New Proposal of University Reform by Significant Other Groups in Eduinformatics

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Abstract

Kobe Tokiwa University was established in 2008 in Japan, and underwent its first reform in 2015. This reform led to a new curricula of competency-based education from 2017 onward. The second university reform for new curricula is expected to begin in 2022. For this purpose, we assessed the old 2017 curricula. The result shows that Tokiwa's competency must be rebuilt. To this end, we propose the new inter-disciplinary field of Eduinformatics. The proposed 2022 curricula should consider two axes: "university reform" and "eduinformatics." Further, a new group—named Significant Other Groups (SOGs)—should implement university reform using informatics. SOGs would include participants who want to develop higher education, reflecting their important role. The assessment of university reform should also prioritize eduinformatics.

Keywords: Eduinformatics, SOGs, university reform.

1 Introduction

1.1 University Reform in Japan

The period after the early 1990s saw many university reforms in Japan in order to improve the quality of higher education [1]. These reforms were implemented by both individual universities as well as the Ministry of Education, Culture, Sports, Science and Technology (MEXT) [1]. Such reforms can be traced to the Second World War [2], when the population increased in Japan and universities had to receive many students [2]. Contrariwise, the reforms from the early 1990s coincided with a population decline [3]. In 2012, especially, MEXT required stringent university reforms to be implemented across Japan [4].

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1.2 Kobe Tokiwa University

Kobe Tokiwa University is part of the Tamada Educational Institution [5]. Tamada was established in 1908 and Kobe Tokiwa College in 1967 [6]. By 2008, Kobe Tokiwa University was established, with some departments of Kobe Tokiwa College being transferred to Kobe Tokiwa University. Currently, Kobe Tokiwa University has two faculties and five departments: the faculties of Education and Health Science. The former includes the child education department, and the latter includes the nursing, medical technology, and radiology departments. At the same location, Kobe Tokiwa College operates two departments: oral health and a correspondence course of nursing. Kobe Tokiwa University has about 1,500 students, and is considered "small" in student size by MEXT [7].

At Kobe Tokiwa University, all departments help students obtain special national certification as medical technologists, nurses, public health nurses, school nurses, radiological technologists, nursery teachers, kindergarten teachers, elementary school teachers, and dental hygienists.

1.3 Kobe Tokiwa University before the First Reforms

We performed a SWOT and complex network analyses of faculty and staff in 2015, to determine the best starting point for university reform [8]. SWOT analysis evaluates the strengths, weaknesses, opportunities, and threats of a company; it is also a strategic planning process. SWOT analysis was developed as part of the Harvard Business Policy in the 1960s.

We visualize our SWOT results using complex network analysis. These networks helps us analyze features of large and complex networks. In 1998, Watts et al. revealed "small-world" networks [9]. Our findings suggest that, to make the university a better place, it is critical that all academic faculty and administrative staff are aware of the need for improvement [9].

Our prior results led to the creation of a task team for the first set of university reforms under president Kunihiro Ueda in December 2015. We belong to this team, which developed ideas for learning and teaching management reform through collaboration between academic faculty and administrative staff [10].

We now discuss the features of the first university reforms. This research was not conducted for university reform. Based on our results, we determine when the first university reforms in Kobe Tokiwa University began. The research includes both faculty and staff. These points are important to the definition of Significant Other Groups (SOGs).

1.4 First University Reforms at Kobe Tokiwa University

The first university reforms under president Kunihiro Ueda led to the creation of new curricula in 2017. First, we proposed properly defined educational goals for Kobe Tokiwa University. Since our university had no unified policies, we proposed integrating AP, CP, and DP using properly defined educational goals. This led us to conclude that in order to enhance learning and teaching management, more than three policies would be necessary.

