AN APPROACH OF PROGRAMMING EDUCATION TARGETING HYBRID MOBILE APPLICATION DEVELEOPMENT

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Synopsis:

  Online learning has been introduced widely in university education due to COVID-19. It is very difficult to decide when we switch online to face-to-face lessons under the emergency state period. Especially in computer practices, the developing environment may differ between university facilities and personal devices, which makes the operation of online learning more difficult. This paper shows an example of managing a hybrid lesson into plural universities using an environment-independent cloud service.

An Approach of Programming Education
Targeting Hybrid Mobile Application Development

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Abstract

As the changes in the social situation due to the recent spread of COVID-19 infection, online learning has been introduced widely in university education, and it is necessary to devise daily measures. It is very difficult to decide when we switch to online lessons and when we return to face-to-face lessons in case that the period of refraining from attending school due to the emergency state declaration cannot be foreseen. Especially in computer practice classes, the developing environment may differ between university equipment and personally owned devices, which makes the operation of online learning more difficult.

This paper describes an example of managing a hybrid lesson using a cloud service that does not depend on the developing environment. By introducing this method to plural universities, we were able to achieve equal educational quality that does not depend on face-to-face or online.

Keywords: Programming Education, Cloud based Integrated Development Environment, JavaScript, HTML/CSS, Hybrid Mobile Application Development

1. Introduction

Due to the recent changes in social conditions caused by the spread of COVID-19, online classes have been introduced in university education. With no foreseeable time frame for refraining from attending school following the declaration of a state of emergency, it is extremely difficult to determine when to switch to online learning and when to return to face-to-face learning. In particular, the operating environment of computer-related classes often differs between university equipment and personally owned devices, which makes the operation of online classes more difficult.

In this paper, we describe a case study of a hybrid class using a cloud service that does not depend on the operating environment. By introducing this method into two

universities, we aim to realize the provision of educational quality independent of online and face-to-face learning.

2. Hybrid Class Using Cloud Services

To plan a hybrid practical class, we first surveyed the students' learning environment. Table 1 shows the results of a survey on the ownership of devices for online learning among the students who took the class in the fall semester of FY2020. The survey was conducted in the first-year students of the class in 2020, but it was not expected that the class would be conducted through online at the time of admission, and the university did not require students to purchase personally owned computers.

On the other hand, although it depended on the financial situation of each family, it could be inferred that half a year had passed since the start of the course, and the procurement of necessary equipment for the course had reached a certain level of standards. For lecture courses without PC practices, mobile phones and other devices can be used only to view the lectures, but for practical courses, students must operate their own PCs, therefore PC devices with a practical environment is essential. To estimate the percentage of students who owned a PC in the second year of the COVID-19 disaster, we asked the following questions to the students and conducted a survey [1].

Question 1: Which of the following equipment do you use most frequently to take distance learning classes?
(1) My own PC (desktop or laptop)
(2) PC shared with family
(3) My own mobile phone/tablet
(4) Other, not decided.

Table 1: Responses to Question 1

Question 1	#Students	(1)	(2)	(3)	(4)	N/A	Total
Lecture courses	92	**65**	**13**	9	1	4	92
Practical courses	42	**31**	**4**	1	0	6	42

From the results in Table 1, we can conclude that the PC ownership rate of students taking practical courses is high ($(31 + 4)/(42 - 6) \approx 97\%$), and the practical environment at home is better than that of lecture courses ($(65 + 13)/(92 - 4) \approx 89\%$). From this fact, we judged that hybrid classes [2] that utilize both university equipment and personally owned devices are possible and decided on the practical environment to

be introduced. The term "hybrid" here mainly means a mixed implementation of online and face-to-face classes, but also includes the following factors:

(1) Parallel use of university equipment and personal devices by using cloud services
(2) Simultaneous progress of the same educational content for multiple educational institutions and common development platforms
(3) Capability to develop applications for both Android and iOS

Based on the above factors, we aimed to construct and implement a learning platform that can respond appropriately and efficiently to the recent social situation and various constraints and tried to apply it to the educational field in charge.

3. Practical Example

In this study, we introduced Monaca Education [3], an educational version of Monaca, which is an application development platform that utilizes cloud technology. This service uses JavaScript and HTML/CSS as its development language, and since it is not a system-dependent language, it is relatively easy to implement. In addition, it targets mobile phones, so it is possible to verify operation not only by connecting to actual devices but also by emulation. The target OS can be developed as a hybrid of Android and iOS, and both operation verification using the Monaca debugger, which is a dedicated application for each OS, and operation directly installed on the device after building are possible. Furthermore, since the processing system is in the cloud, development and verification can be done anywhere and, on any device, if a browser is available (Figure 1).
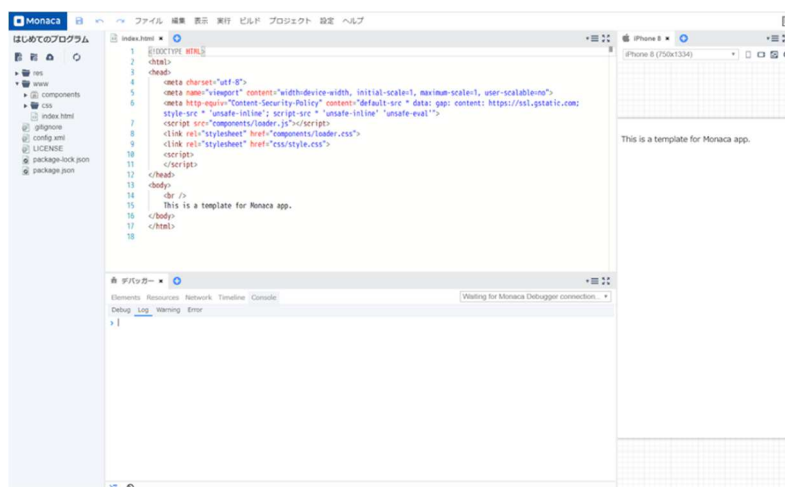

