A REPORT ON OPEN COURSES IN FINANCE FOR CITIZENS, TAUGHT BY FEMALE STUDENTS (RIKEJO) AT NIT, KURUME COLLEGE

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Abstract

In Japan, it has been said that, in the past, there were few opportunities for children to learn financial literacy. In reference to this, the country's surrounding environment has been changing: low interest rates, the spread of the Internet, and the lower age of adulthood. Then, in 2022, financial education was introduced to high schools. However, in the age of Society 5.0—the concept of a future society advocated by the Japanese government—there is a need for human resources with the skills to grasp things from multiple perspectives and solve problems, referred to as STEAM human resources. (STEAM is an abbreviation of science, technology, engineering, (liberal) art and mathematics.) Since 2019, we have practiced STEAM education in the "Liberal Arts Special Lecture" with the 4th-year students at the National Institute of Technology, Kurume College (Kurume KOSEN). In the lecture, teachers give themes related to their own expertise. Through collaborative learning between students from various departments, we have led those students in integrating knowledge and creation so as to achieve deep learning. We have formulated financial teaching material on simple interest and compound interest from the perspective of STEAM education, i.e., a fusion of economics and mathematics. Moreover, we have used this material in an open course for citizens by utilizing the abilities of liberal arts special course students and the 3rd-year students who studied both subjects as instructors. In addition, we have selected female science students (RIKEJO) to serve as the instructors of this course, since we are informed that RIKEJO are studying in KOSEN. As a result, we have been highly rated by the participants and the female students have had a good opportunity to give back their acquired knowledge and ability to society. This initiative has just begun, and so we must continue to develop education methods. In the current report, we propose financial teaching material which is relevant to economics and mathematics, while we also review the open course.

Keywords: *financial education, simple interest and compound interest, STEAM education, economics, mathematics*

Introduction

Introduced by Georgette Yakman, STEAM education is an approach to learning that uses science, technology, engineering, the arts, and mathematics as access points to guide student inquiry, dialogue, and critical thinking in order to solve problems in the real world.

The main purpose of this work is to create financial education material regarding simple and compound interest for citizens from the perspective of STEAM education by utilizing the abilities of RIKEJO (female science students) as teachers.

We have studied mathematics education of and put it into practice in many different places (e.g., M. Sakai and T. Tanaka, 2014; K. Kawashima, M. Sakai, Y. Matsuda, 2021). We also taught mathematics with our students on many open courses for junior high school students (e.g., M. Sakai & T. Miyaji 2013; M. Sakai, T. Miyaji and S. Nakabo 2013; K. Kawashima, Y. Matsuda, M. Okita, M. Sakai, and T. Tanaka, 2018).

In this paper, we report on our practice of STEAM education for citizens. We formulated financial teaching materials as a fusion of economics and mathematics.
In this practice, our female students acted as teachers and used these teaching materials.

This article is organized as follows. The structure of open course describes the construction of open courses. In some scenes of open course, we review scenes from an open course using photographs. In economics and mathematics, we introduce the open course in economics and mathematics. Results of the questionnaire describes the results of the questionnaires administered to participants. Finally, conclusion of this effort and a future subject presents conclusions and future challenges.

The structure of open course

We constructed the open course in economics and mathematics as follows:

(a) Learning content
Simple and compound interest viewed from the perspective of economics and mathematics.

(b) Construction
- Participants: Seven citizens
- Leaders: Three female students as teachers and two teachers as facilitators
- Time: 120 minutes (60 minutes for economics and 60 minutes for mathematics)

Some scenes of open course

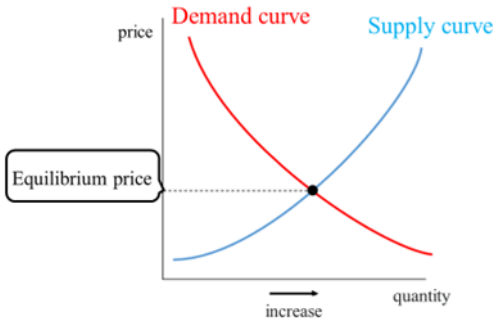
In this section, we review scenes from the open course with photos. Female students showed slides on the screen (Figure 1) and explained some points for solving problems involving simple and compound interest. Participants took notes on their answer sheets before solving the problems while female students walked around and answered their questions (Figure 2). Through these activities, female students developed their ability to teach others.