Second, we proposed a new policy called the student support policy, whereas AP, CP, and DP only deal with regular curricula. We think it is important for students to be exposed not only to regular curricula, but also quasi-regular and extra curricula. Quasi-regular curricula are used

Table 1: Competencies from the Student Handbook of Kobe Tokiwa University from [12]

Abbreviated Name of Competency	Competency
1. Culture	Ability to use liberal arts as the foundation of human nature, which can involve a variety of people
2. Common Sense	Ability to behave sensibly and show sound judgment in practical matters
3. Professionalism/Expertise	Having the necessary knowledge and skills to perform the duties of each profession
4. Media Literacy	Ability to collect, organize, and analyze necessary information from various media sources for proper thinking and judgment
5. Logical Thinking	Ability to consider situations logically based on evidence.
6. Critical Thinking	Ability to have a multilateral, critical perspective that can grasp and consider various ideas
7. Intellectual Curiosity	Ability to be curious, to learn and remember things, and to have fun and take pleasure in learning
8. Exploration	Ability to think deeply about things and methods
9. Continuity	Ability to maintain a consistent stance on issues and act knowledgeably and thoughtfully
10. Self-Management	Ability to manage one's physical and mental health appropriately
11. Reflection	Ability to continually seek ways to improve oneself by reflecting on one's thinking and behavior
12. Design Thinking	Ability to design solutions and develop comprehensive knowledge
13. Presentation	Ability to appropriately communicate one's personal feelings and thoughts to others
14. Judgment	Ability to make appropriate decisions given the circumstances, based on valid information and sound thinking
15. Implementation	Ability to take specific actions based on one's feelings and thoughts and without fear of failure
16. Responsibility	Ability to behave and face things responsibly as a member of society
17. Contribution	Ability to feel happy for others and take actions that are useful for others
18. Communication	Ability to listen to others' opinions, without which it is impossible to have a creative dialogue
19. Cooperation & Collaboration	Ability to set aside personal and individual interests to work together harmoniously

in remedial education, whereas extra curricula comprise volunteer and club activities.

To continue the plan-do-check-act or plan-do-check-adjust cycle in order to verify the quality of learning and teaching at the university, we considered three policies, along with an assessment policy. Some reports released by the central council for education stress the importance of connecting an assessment policy with AP, CP, and DP [11].

To evaluate and connect the aforementioned policies (AP, CP, DP, assessment policy, and student support policy), we needed to create a common evaluation indicator. We developed a list of the 19 Tokiwa competencies that students acquire through regular, quasi-regular, and extra curricula (see Table 1) [12].

Global competency refers to the knowledge and skills people need to understand today's "flat world"; such knowledge and skills need to be integrated across disciplines, so that global events can be comprehended and addressed. Global competencies are also the attitudinal and ethical dispositions that make it possible for people from diverse geographies to interact peacefully, respectfully, and productively [13].

As such, competency-based education—an approach to teaching and learning used more in the learning of concrete skills than in abstract learning—has attracted increasing attention in

higher education circles. Competency-based education has been introduced in most Japanese universities, notes Huang, who has traced its history in Japan [14]. The term "competency" (and its derivatives such as "competence") has been defined accordingly [15]. In this study, we define a competency as a functionally linked complex of knowledge, skills, and attitudes that enable successful execution of tasks and problem-solving [16].

The Tokiwa competencies indicator evaluates 19 types of indicators: culture, common sense, professionalism/expertise, media literacy, logical thinking, critical thinking, intellectual curiosity, exploration, continuity, self-management, reflection, design thinking, presentation, judgment, implementation, responsibility, contribution, communication, as well as cooperation and collaboration (see Table I). However, it is difficult to acquire all Tokiwa competencies by only engaging in regular curricula; the competency of responsibility, for example, is more easily acquired through club activities.

Consequently, the university has established a relationship between the coursework design and the Tokiwa competencies—an initiative first implemented in the 2017 syllabi.

In 2017, teachers had to choose less from Tokiwa competencies and, rather, show the relationship between their lectures and selected competencies using their rubrics, for all first-year lectures; in 2018, for all first to second grade lectures; in 2019, for all first to third grade lectures; and in 2020, for all first to fourth grade lectures (that is, all lectures).

The new reforms in Kobe Tokiwa University led to new curricula in 2017. In 2020, this year, all syllabi from the first to fourth year were expected to show the relationship between all lectures and the Tokiwa competencies.

