arts. The classes used a worksheet with scenario-type game teaching materials. Students

used individual desktop PC.(OS Windows Vista).We have verified the teaching materials, a) Awareness survey of pre-trial and post-trial questionnaire, b) Evaluation of the teaching materials by post-trial questionnaire.

a) Awareness survey of pre-trial and post-trial questionnaire

We have set 13 question items (Table 2).for the knowledge of transmission and distribution results are 3.33 averages, SD1.03. And for the advanced, the result was more of a post significantly higher at the 5% level (3.64 averages, SD0.93)

b) Evaluation of the teaching materials by post-trial questionnaire

For the evaluation of teaching materials, we have set 13 items. For the answers, we categorize to negative answers for checking 1-3 and to positive answer for checking4-5. For the results of binomial test, it is significantly higher by 5% in 11 items.

Table 2: Item of awareness survey * 4 selection

No.	Item
Q01	I think the work of the power company looks interesting.
Q02	I am interested in the TV programs or the newspaper about power generation.
Q03	I want to know about the various power generation methods.
Q04	I want to know the mechanism of transmission.
Q05	I think that we should have knowledge of the power generating technology.
Q06	I think that we should have knowledge of the power transmission technology.
Q07	I think that we should have knowledge of production and design for energy saving.
Q08	I think that we should have knowledge about the devising of energy saving equipment to be used.
Q09	I think to be aware of the energy saving when I use electrical products and machines.
Q10	I think to try to devise related to energy saving when I make electrical products.
Q11	I think to try to devise increase the effect of energy saving when I use electrical products and machines.
Q12	I think to try to use the function of energy saving in electrical products and machines.
Q13	I think to be aware of the energy saving when I make electrical products.

4. Conclusion

In this study, we aimed to develop the scenario game teaching materials for the learning of power network using the GBS theory for junior high school students. Teaching materials were developed to attract the interests of students. And it can be utilized as a teaching tool of power network. We plan to use in the classroom more often and further improvements will be made in the future.

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