[Figure 1: Lecture]

[Figure 2: question answering by a female student]

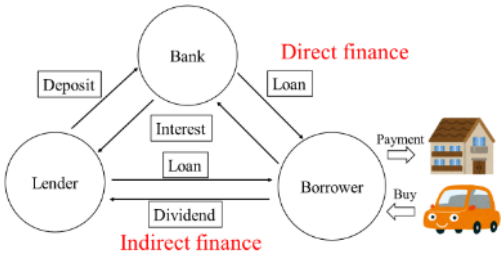
Economics

In the economics section, female students specializing in economics (liberal arts) provided explanations on such subjects as economics, household finances, finance, and debt. In the introduction to economics, participants were asked to give examples of economic reports in daily news stories that aroused their interest. In the lecture, economic activities were defined as human production and consumption activities and various activities derived from them (e.g., finance). In the case of household finances, the relationship between supply and demand in the market was explained using graphs after explaining the purposes of companies and households (Figure 3).



[Figure 3: Relation between demand and supply]

We explain direct and indirect financing using diagrams (Figure 4).

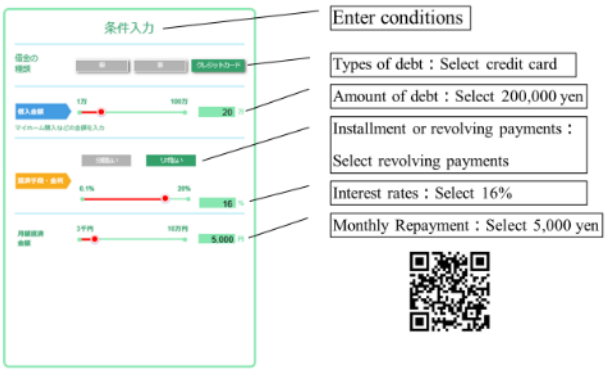


[Figure 4: Relation between direct and indirect finance]

Regarding debt, questions were given in the form of a quiz, as shown below, and the answers were provided using a simulator (Figure 5).

[Table 1: Exercise 1.]

Exercise 1.
I borrowed 200,000 yen at a 16% interest rate because I am going on an overseas trip with my friends. If I repay 5,000 yen per month, how many years will it take to repay and how much will I pay back in total? (Choose from (1) to (3), below):
(1) one year, 210,000 yen
(2) three years, 250,000 yen
(3) five years, 290,000 yen



[Figure 5: Debt simulator]

Mathematics

In the math section, a female student taking the responsible author's math class explained simple and compound interest, how to save and pay back money, and the power of long-term accumulation and compound interest. For simple and compound interest, the differences and calculation methods were explained. Students used their calculators to solve a problem exercise 2 in which these differences were confirmed (Figures 6 and 7).

[Figure 6: Explanation of simple and compound interest**]**

x years later	1	2	3	5	6	7	8	9	10
simple interest									
compound interest									

How to calculate by calculator	
100×1.03^2	100×1.03 = =
100×1.03^3	100×1.03 = = =
100×1.03^4	100×1.03 = = = =

[Figure 7: Calculation of simple and compound interest]

[Table 2: Exercise 2]

Exercise 2.
Use a calculator to calculate simple and compound interest when investing 1 million yen at an annual interest rate of 3%.

In the question regarding how to save money and return it, we posed the problem of using a simulator to calculate how saving and returning one million yen would change when the amount of money saved, and the interest rate changed (Exercises 3 and 4).

