



Planning and Practice of A RIKADOKU (Science Reading) Program "Until Milk Arrives Home" Based on the 5E-Model

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Abstract

Early childhood education in Japan does not have a subject-based framework. Instead, five areas: "health," "human relationships," "environment," "language," and "expression" are set as the contents of the curriculum. A RIKADOKU (science reading) program to cross "environment," "health," and "language" using the trade books was developed in addition to the normal Food and Nutrition Education conducted in the "health" area. We adopted Bybee's 5E Instructional Model (5E-model), which BSCS Science Learning that leads life science education in the United States, has shown as an effective teaching model; as a theoretical framework. In this study, the third educational program in our RIKADOKU series, which adds "human relationships" such as food culture and distribution related to career education to the perspective of crossing "environment," "health" and "language" was developed. Two points: 1) using trade books and 2) response to milk allergies; were emphasized in development of the program to make it widely practical. The results of the practices are reported. The practices were conducted in a nursery school in urban area and a kindergarten in rural area. Results show that the children became interested in where their food came from, as well as the increase in awareness to the facilities and people involved in manufacturing and distribution on the way milk arrived at their home. In addition, the results such as the teachers planned an extra activity to visit a nearby supermarket with children suggested that the program influenced on the teachers' view of career education. Many Performance expectations were achieved in both rural and urban children, but some differed. Additionally, after the survey was conducted, the teachers and parents produced extra activities. It suggested that the program affected not only children, but also teachers and parents.

Keywords: 5E-model, Food and Nutrition Education, Career Education, Early Childhood Education in Japan.

1. Introduction

Early childhood education in Japan does not have a subject-based framework. Instead, five areas: "health", "human relationships," "environment," "language," and "expression" are set as the contents of the curriculum.

Food and nutrition education is conducted in the "health" area in early childhood education in Japan [1]. However, issues as follows has been pointed out: undeveloped fundamental points such as setting goals, insufficient training for teachers [2], and inconsistency between preschool and school education [3]. Additionally, career education also has the similar problems: inconsistency between preschool and school education, the difficulty for teachers to introduce many jobs with a sense of reality [4].

As a way to solve the above problems, we have been developing *RIKADOKU* (science reading) program that can be used in early childhood education in Japan. The effectiveness of science education programs that introduced reading in early childhood education has already been reported in English-speaking countries [e.g., 5]. However, it is not possible to use the subject-based educational program in English-speaking countries in early childhood education in Japan as it is. Therefore, it is necessary to develop a program unique to Japan that takes into consideration the contents of the five areas.

2. Examination of the theoretical frameworks

In science education, the process of conceptualizing and accumulating the experience gained from inquiry activities has been examined. The learning cycle of "exploration-invention-discovery" proposed by R. Karplus is one of them [6]. R.W. Bybee expanded Karplus's learning cycle and proposed 5E instructional model (5E-model) from the BSCS Science Learning (BSCS). This model is used for curriculum and lesson design based on the Next Generation Science Standards (NGSS) in US [6], [7]. Picture-Perfect series, the guidebooks including many science / STEM lesson plans using trade books for K-12; also adopt Bybee's 5E-model [5].



RIKADOKU, which has been advocated in Japan since 2010, is a general term for activities that emphasize going back and forth between scientific reading and actual experience of RIKA (Japanese school science) [8].

According to these backgrounds, it is considered the 5E-model is a suitable framework for the development of the *RIKADOKU* program for young children that crosses "health," "environment," and "language." Then, in order to develop a food and nutrition education program, performance expectations of children for "milk, food and nutrition education" was developed based on the 5E-model (Table 1) [9].

Table 1. The performance expectations of children for "milk, food and nutrition education" based on the 5E-model

| 5E-model | The performance expectations of children |
|------------------|--|
| 1 Engagement | 1-1) Be able to recall experiences of themselves or their sister(s)/ brother(s) growing up drinking milk (from mother, other mammal, and/or artificial-made), having eaten milk and dairy products, and try to express them verbally and/or physically. 1-2) Be able to express verbally and/or physically what they noticed and thought while listening to read aloud and engaging in hands-on activities. |
| 2 Exploration | 2-1) Be able to aware many jobs on the route of milk and dairy products arriving home, and express that in verbally and/or physically. |
| 3 Explanation | 3-1) Be able to know about many jobs exist until milk arrives home, and express that in verbally and/or physically. 3-2) Be able to understand that milk can be transformed into various forms such as cheese and butter, and express it in verbally and/or physically. |
| 4 Elaboration | 4-1) Be able to realize that there are many food cultures related to milk all over the world, and milk of various mammals not only cows is also processed and eaten, and express that in verbally and/or physically. 4-2) Be able to verbally and/or physically express what they noticed and thought while listening to read aloud. |
| 5 Evaluation | 5-1) Be able to realize that there are many jobs related each other until milk and dairy products arrive home. Then, be able to say "ITADAKIMASU (I'll humbly take this food)" / "GOCHISOUSAMA (thank you for the great meal)" at the beginning and the end of meals with gratitude. 5-2) Be able to eat willingly, realizing that foods contains the necessary nutrients to grow and stay healthy. |

3. Development of a *RIKADOKU* program based on the 5E-model

Based on the 5E-model, two *RIKADOKU* programs: "What is milk?" and "Milk is full of nutrition" had been developed in advance for early childhood education in Japan [10]. In this study, "Until milk arrives home" was developed as the third educational program in our *RIKADOKU* series, which adds "human relationships" such as food culture and distribution related to career education to the perspective of crossing "environment," "health" and "language" (Table 2). There were three important points in the development shown as follows:

- Point 1: Ensuring expertise and cross-cutting in science, food and nutrition education, career education and books
The educational program was planned through multiple online meetings by the interdisciplinary members with specialities such as science education, life science education, school library, and teacher training (primary education). Those members collaborated to formulate one program, instead of dividing the work into parts.
- Point 2: Ensuring the versatility of the educational program
 - 1) Using trade books
The trade books have advantages. For example, they are easily available, and "appealing and memorable [5]" for children. Doi et.al. argued that Japanese trade books also could be adopted to each stage of the 5E-model as well [11].
 - 2) Response to milk allergies
It may not be an appropriate to simply emphasize the nutritional benefits of milk, or to include hands-on activities using milk for the classes with children having milk allergies. Therefore, the



following two points were noted: a) to include hands-on activities that follow the process of milk being processed into the products such as cheese or butter, and b) to promote children's awareness that there is a culture that uses milk of various mammals, not only cows.

Table 2. The program of "Until milk arrives home"

| 5E-model | activities | performance expectations |
|--|--|--------------------------|
| Engage | Read Aloud : "Bokujou ni Kitene(Come to the ranch)" [12] | 1-1) |
| | Q: What happens to milk after it has been collected by agricultural cooperative staff? | 1-2) |
| Exploration | Q: What route does milk take to reach you? | 2-1) |
| | Let's follow the story of "Journey of Milk"! | |
| | Activity 1: Trace back the "Journey of Milk" Map | |
| | 6 Home | 2-1) |
| | 5 Supermarket | |
| | 4 Distribution center | |
| | 3 Milk factory | |
| | 2 Inspection site | |
| 1 Ranch | | |
| Explanation | Let's look back on the milk journey. What kind of workers were there during the journey? | 3-1) |
| | Activity 2: Put "Workers" stickers on the "Journey of Milk" map | |
| | 1 People milking on the ranch | 3-1) |
| | 2 People inspecting milk | |
| | 3 People who make packed milk at the factory | |
| | 4 People delivering milk cartons to supermarkets | |
| | 5 People selling milk at supermarkets | |
| | 6 People buying milk at supermarkets | |
| | Milk may change its form and come our home. Q: Can you tell me the examples? | 3-2) |
| | Let's follow another journey of milk! | |
| | Activity 3: Expand the "Journey of Milk" map, and put additional "Workers" stickers. | |
| | 1 People milking on the ranch(Common) | 3-1), 3-2) |
| | 2 People inspecting milk (Common) | |
| | 3 People delivering milk to dairy factories | |
| | 4 People who make dairy products at the factory | |
| 5 People delivering dairy products to distribution centers | | |
| 6 People who deliver dairy products from distribution centers to supermarkets | | |
| 7 People selling milk at supermarkets (Common) | | |
| 8 People buying milk in supermarkets (Common) | | |
| Milk is full of nutrition. It arrives at us in various forms such as butter, powdered milk, and cheese. | 3-2) | |
| Elaboration | Read Aloud: "Toya no Hikkoshi (Moving Toya)" [13] | 4-1) |
| | In Mongolia, milk from mammals other than cows was also used in various forms. | 4-1), 4-2) |
| Evaluation | The main character, Toya, was getting camel milk directly, but in case of milk and butter that arrives our home, there were various people involved in various jobs. | 5-1) |
| | Book talk | 5-1), 5-2) |
| | People worked during the milk journey were careful about safety and cleanliness until milk arrive our home. | 5-1), 5-2) |
| | Other foods also travel or change their figures until they arrive our home. | 5-1), 5-2) |



4. Practices and results

The practices were conducted in A) a nursery school in urban area (face-to-face), and B) a kindergarten in rural area (on-line and face-to-face hybrid). The results were collected through the video records and the interviews (oral and email) to the lecturers of this program and teachers in the nursery school or the kindergarten. Then, they are analysed against the performance expectations of children shown in Table 1.

As infants' "expression" activities, not only verbal expressions but also physical expressions were regarded. Performance expectations 1-1), 1-2), 3-2), 4-2) were achieved by many children in both nursery school A and kindergarten B. Regarding 2-1) and 4-1), many children could achieve it in rural areas, but few in urban areas. The part of 5-1): "Be able to realize that there are many jobs related each other until milk and dairy products arrive home" was confirmed. For other parts, it is necessary to continuously check the effect of the program.

The lecturers mentioned that children seemed to think that they shouldn't make a mistake, or do not want to make a mistake in Activity 2. However, they seemed to start thinking themselves when they proceeded to Activity 3. Furthermore, teachers felt that children became to have each thought about milk or ranch after the program.

In addition to these results, the change in the consciousness of teachers was shown. For example, extra activities such as "going shopping" at a nearby store to follow the "Journey of Milk", cooperating with nearby ranch to implement an advanced program for children to experience butter making were planned. Moreover, many teachers felt that the program was not only to learn about "milk", but also extends to career education and food and nutrition education.

Besides, at kindergarten B, where hybrid practice was held, the possibility of remote program also mentioned. On the other hand, Wi-Fi environment remained as an issue.

5. Conclusion

Results show that the children became interested in where their food came from, as well as the increase in awareness to the facilities and people involved in manufacturing and distribution that exists before the milk arrived at their home. Practices were carried out in both rural and urban areas, and activity records and interviews with lecturers and teachers revealed that both practices were successful. Many performance expectations were achieved in both rural and urban children, but some differed.

In addition, the results such as the teachers planned an extra activity to visit a nearby supermarket with children suggested that the program influenced on the teachers' view of career education. It suggested that the program affected not only children, but also teachers and parents. In that sense, it was suggested that this program may have been in line with the planning goals.

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