Department of Management and Information Sciences

Key words Programming education, Scratch, Actual robot control, Embedded system, GUI, CUI, Continuous learning, Obtaining particular solutions of P/T Petr nets, Automatic program generation

Doctor of Engineering / Professor

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Education

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Technical support staff at IBM of Japan Corporation; Research Associate, Associate Professor, and Professor at Fukui University of Technology

Consultations, Lectures, and Collaborative Research Themes

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Main research themes and their characteristics

「Development of teaching materials and verification method for the continuous learning from GUI-based to CUI-based in programming education」

With the remarkable progress of today's information society, ICT (Information and Communication Technology) has been essential to our life. However, according to the annual economic and fiscal report issued from the Cabinet Office of Japan in July 2013, there is a chronic workforce shortage of ICT engineers[Cabinet Office Government of Japan "2013 Annual Economic and Fiscal Report" (June 2014 revised)]. Therefore, cultivating ICT engineers has become an urgent task for our country. In the new educational guidelines of Japan, the ICT curriculum in elementary, middle, and high school has been extended["The new educational guideline of Japan", April 2017]. For this reason, the development of effective teaching materials for learning programming is being researched. Additionally, we have researched the effects of robot control through GUI-based programming (Scratch) as an introductory education to programming[1-3](Refer to Fig.1 and Tab.1-3). Much research involving the introductory education of programming uses a GUI-based environment. On the other hand, continuous programming learning, which is the next stage of introductory education, is also required [Ministry of Internal Affairs and Communications, "Research report on the way of programming human resource development", Jun. 2019]. For such continuous learning, a learning method that can smoothly transition from GUI-based to CUI-based is needed.

In this research, the aim was to focus on the development of methods used for transition education from GUI-based programming to CUI-based programing. Specifically, would it be possible to learn algorithms, which are an important aspect of learning programing, effectively through the easier to understand visualization of a GUI-based programming environment. Additionally, another aim was to establish a general-purpose questionnaire method that could be used for evaluating the effect of the course contents. A questionnaire was devised that avoids asking provocative questions and that could be analyzed based on a psychological scale.

In future studies, the effect of the timing of pre GUI-based learning (for example every half-year, every other week, the first half or second half of class, etc.) on the comprehension level of students will be researched.

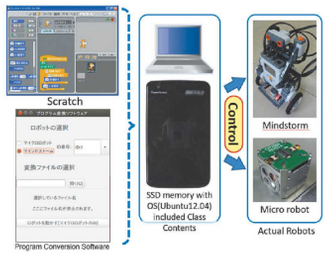

Fig.1 Developed materials

Tab.1 Contents and results of the questionnarie before and after classes[1]

The questionnarie before class	Results			
Before 0) What classes do you like?	1 Japanese 12(21%)	2 Mathmatics 22(39%)	3 Science 19(34%)	4 Society 14(25%)
	5 English 7(13%)	6 P.E. 30(54%)	Technology and Home Economics 11(20%)	8 Art 16(29%)
Before A) I like computer operation.	4:13(23%)	3:33(59%)	2:10(18%)	1: 0(0%)
Before I) I understood information classes at high school.	4: 7(13%)	3:39(70%)	2: 9(16%)	1: 1(2%)
The questionnarie after class	Results			
After A) I understood today's lecture.	4:25(45%)	3:30(64%)	2: 1(2%)	1: 0(0%)
After I) I had fun today's class.	4:45(80%)	3:11(20%)	2: 0(0%)	1: 0(0%)

Tab.2 Distribution of evalution value differences before and afdter classes [1]

Questionnarie (before and after classes are same)	Distribution of evaluation value differences before and after classes						
	3	2	1	0	-1	-2	-3
Before/After B) I acknowledge the importance of absorbing knowledge about computers	0	0	6	45	5	0	0
Before/After C) I have the desire to pursue an ICT related vocation.	0	2	10	40	4	0	0
Before/After D) I am interested in application software.	0	1	13	40	2	0	0
Before/After E) I am interested in computer hardware.	0	1	13	42	0	0	0
Before/After F) I prefer practical work to lecture in classes information sciences.	1	0	11	41	3	0	0
Before/After G) I acknow ledge the importance of computer know ledge in daily life.	0	0	4	48	3	1	0
Before/After H) I regard computer know ledge to be useful for the future.	0	0	5	48	3	0	0

Tab.3 standard deviation, average of evaluation value differences and significant difference of before and after classes[1]

Questionnarie	B	C	D	E	F	G	H
Average of evaluation value differences before and after classes	0.018	0.179	0.232	0.268	0.196	-0.018	0.036
Standard Deviation	0.443	0.601	0.534	0.481	0.610	0.443	0.376
Significant difference for average of before and after classes (t-value)	0.299	*2.204	**3.223	**4.126	*2.388	-0.299	0.704

*: $P < 0.05$, **: $P < 0.01$

Major academic publications

[1] Masahiro Osogami, Kazumasa Ohkuma, and Christopher Pirotto, "The impact of teaching a graphical programming language before character-based programming on Japanese university students ' programming understanding", SN Social Sciences, Springer, Vol.4, No.17, (2024)

[2] Masahiro Osogami and Kazumasa Ohkuma, "Effects of GUI-based Programming Learning before CUI-based Programming Learning: Toward Continuous Learning in Computer Programming", Proc. of The 18th International Conference on Information Technology Based Higher Education & Training (ITHET 2019), in Magdeburg, Germany, September 26-27, 2019, ID-114, 978-1-7281-2464-3, 2019 IEEE, 2019.12, 2019.

[3] Masahiro Osogami, Kazumasa Ohkuma and Kazutomi Sugihara, "The Practice of Programming Education by Controlling Actual Robots Using Scratch", Journal of Information Processing Society of Japan, Transactions on Computers and Education, Vol.2, No.2, pp.76-84, Oct. 2016.