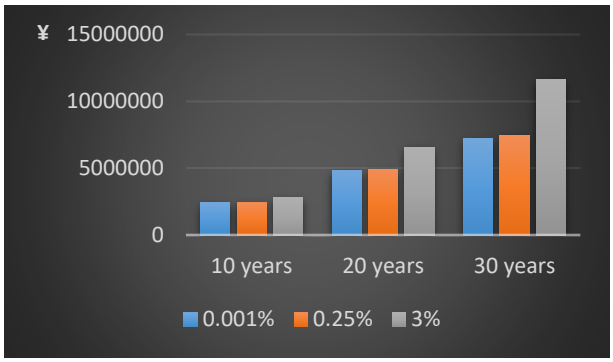
[Table 3: Exercise 3]

Exercise 3.
Determine how much you can save over 10, 20, and 30 years of compounded interest, assuming a monthly reserve of 20,000 yen and annual rates of 0.001%, 0.2%, and 3%.

[Table 4: Exercise 4]

Exercise 4.
I borrowed 1 million yen at an annual interest rate of 5%.
(1) If I return 100,000 yen at the end of each year, how many years will it take to repay it?
(2) If I return 40,000 yen at the end of each year, how many years will it take to repay it?

In terms of the power of long-term accumulation and compound interest, we used a graph to illustrate the comparison of the total amount of 20,000 yen when the period of accumulation and interest rate changed (Figure 8).



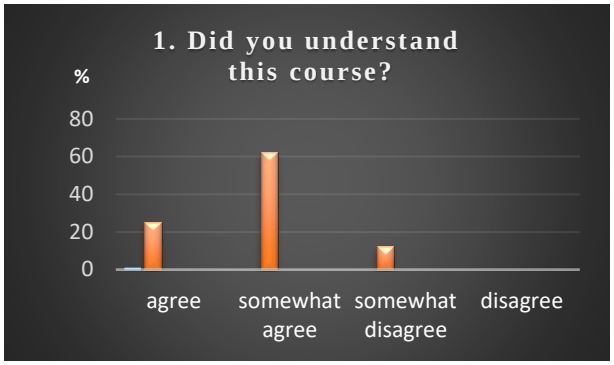
[Figure 8: Saving period and interest rates]

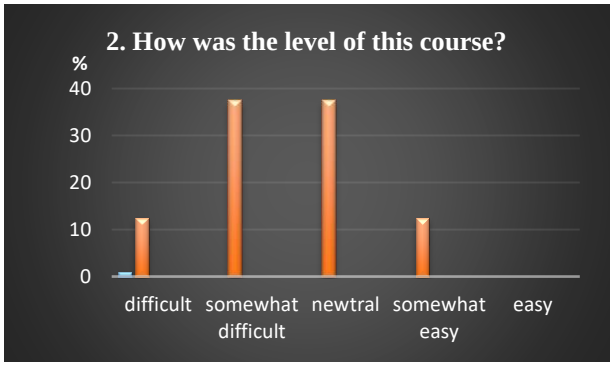
Results of the questionnaire

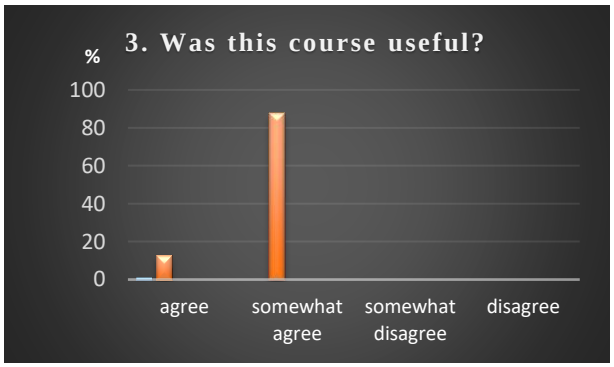
We administered a questionnaire to the participants concerning the above themes. The questions and their results follow:

[Table 5: Questionnaire for the participants]

Question 1. Did you understand this course?
Question 2. How was the level of this course?
Question 3. Was this course useful for you?
Question 4. Were you satisfied with this course?







