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Assessing Social Applicability of Student Learning Outcomes Considering Faculty and Career Path Differences

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Abstract

Although the social implications of student learning outcomes have been studied, the impact of diversity on educational objectives and career trajectories remains unclear. This study examined graduates' self-assessments of student learning outcomes to evaluate variations across faculties and career paths. Using cluster analysis, four groups were formed, each demonstrating patterns of skill recognition—positive, indifferent, selective awareness, and balanced—which highlighted unique distribution patterns among faculty and career selections.

Keywords: cluster analysis, graduate survey, higher education, student learning outcomes.

1 Introduction

A global shift has occurred from "what teachers teach" to "what students learn" [1]. As part of this shift, the visualization of Student Learning Outcomes (SLOs), which assesses competencies from multiple perspectives, has gained importance for quality assurance in education in Japan [2]. At Akita University (Akita, Japan), SLOs are categorized into 15 "bachelor's degree skills" based on course-specific weights and academic performance [3].

A graduate survey conducted as part of the Plan-Do-Check-Act (PDCA) cycle to examine whether SLOs are being applied in society revealed an emerging connection between SLOs and the skills needed in society [4]. However, considering that differences in educational objectives across faculties and variations in career paths may influence this relationship, the related factors remain underexplored. Addressing this gap could enhance the accuracy of SLO assessments.

Accordingly, this preliminary study conducted a cluster analysis of graduate survey data and compared and evaluated differences across faculties and career paths. The aim was to gain insights into how educational objectives and career choices relate to the skills required in society.

2 Methods

2.1 Subjects

Among 1,981 students from four faculties who were enrolled from 2015 to 2017 and graduated within the standard period, 299 responded to the survey (Faculty H: 36 of 244, Faculty I: 105 of 520, Faculty J: 61 of 255, and Faculty K: 97 of 962), yielding a 13.1% response rate.

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Table 1: Bachelor's Degree Skills at Akita University

Major Categories A–C, Subcategories 1–15	
A	Knowledge & Understanding
	1. Understanding of knowledge related to different cultures
	2. Understanding of knowledge related to human culture and society
	3. Understanding of knowledge related to nature
	4. Understanding of knowledge related to specialized fields and acquisition of skills
B	General Skills
	5. Communication skills
	6. Quantitative skills
	7. Information literacy
	8. Logical thinking skills
	9. Problem discovery and solving skills
C	Attitude & Mindset
	10. Self-management ability
	11. Teamwork and leadership
	12. Ethics
	13. Social responsibility as a citizen
	14. Lifelong learning ability
D	15. Comprehensive learning experiences and creative thinking

2.2 Graduate Survey

Table 1 shows the major categories A–D and subcategories 1–15 of the bachelor's degree skills that can be acquired at Akita University. Considering that higher education's impact may take time to manifest [5], this survey targeted graduates three years post-graduation. For each of the 15 subcategories, the respondents answered the following three questions: I. Applicability in society, II. Growth during studies, III. Necessity in society. Responses were rated on a five-point Likert scale (1 = strongly disagree; 3 = neutral; 5 = strongly agree). Free responses were also collected. The survey was conducted online using Microsoft Forms.

2.3 Analysis Procedure

To characterize the responding graduates, compare groups across faculties and career paths, and assess differences, an analysis was conducted following the procedure below. First, for each respondent, response values for subcategories 1–15 in Sections I–III were averaged within major categories A–D. Then, nine values were selected from the combinations of major categories A–C and sections I–III. Major category D, related to graduation research, was excluded due to differences in evaluation methods compared to other items.

Next, classification was performed using cluster analysis based on the nine response values with Ward's method. The number of clusters (CL) was determined using the elbow method.

Based on analysis of variance (ANOVA) and Tukey's multiple comparisons, each CL was characterized and defined. Respondent numbers in each CL were compared across four faculties and six career categories: further education (64), company (76), teacher (39), public servant (61), nursing field (50), and undecided (9). SPSS Statistics version 26 (IBM) was used for analysis.

