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Analyzing Student Questionnaires for the Early Discovery and Implementation of Learning Outcomes

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Abstract

In addition to grades, Japanese universities use student surveys to evaluate student learning and educational outcomes. These surveys are not only conducted immediately after class, but also some time after class. If students do not remember what they have learned, the class cannot be said to have resulted in high learning outcomes. This study defines highly rated classes as those in which students remember what they have learned even after several years have passed, in other words, classes with high learning outcomes. By clarifying the characteristics of such classes, the aim was to indicate directions for improving classes. This study utilizes three questionnaires for students, asking for their evaluation immediately after the class, after a period of approximately three to six months, and a few years later, at the time of graduation. It was found that classes that left a lasting impression in questionnaires administered after several months were more likely to remain in students' long-term memory. This indicates that it is possible to identify the elements and directions contributing to class improvement at an early stage. If these results are used effectively, efforts to improve classes that were not highly rated can be actioned in a few months and may be implemented in the following year.

Keywords: long-term memory, learning outcomes, questionnaire analysis, text mining, emotion analysis

1. Introduction

Japan's "Guidelines for Educational Management," compiled by the Ministry of Education, Culture, Sports, Science, and Technology in January 2020 called for a shift from the faculty to the student perspective in Japanese higher education. To determine and realize student learning and educational outcomes, it is necessary to evaluate student data. In addition to grades, which are the direct evaluation results of classes taken by students, various questionnaires are used to confirm student outcomes. Accordingly, it has become essential for universities to use such data to implement educational improvements. For example, since class evaluation questionnaires are conducted immediately after classes, they can be used by each faculty member to improve their teaching methodology. Many indicators and models have been presented, and approaches using various methods have been implemented to achieve better learning outcomes (Kiichiro, 2004; Masami & Ken, 1998; Ruriko, 2013; Takanobu et al., 2003; Yukimasa & Yahachiro, 2004). However, few studies and initiatives are aimed at evaluating what is actually learned in class.

Although class evaluations have been conducted, it is difficult to assess whether they are meeting their objectives. One of the reasons for this may be that the purpose of education, such as "What are learning outcomes?" is not considered. Therefore, the evaluation may be unable to discuss the merits and demerits of the class content or find direction for improvement. Thus, it is necessary to have an effective evaluation axis that does not delve into the content of each class.

For example, if a student scored highly on a test by cramming overnight before the test but forgets the content of the test a week later, no faculty member would argue that the student had achieved a high level of learning. This leads to the question, "What are learning outcomes?" One of the axes of evaluation is whether the student recalls what they have learned, even several years after taking the class.

It is a prerequisite for students to remember what they have learned in classes in order for it to become a learning outcome. Thus, it is important to identify classes that leave a lasting impression on students. The latest point at which a university can receive confirmation from students regarding which classes left a lasting impression is at graduation.

Previous studies have focused on the image of teachers that leave a lasting impression; however, few have focused on classes that leave a lasting impression as a long-term memory. Therefore, there is a possibility that better classes could be implemented by elucidating classes that remain in students' memories rather than teacher's images and impressions.

This study defines highly rated classes as those in which students do not forget what they have learned, even after a long period of time. By clarifying the characteristics of such classes, the aim is to indicate how classes can be improved. Rather than creating a new questionnaire that would be burdensome to students, this study identified the characteristics of highly rated classes from the results of existing class evaluation questionnaires, current student survey questionnaires, and graduation survey questionnaires. Clarifying the characteristics of classes remembered by students will also help identify common factors,

which will help to further enhance learner-centered education.

In summary, the focus of this study is to understand the factors allowing students to recall what they have learned in class even after a long period of time. Rather than waiting for the identification of highly rated classes when students graduate, which would mean the classes could not be improved until several years after they were taught, this study identifies these classes as early as possible.

2. Analysis of Student Learning Outcomes

2.1 Analysis of Education data

For students, remembering what they have learned in class is a prerequisite for academic achievement. Therefore, it is important to identify classes that leave a lasting impression on students. One way to determine which classes left a lasting impression on students is to ask them at the time of graduation, several years after they took the class. However, to improve the class and teaching promptly, it is important to identify areas for educational improvement early, rather than wait until students graduate.