To begin the new curricula in 2020, the second set of Hamada University reforms will be implemented in Kobe Tokiwa University. Before constructing the new 2020 curricula, we need to reflect on and assess the 2017 curricula. In this study, we will show the result of the assessment of the old curricula based on evidence and, will accordingly suggest directions for the new curricula.

2 Assessment of Old Curricula

First, we show an example of the relationship between courses and the 19 Tokiwa competencies in the syllabi (see Table 2) [17][18]. The total of competencies in each course is 100%. There are rubrics corresponding to a positive number in the syllabi (see Table II). Kobe Tokiwa University began competency-based education in 2017, and developed systems to do so effectively. We have already developed a new way of visualizing curricula using competencies with cosine similarity, multidimensional scaling methods, and scatter plotting [18]. Moreover, we developed a new way of visualizing curricula using competencies with cosine similarity and t-SNE [19].

Table 2: The Example of a Relationship Between Courses and
the 19 Tokiwa Competencies [18]

course name \ competency	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Academic Skills and Deep Learning I	0	0	0	0	0	0	0	20	0	10	25	10	15	0	0	0	0	0	20
2. Academic Skills and Deep Learning II	0	0	0	0	0	0	0	20	0	10	25	10	15	0	0	0	0	0	20
3. Freshman Seminar I	0	0	0	0	0	0	25	35	0	0	20	0	0	0	0	0	0	20	0
4. Freshman Seminar II	0	0	0	0	0	0	25	35	0	0	20	0	0	0	0	0	0	20	0
5. Leadership and Facilitation	0	0	0	0	0	0	0	0	0	0	40	15	0	0	0	10	10	5	20

First, we calculated the sum of competencies from the first to fourth grade of syllabi in 2020 (see Figure 1). Kobe Tokiwa University offers 410 courses. Each course includes less than six Tokiwa competencies, and the sum of the ratio is 100% in the syllabi. As you can see, the third competency "Professionalism/Expertise" accounts for the highest proportion. From Figure 1, we
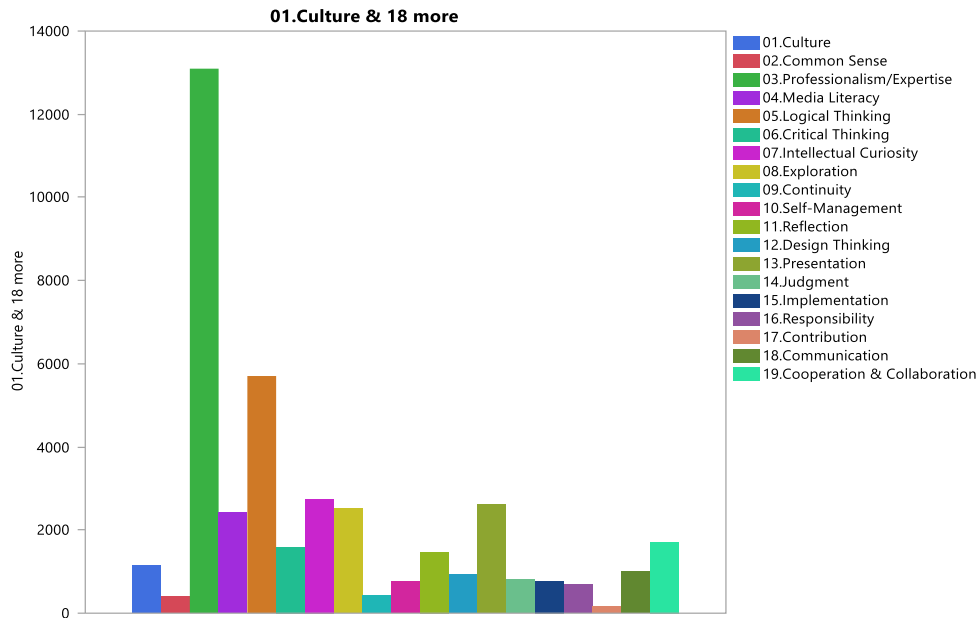