3 Results

Figure 1 presents the results of the elbow method. Given that the residual sum of squares leveled off after three CLs, the number of CLs was set to three or four; the distribution of respondents across CLs was also examined. For the model with three CLs, the distribution was as follows: CL1: 64, CL2: 86, and CL3: 136. For the one with four CLs, the distribution was CL1: 64, CL2: 86, CL3: 64, and CL4: 72. Given the more balanced distribution, the model with four CLs was selected. Prior to performing the CL analysis, responses from 13 individuals with extremely low values were identified as outliers and excluded.

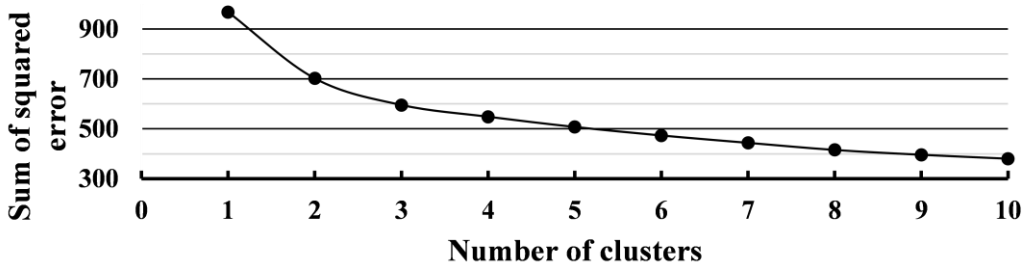

Figure 1: Elbow Plot

Table 2: Results of ANOVA and Multiple Comparisons

Conditions		Items	CL1	CL2	CL3	CL4	*F*	Multiple Comparison (Tukey's Method)
		N	64	86	64	72		
I	A	Average	4.15	3.16	3.33	3.82	65.85	CL1 >> CL4 >> CL3 > CL2
		SD	0.44	0.61	0.45	0.31		
	B	Average	4.61	3.42	3.83	3.84	90.61	CL1 >> CL4 > CL3 >> CL2
		SD	0.36	0.52	0.49	0.35		
	C	Average	4.41	3.12	3.65	3.87	108.21	CL1 >> CL4 >> CL3 >> CL2
		SD	0.39	0.63	0.34	0.26		
II	A	Average	4.13	2.99	3.38	3.69	74.18	CL1 >> CL4 >> CL3 >> CL2
		SD	0.44	0.61	0.45	0.37		
	B	Average	4.37	3.34	4.14	3.68	60.32	CL1 > CL3 >> CL4 >> CL2
		SD	0.52	0.58	0.50	0.41		
	C	Average	4.01	3.07	4.05	3.76	58.44	CL1 > CL3 >> CL4 >> CL2
		SD	0.70	0.58	0.40	0.32		
III	A	Average	4.15	3.30	3.76	3.76	44.46	CL1 >> CL3 > CL4 >> CL2
		SD	0.38	0.54	0.43	0.41		
	B	Average	4.75	3.88	4.66	4.00	81.07	CL1 > CL3 >> CL4 > CL2
		SD	0.30	0.61	0.26	0.35		
	C	Average	4.63	3.72	4.48	3.96	74.59	CL1 > CL3 >> CL4 >> CL2
		SD	0.32	0.59	0.35	0.31		

