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Computational Fluency and the Digital Divide in Japanese Higher Education

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Abstract: The COVID-19 pandemic has revealed a widening digital divide within the Japanese educational system. Most research on the digital divide focuses on K-12 education, whereas our research explores the situation more specifically in a Japanese higher education context. In higher education, we have identified a knowledge gap which can affect the career path of these students. We conducted a survey in 6 universities in the Kansai and Chugoku areas in Japan to map out the digital divide with different types of universities. This poster is intended to encourage stakeholder discussion in Japan to create a new curriculum for all higher education students and encourage all educators to pursue lifelong learning to improve their ICT and computational literacy skills.

Keywords: ICT, computational fluency, digital divide, Japanese education, higher education

1. Introduction

Japan's ambitions for the 21st century revolves around establishing what is termed as "Society 5.0," which aims at integrating advances in infrastructure, financial technology, healthcare, logistics and AI into the daily life of Japanese citizens (Minevich, 2019; Cabinet office, 2021) and improving the level of AI research before 2030 (Yamashita, 2019).

Japan faces a challenge when it comes to improving Information and Communication Technology (ICT) and computational fluency skills of its students and workers. Computational fluency was defined by Mitchel Resnick knowledge which is not limited to *computational concepts and problem-solving strategies, but also the ability to create and express oneself with digital technologies* (Resnick, 2018). Japan is currently ranking below the world average and often last in several international surveys such as the Programme for International Student Assessment (PISA,2020) 2018 (OECD, 2018) and Teaching and Learning International Survey (TALIS) (TALIS, 2020) in integration of ICT in education. This poster examines the computational fluency level of Japanese university students in order to identify their strengths and weaknesses in acquiring 21st century skills and attempts to answer the following questions:

- What is the ICT and computational literacy level of Japanese university students in the Kansai and Chugoku areas?
- Are there differences in the level of ICT and computational literacy between different private and national university students that were surveyed?

2. Method

A survey was distributed online to gather data about Japanese university students' computational fluency level. The survey was distributed from May 2020 to six higher education institutions.

Several questions of the survey were adapted from the International Computer and Information Literacy Study (ICILS) conducted by the International Association for the Evaluation of Educational Achievement (IEA). The ICILS is a measuring instrument aimed at 14 years old students, but some of the survey items are also applicable to adult students. The survey contains 55 questions pertaining to

socio-economic background, computational fluency, and information literacy. We conducted a Wilcoxon rank sum test with continuity correction to identify significance.

The survey received 481 responses from 6 national and private universities located in Hiroshima, Okayama, Hyogo, Osaka and Nara. The data is almost evenly split with 50.6% of the students at universities that are public and 49.4% being private

The *hensachi* scale is a numeric which is correlated with difficulty of admission into a university and is also a value used to rank universities (Makino, 2016; Toshin, 2021). National universities ranked between 50-60 and three out four private universities between 35 to 40 except for one private university in the Kansai area which ranked around 50, which is considered average. National universities in Japan are considered more prestigious than private universities, have lower tuition, and are more competitive to enter.

3. Results

Based upon the survey results, 36 out of 481 students reported not owning their own personal computer. 69% of the students who do not own a computer are studying in private universities The self-evaluation of ICT skills is illustrated in Table 1 reveals that students from public universities have higher comfort in using ICT than their counterpart in the private sector. Questions related to computer skills such as coding lessons prior to entering university reveals that 81% of students had never studied coding.

Table 1. *Students Comfort Level using ICT on A 5-Point Likert Scale*

	Public	Private
Strongly agree	20%	0%
Agree	40%	16.7%
Neutral	10%	50%
Disagree	20%	16.7%
Strongly disagree	10%	16.7%

The survey also collected basic socio-economic information about the students. The most relevant data is the highest level of education attained by the family of the student which is 9% higher from parents of students attending public universities than parents who send their children to private universities.

4. Discussion

Digital divide is defined as a growing gap between groups within a society regarding access to computers and the internet. Matsuoka is directly correlated to the education level of the family of the student with the level of inequality within the traditional educational system (Chokuron, 2021). 50.8 % of students from public universities come from household where parents hold a higher degree education while 41.8% of private universities students family hold a higher degree education. These socio-economic factors seem to be at the root of the digital divide within higher education in Japan.

A better understanding of the academic level of the high school that students attended before entering university and the data on cramming school attendance would have helped in highlighting the socio-economic factor underlying their ICT competence. Students from public universities or higher "hensachi" institutions considered themselves more comfortable in using ICT. None of the students from private universities felt very confident with the statement: "I am comfortable using ICT" while 20% of their counterpart in the public universities felt very confident. The current data does not allow us to clearly explain why students feel more confident in using ICT. The Wilcoxon rank sum test with continuity correction on confidence does not show significance with a p-value = 0.6618.

Task based measurement of computational fluency are needed to measure more accurately the level of students from private and public universities. The self-reporting of ICT confidence level would benefit from task-based assessment.

5. Conclusion

We have observed a digital knowledge gap between the private and public institutions surveyed in the Kansai and Chugoku area which indicates the presence of a digital divide in higher education. This digital divide is added to the advantages that students from higher level universities already have over students from lower-level universities. Japan can reverse this trend and position itself in line with the SDG Goal number 4 by improving digital literacy and access to educational technology to all its students at all levels.

The public k-12 educational system and higher education institutions have the responsibility to include computational fluency within their curriculum. Failure to do so, would favor the students who can afford private lessons known as cramming school in Japan.

This disparity in skills can affect students' chances in finding work after graduation can be addressed by improving the ICT skills of all Japanese students. By adopting new educational policies aimed at improving computational fluency within the public educational sector, the Japanese government can reduce the digital divide within higher education. The COVID-19 pandemic has prompted the Japanese government to accelerate the digitalization of all institutions and this effort will ne to be supported with training in computational fluence at scale.

6. Future work

We also intend to further study the digital divide and socio-economic background of university students by conducting more in-depth surveys and present the results in the poster presentation.

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