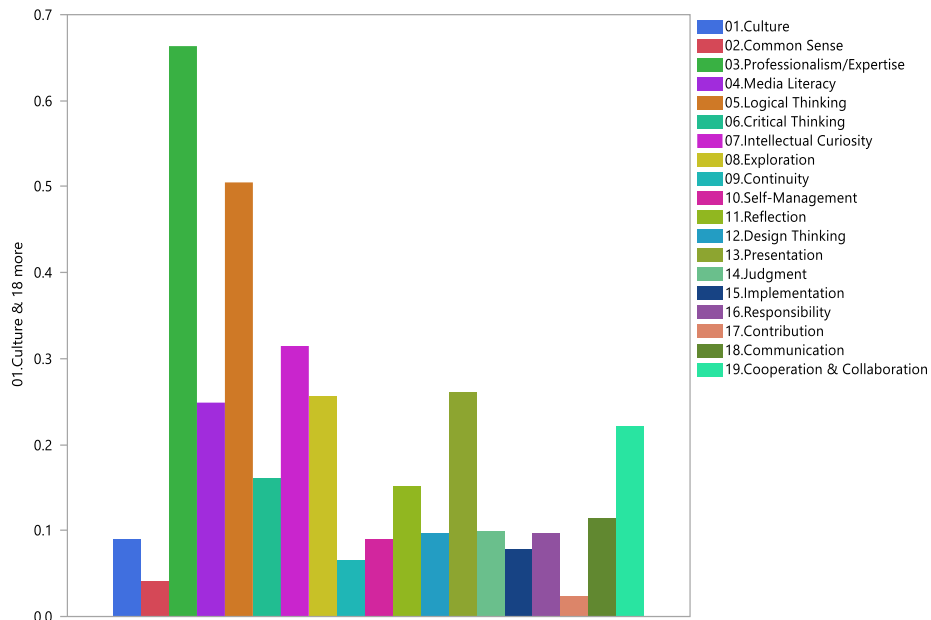Figure 1: The sum of the 19 Tokiwa competencies of syllabi in 2020

Figure 2: The ratio of the 19 Tokiwa competencies of syllabi in 2020

derive the hypothesis that most courses include the third competency "Professionalism/Expertise". To investigate this, we construct a new matrix similar to Table II. Table II includes the ratio for each course. We change "1" if the number is positive, and calculate the average against each competency. Using these data, we plot the bar graph (see Figure 2).

Surprisingly, 66% of courses include "Professionalism/Expertise." Notwithstanding that most courses of university include professional contents, we did not expect more than half of the courses to include the third competency. Moreover, half of the courses include the fifth competency of logical thinking.

Next, we investigate the correlation to know what pair of competencies have strong or weak correlation. First, we check the goodness of fit to normal distribution against each competency using the Shapiro–Wilk W test. The results show that all courses do not follow the normal distribution. Therefore, we calculate the non-parametric Spearman's correlation for whole pairs against the 19 Tokiwa competencies with p values. In this study, the significance level is 1%. We can obtain 37 significant pairs in $_{19}C_2 = 171$ pairs. We show only those with values more than 0.2 or less than -0.2 in Table 3.

Table 3: Spearman's Correlation against Whole Pairs against 19 Tokiwa Competencies

by Variable	Variable	Spearman ρ	p-value
19. Cooperation and Collaboration	15. Implementation	0.255	1.707E-07
18. Communication	13. Presentation	0.235	1.428E-06
17. Contribution	01. Culture	0.234	1.736E-06
19. Cooperation and Collaboration	11. Reflection	0.228	2.983E-06
10. Self-Management	09. Continuity	0.210	1.746E-05
19. Cooperation and Collaboration	18. Communicaiton	0.206	2.638E-05
19. Cooperation and Collaboration	07. Intellectual Curiosity	-0.221	6.360E-06
03. Professionalism / Expertise	01. Culture	-0.223	5.425E-06
19. Cooperation and Collaboration	05. Logical Thinking	-0.288	2.765E-09
4. Media Literacy	03. Professionalism / Expertise	-0.308	1.799E-10
13. Presentation	03. Professionalism / Expertise	-0.331	6.321E-12

As you can see, "Professionalism/Expertise" has weak negative correlation with "Culture" (first competency), "Media literacy" (fourth competency), and "Presentation" (thirteenth competency). This result is reasonable because we find that more than half of the courses include "Professionalism/Expertise" (see Figure 2). Since the total percentage is 100%, if teachers select "Professionalism/Expertise," the ratio of other competencies has to decrease.