>>: Significant at the 5% level
>: No significant difference

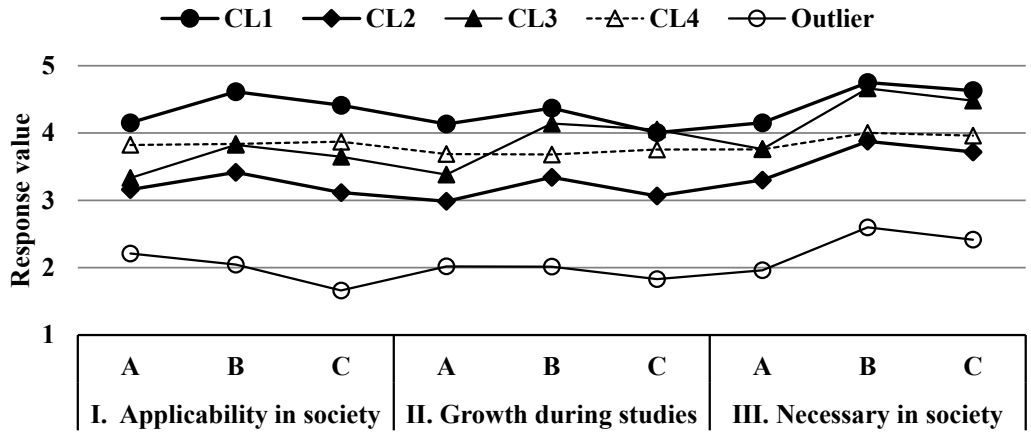

Figure 2: Comparison of Mean Response Values by Cluster. Y-axis: Five-point Likert Scale

Table 3: Cluster Definitions and Descriptions

Groups		Descriptions
CL1	Positive	Recognition of categories A to C most prominent among all sections (I–III), with a strong sense of realization throughout.
CL2	Indifferent	Recognition of categories A to C is neutral, with scores near the mid-point (≈3) across sections I and II. Categories B and C in section III show some recognition.
CL3	Selective awareness	Recognition of A is neutral (≈3) across sections I and II, whereas recognition in categories B and C is relatively high (≈4) across sections II and III.
CL4	Balanced	Recognition of categories A to C is moderate (≈4) across all categories (I–III), indicating a balanced sense of realization.
—	Outlier (Negative)	Recognition of categories A to C is low (≈2) across all categories (I–III), with little overall realization.

Table 2 presents the ANOVA and multiple comparisons for the nine response values from CL1 to CL4. Figure 2 illustrates the mean value of each response in the CL group. The characteristics across CL1–CL4 are identified and defined. The results are summarized in Table 3. The mean values of the nine response items for the outlier group are as follows: IA, 2.2; IB, 2.0; IC, 1.7; IIA, 2.0; IIB, 2.0; IIC, 1.8; IIIA, 2.0; IIIB, 2.6; and IIIC, 2.4.

Figure 3 presents the proportions of CL1 to CL4 and the outlier groups across the faculties. Faculty H had a high proportion of CL1 (Positive). Faculties I and J exhibited higher proportions of CL2 (Indifferent) and CL4 (Balanced), whereas Faculty K had a higher proportion of CL2 (Indifferent). Additionally, CL3 (Selective awareness) accounted for over 25% of Faculty K. These results confirm that each faculty exhibited distinct clustering tendencies.

Figure 4 presents the proportions of CL1 to CL4 and the outlier groups across career paths. Further education had a high proportion of CL1 (Positive), while private companies had more CL2 (Indifferent). The teaching profession had more CL4 (Balanced), whereas public servants had more CL2 (Indifferent) and CL3 (Selective awareness). The nursing field had more CL2 (Indifferent) and CL4 (Balanced), while the undecided group had a notably high proportion of CL2 (Indifferent). These results confirm distinct clustering tendencies across career paths.

