

A Lesson Plan for “Home Economics” Considering Product and Energy-Saving Specifications Encountered in Daily Life

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省エネルギーと生活に密接な物理情報の利用による
教科「家庭科」の新学習指導要領に基づいた指導案
－大学での「家庭電気・機械」を手がかりとして－

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概要

「家庭電気・機械」は中学校での教科「技術・家庭科」および高等学校での教科「家庭科」のための科目である。今回は第13回目（全15回）の授業において、「家庭電気・機械」の最終課題である学生による学習指導案の具体例となるように構成し、省エネルギーの観点から身近な題材（ヘアドライヤー、薄型テレビ、電力、消費電力量）をもとに授業展開した。

Key words: 家庭電気・機械 Home Electrical and Mechanical Engineering, 家庭科 Home Economics, 技術・家庭科 Technology and Home Economics, 省エネルギー energy saving, 消費電力量 Electricity Consumption, 学習指導案 Lesson Plan

1. Introduction

The subject “Home Electrical and Mechanical Engineering” at Hiroshima Jogakuin University is provided for second-year students seeking to attain a certificate for teaching “Home Economics” in senior high schools and teaching “Technology and Home Economics” in junior high schools.

According to the guidelines for the “Technology and Home Economics” course of study¹⁾, as revised by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2008, junior high school students are required to learn to live as consumers capable of considering their surrounding environment and to design and practice a better life in terms of their behavior as consumers. For senior high school curricula, the subject “Art of Living” has been revised to “Life Design”, with “Home Electrical and Mechanical Engineering”, a part of the original “Art of Living”, being omitted in the new guidelines.

On the other hand, “Home Economics” for senior high school students comprises three subjects, “Basic Home Economics”, “Integrated Home Economics” and “Living Design”, and students are required to take at least one of these subjects. One of the aims for these three subjects is to provide students with the ability to live while taking the environment into consideration, according to the guidelines for “Home Economics” as revised by MEXT in 2010²⁾.

This means that high school students especially need to learn practical skills, such as how to select a more energy-saving product at high-volume electronics retailers rather than how the actual mechanisms and technology used in electrical home appliances and machines (e.g., flat-screen TVs, refrigerators, sewing machines, and bicycles) function. Thus, herein, a lesson plan for developing “Home Economics” using product specifications (e.g., electric power, energy consumption) linked to the daily life of students is proposed. These product specifications can be seen on many sales fliers made by high-volume electronics retailers and can be used as energy-saving indicators.

2. Lesson Plan for Senior High School “Home Economics”

An example of a lesson plan for senior high school “Home Economics” is shown in Table 1. The plan was modified after demonstrating it to university students. The format is based on SABES/ACLS LESSON PLANNING RESOURCE GUIDE⁹.

Table 1 Lesson plan for senior high school “Home Economics”

Topics: Energy consumption efficiency for flat-screen TVs
Learning Objectives: Students will be able to do the following. Explain an energy saving label. Estimate the annual rate of electricity use for a TV with 100% accuracy using its annual energy consumption.
Materials: High-volume electronics retailers’ fliers or manufacturers’ catalogs which include the energy consumption for TVs in kWh/year. A handout of a graph ⁴⁾ showing the projected transition in energy consumption of Japanese electrical home appliances per household. A handout of a graph ⁵⁾ showing the dependence of major countries on imported energy sources.
Assessment: (Homework) Ask: “What is the annual rate of electricity use if you watch a 150-kWh/year TV for six hours every day?” 150-kWh/year TV: approximately 40 inches
Warm-Up Work (using homework given the previous week): [5 min] Ask students to put the sheet ⁶⁾ given as homework from the previous class on their desk. Ask for a student volunteer to discuss how electricity use (kWh meters) at his/her home changed during the past week.

Activities:

Part One: [10 min]

Ask: “Did you do “Asha-Shan (or Sham)?”, which is a popular Japanese custom of shampooing in the morning, and using a hair dryer.

Ask: “Can you tell your hair dryer’s performance by the [W]?” Ask: “What is [W]?”

Talk about estimating the rate of electricity use if using a hair dryer for 10 minutes.

[W]: electric power; that is, electric energy per second

$1500 \text{ [W]} / 1000 \times 10 \text{ [min]} / 60 \text{ [min]} \times 22 \text{ [yen/kWh]} = 5.5 \text{ [yen]}$

22 [yen/kWh]: conversion rate generally used in Japan⁷⁾

Ask: “5.5[yen] is very cheap, but how much is the total energy consumption if all of us use a hair dryer?”

Part Two: [5 min]

Show graphs and talk about Japan’s dependence on energy imports and the transition of energy consumption per household despite emphasis on energy conservation measures.

Part Three: [15 min]

Show fliers and ask: “Have you ever seen these types of fliers? Do you know that these fliers have energy-saving labels for TVs on them?”

Talk about the labels on which energy saving standard achievement rates and energy consumption efficiencies are printed.

Write numerical values for a TV as an example:

energy saving standard achievement rate: 115%

energy consumption efficiency: 83 kWh/year

kWh/year: an annual electricity consumption

Talk about the Top Runner Program⁸⁾, which uses the value of the product with the highest energy consumption efficiency.

Inform students that energy consumption efficiency (e.g., annual energy consumption) is an index of how much energy a given product consumes⁹⁾.

Inform students that the average time for watching television per household is considered 4.5 hours/day in Japan, but it is more than 11 hours for a multiple-member household⁹⁾.

Ask for a student volunteer to determine how much you pay for a 83 kWh/year-TV if watching this TV for 4.5 hours every day for one year.

$83 \text{ [kWh]} \times 22 \text{ [yen/kWh]} = 1826 \text{ [yen]}$

Wrap-Up [5 min]

Ask: "Can you judge a product that consumes more energy from one that consumes less when buying from a high-volume retailer? If so, how do you know it?"

Ask: "Is it suitable to only use energy-saving home appliances? Point out that: "Leaving the TV on is wasting energy even if the TV is an energy-saving home appliance."

"Home Electrical and Mechanical Engineering" at our university comprises 15 lessons and students are required to make an original 20-minute lesson plan. The lesson plan described in section 2 was conducted as a demonstration for university students. There were forty-eight students who attended this class in 2010 but only six wanted to obtain a teaching certificate in "Home Economics" and "Technology and Home Economics". However, nearly all the students made lesson plans that were easy to understand. So, the plan incorporating material from daily life is considered to be helpful for university students seeking to make lesson plans for teaching practical, environmental awareness.

3. Summary

The performance specifications for electrical home appliances are given in quantities that are generally studied in a physics classes. However, the lesson plan proposed herein does not aim to teach the theoretical meaning behind these specifications, but rather make students recognize these specifications as an index to gauge the impact of a product on the environment because the practical knowledge and skills associated with environmental management are required according to the recent guidelines set forth by MEXT.

Thus, the lesson plan in the present study focuses on the following three points.

1. According to revised courses of study, flat-screen TVs are chosen as products encountered in students' daily lives.
2. Knowledge of product specifications, such as W, kWh and kWh/year seen on fliers and in catalogs of electrical home appliances is needed.

3. Linking points 1 and 2 is important for energy-saving practices in daily life.

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