This result shows that a dominant competency appears—"Professionalism/Expertise" in this case—and it is difficult to understand the relationship among competencies.

To investigate in detail the ratio of competencies, we performed a cross-tabulation by department and grade against the 19 Tokiwa competencies (see Figure 3). This result shows that, especially in the department of medical technology and nursing, most grades include "Professionalism/Expertise" and "Logical thinking."
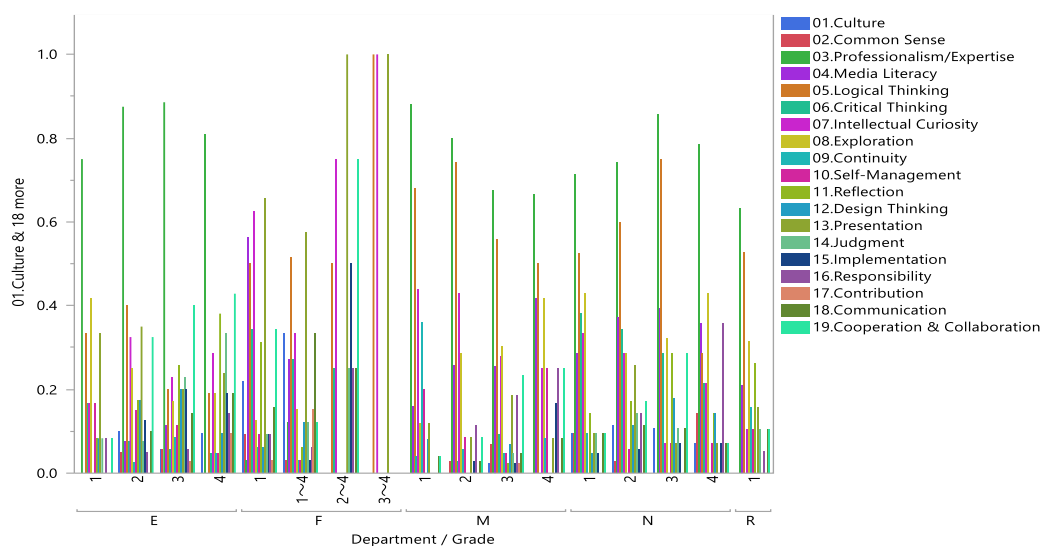
Figure 3: Competencies vs. department and Grade

"E" is department of child education, "M" is department of medical technology, "N" is department of nursing, "R" is department of radiology

3   Discussion: Second University Reform

Eduinformatics, a portmanteau of "education" and "information," is a new field of education that combines both education and informatics [20]. It not only deals with students' data, but also provides new analysis methods and concepts to deal with data in education, similar to bioinformatics.

The 2022 curricula for Kobe Tokiwa University is developed based on two axes: university reform and eduinformatics.

In section II, we assessed the old curricula under the Ueda University reform in eduinformatics. This assessment was performed by both faculty and staff in Kobe Tokiwa University as well as undergraduate and graduate students of Kobe Tokiwa University and other universities' faculty. This makes the assessment more effective.

Thus, we defined SOGs as a group including both faculty and staff as well as undergraduate and graduate students of Kobe Tokiwa University and other institutes. Notably, we consider SOGs to be stakeholders, and there are two type of stakeholders [21]: internal and external. However, stakeholders do not include graduate or former faculty members of Kobe Tokiwa University. Indeed, while we include faculty, staff, former faculty, undergraduate and graduate students, and faculty of other universities, the word "stakeholder" itself includes interests. However, SOGs does not include interests or interested parties. Indeed, we define SOGs as participants who want to develop higher education.

We contend that SOGs play an important role in implementing university reforms, along with eduinformatics. We find that, in the next curricula, it would be important to re-construct the Tokiwa competencies. In future, we hope to conduct a more detailed analysis, such as factor or cluster analysis, with SOGs.

Acknowledgement

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