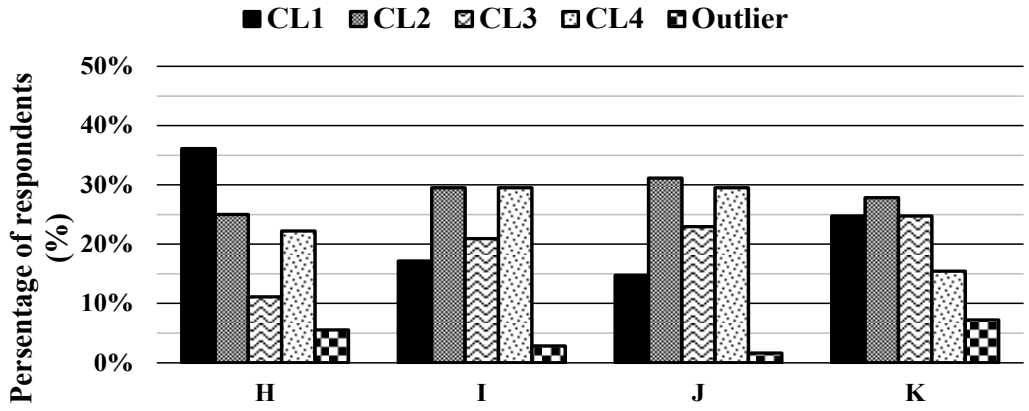

Figure 3: Proportion of Respondents in Each Cluster by Faculties

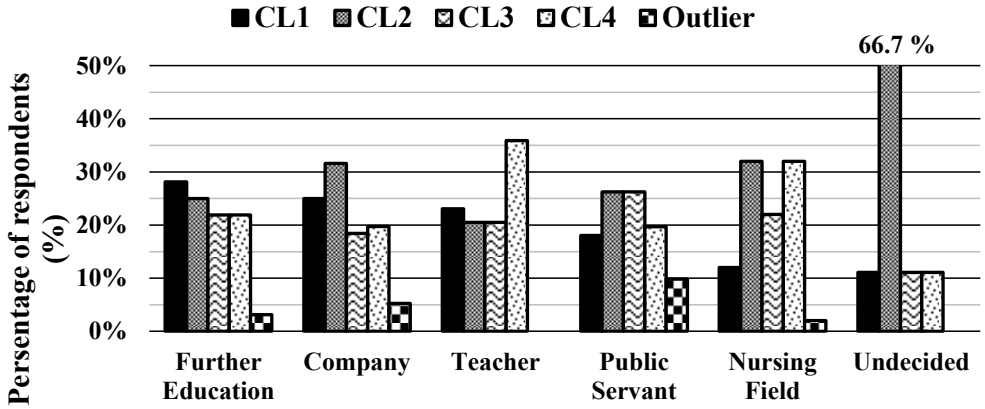

Figure 4: Proportion of Respondents in Each Cluster by Career Path

4 Discussion

Figure 3 shows that Faculty H had the highest proportion of CL1 (Positive). This faculty offered many courses taught in English and provided overseas fieldwork aligned with its educational objectives. Graduate comments highlighted that "interactions with international students and overseas fieldwork fostered growth and enhanced societal awareness, leading to practical skills acquisition." These distinctive courses likely contributed to students' recognition of their SLOs.

Conversely, Faculties I, J, and K had high proportions of CL2 (Indifferent). However, Faculties I and J had more CL4 (Balanced), while Faculty K had more CL3 (Selective awareness). CL3 students rated "I. Applicability in society" for A (Knowledge & Understanding) close to neutral (≈3) with the following mean scores for the subcategories comprising A: 1, 3.06; 2, 3.11; 3, 2.95; and 4, 4.20. The CL4 scores were 1, 3.79; 2, 3.71; 3, 3.54; and 4, 4.25. CL3's lower scores for subcategories 1–3 ($p < 0.05$) indicate weaker perceived applicability. Graduates from Faculties I and J noted that "practical training enhanced their growth and applicability in society," whereas Faculty K graduates stated that "they lacked opportunities for growth." These differences suggest that variations in educational approaches influence students' experiences, as reported in prior research [2].

Figure 4 shows that students pursuing further education made up a higher proportion of CL1, reflecting their positive perception of university learning. Conversely, those entering private companies, public service, and nursing had more CL2, suggesting a weaker recognition of SLOs' societal applicability. Public servants had a relatively high proportion of CL3, indicating a partial connection between their studies and job responsibilities; however, their specialized skills may not be directly linked to practice. This suggests that in roles requiring general knowledge and skills, it may be harder for graduates to perceive tangible SLOs. Meanwhile, those in teaching and nursing careers had more CL4, likely because of their direct links to professional practice. Finally, undecided graduates had a higher proportion of CL2, implying difficulty in finding meaning in their SLOs. These findings suggest that classifying students based on their perceptions of essential societal skills clarifies career path-related trends in SLOs recognition.

5 Conclusion

This study revealed that societal skill requirements vary by faculty and career path. The analysis presented in this study serves as an approach for evaluating educational effectiveness and optimizing education based on career trajectories. Based on these findings, future research will analyze the relationship between societal skill requirements and SLOs, assess gaps, and identify factors. Given the 13.1% response rate, potential bias is considered. Therefore, the survey method will be improved, and the survey administered again to increase response rate.

Acknowledgement

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