

Current Status and Issues of Programming Education in Japan from Preschool (Kindergarten) to Primary School

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1. Introduction

In Japan, the Courses of Study for Elementary Schools were revised in 2019, and elementary school programming education became compulsory in the school year of 2020. The aim of elementary school programming education is to develop "programming thinking skills," i.e. the ability to think logically. The "Explanation of Kindergarten Courses of Education" (MEXT,2018) was published, clearly stating that "direct experience is important" when utilizing computers and other information devices. However, specific programming activities for childcare practices based on direct experience are not indicated. Since kindergarten teachers do not specialize in programming education, clear models are needed to create curricula. Therefore, the purpose of this study is to examine previous research on curriculum and the practice of programming education from preschool (kindergarten) to elementary school stage, and to find a curriculum and practice that can be used as a reference.

2. Prior research on programming education at the preschool (kindergarten) stage

Since the Guidelines for Kindergarten Education are general standards, they do not provide specific details regarding childcare practices based on direct experience. As a systematically constructed curriculum that includes the preschool stage, Isobe and Ueno et al. (2016) published "Basic Research on the State of Programming Education in the Preschool (Kindergarten) Stage and Primary Education Stage". This curriculum provides specific activities and teaching materials, which are useful for kindergarten teachers when selecting programming materials. However, Noguchi (2019) in "Childcare Practices for Developing a Foundation for Programmatic Thinking," states, "It is not easy to foster programming thinking in childcare." He states.

3. Prior research on programming education at Special Needs Education

The Courses of Study for Special Needs Schools (2017) states that "learning activities for children to experience programming and acquire the logical thinking skills necessary to make the computer perform the intended processing" should be implemented systematically according to the characteristics of each subject. Therefore, from FY 2020, programming education should also be implemented in both special-needs schools and regular schools from FY 2020. According to practical research, especially in special needs schools for learners with cognitive impairment and developmental disabilities, the curriculum of "combined subject and domain instruction" is considered highly compatible with the incorporation of programming activities as a means to achieve this goal (Mizuchi, 2019). There are also reports that programming education using flowcharts and

programming toys has contributed to the development of learners with cognitive impairment and developmental disabilities, such as autism.

4. Programming and English - Reinforcing English through Digital Literacy

In EFL (English as a Foreign Language) classrooms, Content Language Integrated Learning (CLIL) is a very popular teaching methodology used in primary and secondary schools in Japan where the content of the lesson is explored in the learners' foreign language (Coyle, Hood & Marsh, 2010). During the worldwide pandemic, Global Language Institute piloted online Scratch classes in four public schools in Tokyo. Programming and English classes were held in six 4th grade classes, three 5th grade classes and four 7th grade classes. The experienced EFL instructor was Australian, and he was also studying programming courses online. With the Japanese homeroom teacher and online bilingual GLI staff supporting learners and monitoring the physical classroom, the EFL instructor directed the English and programming activities online. These series of lessons created a unique and effective team-teaching experience where learners were immersed in their programming tasks in English. Qualitative feedback from the teachers and students reflected the important overlap of CLIL's 4Cs (content, communication, cognition and culture) and the 4Cs in the 21st century learning framework's 4 competencies, i.e. creativity, collaboration, communication and critical thinking.

5. Conclusion

By reviewing the current status of programming education in Japan and examining previous studies on curriculum systems from the preschool stage and practices in special support education for the developmentally disabled, we have confirmed that efforts to foster programming thinking (logical thinking) rather than mastery of programming languages and programming are producing results. It was also suggested that the use of programming software such as Scratch, when implemented in immersion classes or English classes, has the advantage of allowing younger children to learn the language used in programming naturally and effortlessly (as is). Japan needs to design a STEAM education curriculum that incorporates programming education from the preschool (kindergarten) stage in order to realize Society 5.0.

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