

The workshop on 'Kagaku' as one of Japanese early childhood science education: Introducing 'Sound Play' to Enhance Children's Thinking Abilities

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1. Introduction

There is no formal scientific education curriculum for children aged one to eight in Japan. Instead, many Japanese kindergartens provide young children with hands-on experiences in nature, such as cultivating vegetables like tomatoes and sweet potatoes or raising insects like sow bugs and beetles. However, most of these experiences are not designed for early childhood scientific education but rather for teaching children discipline and promoting social-emotional development. Larimore indicates that integrating science into early childhood education aligns with developmentally appropriate practices and prepares children for future science learning (Larimore, R., 2020). Sutama, I.W. and Mumtahanah, I.A. pointed out that science learning in early childhood education aims to provide hands-on experiences for children to explore the environment and develop scientific concepts, processes, attitudes, and problem-solving skills (Sutama, I.W. and Mumtahanah, I.A., 2017). Martins, I. P., & Veiga, L. proposed a didactic strategy for teaching scientific concepts like dissolution and floating in water using everyday life contexts familiar to children, such as observing the behavior of fruits and vegetables in water (Martins, I. P., & Veiga, L., 2001). Early childhood science education should align with developmentally appropriate practices, offering hands-on experiences that encourage children to explore their environment as noted by Larimore and Mumtahanah. Additionally, we should develop teaching materials and programs rooted in everyday life contexts familiar to young children, as suggested by Martins and Veiga. However, we currently lack sufficient early childhood science education programs in Japan.

The purpose of this workshop is (1) to provide an overview of our early childhood science education program 'Kagaku' and (2) to introduce the program, 'Sound Play' as a concrete example to participants, having them attend childcare for 5-year-old children.

2. The overview of our scientific program 'Kagaku' designed for young children

The 'Kagaku' is the early childhood science education program developed by Kotani et al. This program is designed for children aged 0 to 8 years old. The Japanese word 'Kagaku' translates to 'science' in English. We believe that 'Kagaku' differs from both 'school science' as a subject and 'science shows'. The big differences are as follows: (1) Teachers do not teach scientific knowledge, and (2) young children acquire physical knowledge and logical-mathematical knowledge by themselves through exploration in environments prepared by teachers. Preschool teachers guide their children until they begin to interact with substances or phenomena. In this sense, 'Kagaku' is not considered 'free play' but rather a form of 'guided play'. The aim of 'Kagaku' is (1) to develop science process skills such as observation, classification, communication, and more, through exploratory manipulation and (2) to enhance young children's ability to think independently through scientific experiences in the fields of physics, chemistry, and mathematics. Many preschool teachers have encouraged children 'thinking ability through drawing pictures, exercises, and pretend play. In 'Kagaku', we enhance young children 'thinking ability by using 'substances' and 'phenomena' familiar to children's everyday life. We believe that, first and foremost, independent thinking, utilizing 'substances' and 'phenomena', is more important than simply being taught by teachers or parents.

We intentionally select 'substances' and 'phenomena' as themes of 'Kagaku' covered in primary and secondary school science textbooks. We believe that this approach allows young children to establish a more straightforward connection between their hands-on experiences in early childhood and the scientific theories taught in primary or secondary school in the future. Kotani et al have developed more than 30 activities for young children aged 0 to 5 and more than 21 for lower elementary students. (e.g., Kotani, T and Tuji, H,2019).

3.The overview of constructing the early childhood science education program, 'Kagaku' and the flow of its activity

We explain the process of creating a 'Kagaku' program in four distinct steps. First, we select one of the 'substances' or 'phenomena' that children find interesting as the theme for our scientific activity, 'Kagaku.' For example, themes may include 'sink and float, 'freefall', 'elastic force of string', or 'magnet'. Second, we determine the fundamental scientific concepts that preschool teachers aim to introduce to children. For instance, these concepts might include 'Some substances float while others sink' or 'Some substances dissolve in water while others do not'. Thirdly, we prepare teaching materials that enable children to discover fundamental scientific concepts on their own. We follow three important tips for the preparation: (1) We intentionally prepare teaching materials with different characteristics. For instance, in 'Dissolution Play,' we provide substances that both dissolve and do not dissolve in water. (2) We carefully consider the timing and the quantity of teaching materials we provide. (3) We provide teaching materials for each child. This allows children to explore freely until they are satisfied and to develop their own ideas. Fourthly, we enhance the teaching materials and ensure their safety by conducting preliminary experiments before the children use them.

4. Introduction to 'Sound Play' as an Example of 'Kagaku' and Explanation of Its Process

In this 'Kagaku' program, we have determined that 'Some substances emit loud (high) sounds while others do small (low) sounds' as the fundamental scientific concept. We provide transparent containers and substances for children to place inside them as teaching materials, allowing them to notice this fundamental scientific concept through exploration. The 'Kagaku' program consists of four parts. In the first step, preschool teachers demonstrate substances or phenomena to the children. In 'Sound Play', for instance, they place beads into a container and shake them up and down. They also place another substance, like a paper ball. Most children observe that some beads produce loud sounds, while paper balls do not. In the second step, preschool teachers introduce another substance to the children and pose a question that encourages them to think, such as, 'If you place only one substance into a container, what sound does it make?'. In the third step, preschool teachers provide each child with teaching materials and encourage them to explore independently. In the fourth step, preschool teachers gather the children in a different location from where they explored and allow them to share their findings by demonstrating their exploration once again in front of their friends. Most children are interested in their friends' findings and want to try the same exploration. In the fifth step, preschool teachers allow each child to explore their own interests using their own teaching materials. In the fifth step, preschool teachers encourage each child to explore their own interests using the provided teaching materials. Sharing their friends' findings and ideas has a positive effect on enhancing their interest and curiosity. These four processes are basic cycles, but in the case of children aged 0 to 2, the 'Kagaku' program consists of only the first and second steps.

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[Reference] The references for this article can be found at the following URL: <https://forms.gle/v4gRU74FRJXRqPB2A>.