[Figure 9: Answer from the participants]

The results of Questions 1 and 2 indicated that the participants understood the content of the lecture even though it was not elementary. One reason is that the lecture focused on ways to compute curvature instead of strictly theoretical arguments.

Since participants were familiar with a quadratic curve in daily life, many answered Question 3 positively. As indicated by the responses to Question 4, more than 80% of the participants were satisfied with the open course.

We received the following comments about our theme and teaching materials from participants:

[Table 6: Comments from participants]

"In the economics part, I wanted more specific examples. In the math part, the actual numerical calculations made me realize that the impact of interest rates is significant. Overall, I am glad I attended the course."
"The female students' explanations were calm and good."
"It was interesting but disappointing in that there were so few participants."
"I will try the simulation at home. I found the course very useful. I wish more people had listened to it."

Conclusion of this effort and a future subject

We received the following comments about our theme and teaching materials from female students:

[Table 8: Comments from female students]

"I was nervous, but it was a good experience."
"I thought it was useful and easily understood the results of the savings using simulations."
"I should have practiced the simulation a little more. I am glad to have learned about interest rates through this course. I would like to make use of it when I borrow money in the future."

The questionnaire demonstrated that our course was effective for learners and showed potential as a STEAM teaching tool.

Here, we describe two teaching tools for future use. One is knot theory, which is easily understood by beginners because it is not necessary to be familiar with its background. Additionally, various teaching materials promote visual learning. Knot theory is associated with various fields, such as the quantum field theory in physics, molecular design in chemistry, and DNA biology. In the future, we intend to create STEAM teaching materials related to physics and chemistry. K. Kawashima, M. Sakai. and T. Tanaka (2014), K. Kawashima, M. Sakai, T. Tanaka. & Y. Matsuda (2015), and M. Sakai, T. Tanaka (2023) studied teaching with knot theory and used it to guide learners to deeper learning. We will

develop teaching materials on knot theory from the perspective of STEAM education.

The second tool is graph theory, an interesting field of study. It is easily understood by beginners because familiarity with the background is unnecessary. Graph theory is associated with various fields, such as physics and chemistry, computer science, linguistics, and the social sciences.

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References

Collins. W. J, (2003). *The Greenwood Dictionary of Education*, Greenwood Publishing Group.

K. Kawashima, Y. Matsuda, M. Okita, M. Sakai, T. Tanaka, (2018). A report on open courses in mathematics for junior high school students assisted by upper-class students at NIT, Kurume College, *Proceedings of ISATE 2018, the 12th International Symposium on Advances in Technology Education*, 134-139.

K. Kawashima, M. Sakai, Y. Matsuda, (2021). A practice of deep learning by geometry, *Proceedings of ISATE 2021, the 14th International Symposium on Advances in Technology Education*, 124-128.

K. Kawashima, M. Sakai. & T. Tanaka, (2014). An effort of mathematics teaching materials for secondary education using matrix and knot theory（in Japanese). *Gifu Educational Studies in Mathematics*, Vol. 13, 1-11.

K. Kawashima, M. Sakai, T. Tanaka. & Y. Matsuda, (2015). A practice of deep learning about mathematics using knot theory, *Proceedings of the 9th International Symposium on Advances in Technology Education*, 377-382.

M. Sakai & T. Miyaji (2013). Various Efforts to Improve Motivation to Learn Mathematics. *ATINER'S Conference Paper Series*, MAT2013-0572, 5-13.

M. Sakai, T. Miyaji & S. Nakabo (2013). A report of a mathematics open class for junior high school students at Kurume National College of Technology. *Proceedings of 7th International Symposium on Advances in Technology Education*, 241-244.

M. Sakai, T. Tanaka, (2023). A practice of deep learning by knot theory and DNA, *Proceedings of ISATE 2022, the 15th International Symposium on Advances in Technology Education*, 306-310.

M. Sakai & T. Tanaka (2014). Development of Teaching Materials Aimed for Relevance on Learning Mathematics by the Medium of Complex Numbers. *Proceedings of 8th International Symposium on Advances in Technology Education*, C1, 5pages.