In the United States, the use of the term “enrollment management” by John (1976) led to the implementation of various data applications to university management. Enrollment management is defined as an institutional response to the challenges and opportunities that recruiting and retaining the right student body present to a school’s financial health, image, and student quality. It is a research-based process that creates synergies among recruitment, pricing and financial aid, academic affairs, student life, and constituent relationships (Christine, 2012). Several management techniques (Lawrence & John, 2008; Marguerite, 1998) and practical cases (Davis, 2009; Tremblay, 2018) have been studied. Particularly in the United States, it is important to secure enrollment and ensure that students continue their studies at the concerned university. Therefore, it is important not only to secure students, but also to analyze data from admission to graduation, and follow-up with students to ensure that they do not drop out. In this regard, the use of surveys is also important as the voice of students. Students in Japan are not as fluid regarding enrollment as they are in the United States, and it is common for students to remain enrolled at one university from admission to graduation. For this reason, Enrollment Management was delayed as a strategy in Japan. Since the “Guidelines for Educational Management” were announced, it is now gaining importance in Japan in terms of how to secure enrollment and improve the learning and educational outcomes of enrolled students. Therefore, it is important to conduct research and collect necessary data to formulate effective management strategies and financial plans.

Although Japanese universities have made progress in analyzing a range of student information, research has typically focused on improving individual classes or various teaching methods used by faculty members. Japanese universities have set goals for the knowledge and skills students are expected to acquire at different levels, which are stated in the syllabus, together with the content and schedule of classes. To determine whether students have acquired the intended knowledge and skills through class, a class evaluation

questionnaire is usually administered immediately after the class ends (MEXT, 2015). Numerous studies have been conducted on the tabulation and analysis of class-evaluation questionnaires. For example, there are studies that compare the average value of each question by lecture/exercise and required elective, examine the differences in evaluation between courses and electives, or tabulate by faculty, lecture/exercise, and required elective (Hokkaido University Evaluation Office, 2010; Institute for Excellence in Higher Education Tohoku University, 2010; Ruriko, 2012 etc.). Hideo (2002) analysis of class questionnaires found a strong correlation between the overall class evaluation and class comprehension.

Based on techniques employed by previous studies, this study uses text mining to analyze data, given its prevalence and ability to extract emotions (Alexandra, 2018; Anil et al., 2017; Saif, 2016; Tausczik & Pennebaker, 2010; Yla & James, 2010). Additionally, many universities provide free descriptions in their class evaluation questionnaires (Takashi et al., 2006), which are also analyzed using text mining (Hideya et al., 2017; Koji et al., 2015).

2.2 Analysis of Memory

There are two types of memory: long-term and short-term memory. Long-term memory can be divided into two types: “declarative memory,” which can be expressed verbally, and “non-declarative memory,” which cannot be expressed verbally. There are two types of “declarative memory”: “episodic memory” and “semantic memory”. Episodic memory refers to the events that a person has experienced. Semantic memory refers to knowledge that is not directly related to oneself but is remembered because it is useful to know (Endel, 1972; Gabriel, 2021; Nobuo, 2008). There has been extensive research on memory from a variety of perspectives. For example, in the field of education, research has been conducted on teachers who leave a lasting impression. Katsumi et al. (2019) attempted to find memorable images of teachers through semi-structured interviews with university students. Although there have been studies that have directly interviewed students and teachers (Hiroshi, 1996; Takako, 2016), there are no studies that have collected large amounts of data through surveys or other methodologies, or that have focused on the content of classes.

2.3 Aim of this Study

This study analyzes three surveys to identify the characteristics of classes that left a lasting impression on students: a class evaluation questionnaire (immediately after taking a class), a current student survey questionnaire (several months after taking a class), and a graduation survey questionnaire (several years after taking a class). Maya and Kazuhiko (2023a) suggested that there is a relationship between these questionnaires and that it may be possible to discover objects that leave a lasting impression at an early stage, such as in the current student survey questionnaire. Based on this relationship, this study examined whether it is possible to identify classes that leave a lasting impression at an early stage by analyzing the three questionnaires and understand students' positive/negative emotions regarding the classes. Syntactic analysis was used to obtain this information. In summary, this study aimed to clarify the characteristics of good classes and identify points and directions for improvement in other classes.

3. Methodology

3.1 Data Set

This study used data from Y University for the year 2022. The survey data used were as follows:

(1) Class evaluation questionnaire

(2) Current student survey questionnaire

(3) Graduation survey questionnaire

This study focuses on the liberal arts courses taken by students in their first year of study. As many universities in Japan offer liberal arts courses in the first year the results of this study can be widely used for Japanese university education and educational improvement. The implementation period, respondents, and amount of data are listed in Table 1. As the names of questionnaires (2) and (3) are similar, hereafter, (1) will be referred to as "Class Questionnaire," (2) as "Current Questionnaire," and (3) as "Graduation Questionnaire."