Figure 1: Example development screenshot of Monaca Education

A debugger that works on mobile devices is also provided as a standard feature. Of course, emulation can be done on the PC development screen, but running the program on the actual mobile device allows you to verify the operation, including adjustment of the screen size and character size. Figure 2 shows a sample screenshot of "Monaca Debugger for Study," a debugger application on a mobile phone.
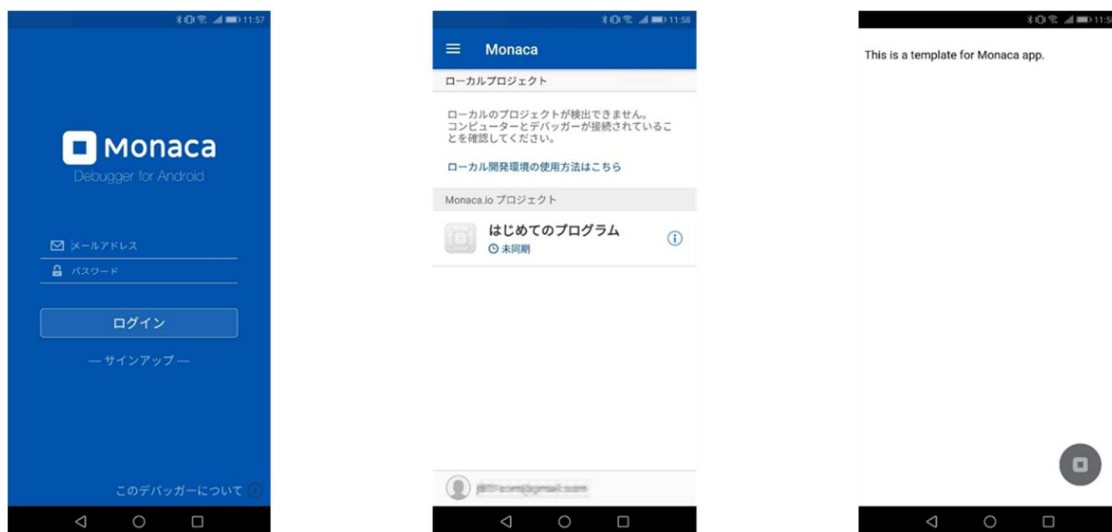

Figure 2: Example screenshot of Monaca Debugger for Study

In this study, we introduced Monaca Education to 15 lessons-long classes in the spring semester of FY2021 at two universities (University A and B). Figure 2 shows the lesson schedule of both universities. In University A, it is a selective course for third-year students in the Faculty of Business Administration, and in University B, it is a selective course for second-year students in the Faculty of Social Sciences, which can also be taken in other faculties. University A has 7 face-to-face and 8 online lessons, on the other hand, University B has only 1 face-to-face and the remaining 14 online lessons.

Lesson No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	#F	#O
University A																7	8
University B																1	14

Legend: ☐ Face-to-Face Lesson (#F) ▦ Online Lesson (#O)

Figure 2: Lesson Schedule of University A and B

A special book [4] was used as the teaching material. We decided to use the book because it comes with an activation code as a license for using Monaca, and because it has a wide variety of practical learning materials, including sample programs on the website [3].

4. Results and Effects

In this chapter, we show the practical results and effects by introducing our method. A questionnaire survey was conducted at the end of the lecture. Questions 2 and 3 are shown below, and the answer results are shown in Tables 2 and 3.

Question 2: How do you think you have gained knowledge, skills, and abilities by taking this lecture?
(1) Very much so
(2) Somewhat agree
(3) Cannot say either way
(4) Not really
(5) Not at all

Table 2: Responses to Question 2

Question 2	#Students	(1)	(2)	(3)	(4)	(5)	N/A	Total
University A	5	**0**	**4**	0	0	0	1	5
University B	36	**10**	**18**	1	1	0	6	36

Question 3: Which of the following skills do you think you have acquired by taking this lecture? (Multiple responses allowed)
(1) JavaScript
(2) HTML/CSS
(3) Monaca
(4) Mobile application development
(5) Game application development
(6) PC operation in general

Table 3: Responses to Question 3

Question 3	#Students	(1)	(2)	(3)	(4)	(5)	(6)	Total
University A	5	4	3	3	0	0	2	12
University B	36	23	22	15	2	2	4	68

Table 2 shows that 100% of the students of University A and 93% of the students of University B responded positively to answers (1) and (2), indicating a high level of satisfaction. In Table 3, there is a slight difference in the responses between the two universities, but it depends on the fact that the subject name of University A was "Applied Information Processing" while the subject name of University B was "Game Programming." In particular, the fact that answers (4) and (5) were selected at University B suggests that the purpose for which the course was designed was sufficiently fulfilled.

5. Conclusions

This paper describes a practical example of a practical training class for hybrid mobile application development under the current social situation and the effects of its introduction. The feedback from the students was generally favorable, and we can conclude that the ingenuity of the implementation was effective.

It is expected that new forms of class management, including online classes, will become regular in the future as each university reacts from the 2020 academic year, but it is important to form the "new normal" at each point in time through constant review.

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