During the data cleaning phase, the following procedures were implemented: The students who responded to each survey were from nine faculties of Y University. From these faculties, medical and veterinary medicine, which are prerequisite faculties for taking the national examinations, were excluded due to the length of study and characteristics of the faculties. In addition, "English" and "English 1" were standardized to the name of the course offered, such as "English Ia." If a faculty member's name was given as a response, it was considered invalid because the faculty member was often responsible for more than one class.

Table 1. Summary of Analysis Data

	Questionnaire name	Respondent	Implementation period	Number of valid responses (Number of texts)	
(1)	Class evaluation Questionnaire	Students who took the class (Responded immediately after the class)	2022.06 / 2022.08 / 2022.12 / 2023.01 /	27 351	(5 290)
(2)	Current student survey Questionnaire	Current Students (grade 1-3)	2022.11-2022.12	697	(697)
(3)	Graduation survey Questionnaire	Students in Final year of study (grade 4)	2022.12-2023.03	112	(112)

The Class Questionnaire was administered immediately after the classes and was answered primarily by first-year university students. The Current and Graduation Questionnaires were answered by all students, second grade and above. These students also took specialized classes for their courses, so narrowing the focus to liberal arts courses, which was the focus of this study, reduced the number of valid responses available.

For this study, the analysis will focus on the question "name of the class that left a lasting impression," and "reasons why the class left a lasting impression."

3.2 Class Evaluation Questionnaire

The Class Questionnaire is primarily taken immediately after attending the classes. In this study, the questionnaire was answered by first-year students taking the liberal arts courses. Since first-year students often take numerous classes during a half-semester, the questionnaire was reduced to seven questions to improve the response rate and ensure the quality of responses.

Question 01: Class attendance

Question 02: Study time outside of class time

Question 03: Level of comprehension

Question 04: Level of achievement

Question 05: Level of satisfaction

Question 06: Responses to the online learning system (when applicable)

Question 07: Free description (Comments and Requests)

Questions 01 through 06 were answered on a five-point scale Likert scale, and in the second semester of the 2022 academic year (8 799 responses), students were asked to provide reasons for their choices to questions 03, 04, and 05, respectively, in a free description format. Therefore, the data for the second semester of 2022 integrated the free description statements for Questions 03, 04, and 05, as well as for Question 07.

This study aimed to analyze the classes that were answered as impressive or not to see if there were special characteristics. Therefore, data from Question 07 for the first semester of 2022, and the integrated data for the second semester of 2022 were used in the analysis.

3.3 Current Student Survey Questionnaire

The Current Questionnaire was administered to current students (grades 1-3). The purpose of this survey was to understand the actual status of students' studies, their satisfaction with education and student life, and to identify what improvements could be made. The questions were designed in the following categories:

Category 01: Basic information (admission examination type, application ranking)

[two questions]

Category 02: Time spent studying, etc. [four questions]

Category 03: Contents of classes [six questions]

Category 04: Satisfaction with education, facilities, etc. [15 questions]

Category 05: Activities, learning outcomes, etc. [16 questions]

Category 06: Free description [one question]

The analysis in this study focused on the question: “name of the class that left a lasting impression in the first semester of 2022,” and “reasons why the class left a lasting impression,” to understand which classes left a lasting impression and why. These questions were among those related to Category 03 “Contents of classes”.

3.4 Graduation Survey Questionnaire

The Graduation Questionnaire was administered to students in their final year of study (grade 4). This survey was designed to determine the results and effectiveness of education and the satisfaction with education and student life, and to identify improvements. The questions were categorized as follows:

Category 01: Basic Information (admissions, career paths, etc.) [seven questions]

Category 02: Contents of classes [six questions]

Category 03: Overall satisfaction [16 questions]

Category 04: Activities, learning outcomes, etc. [15 questions]

Category 05: Free description [one question]

The analysis of this study focused on the "names of class that left an impression during the term in university" and "reasons why the class left a lasting impression." These were conducted to understand which classes left an impression and why and were among the questions related to Category 02 “Contents of classes”.

3.5 Free Text Analysis Algorithm

The method for analyzing the questionnaires’ free descriptions in this study was based on a previous study conducted by Maya and Kazuhiko (2023b) and uses the following method. First, a morphological analysis was performed on the free description sentences in the questionnaire. Morphological analysis divides sentence into words, assigning parts of speech to each word. Morphological analysis is performed on the morpheme sequence to extract the intersections between morphemes, subjects, and predicates. In this study, JUMAN/KNP, which was developed at the Kurosaki Laboratory, Kyoto University, was used as the morphological and syntactic analysis engine. Next, the sensory information and objects of emotion of the sentence were extracted from its syntactic structure. Many polarity dictionaries, such as those developed by the Inui Laboratory at Tohoku University, describe the relationship between words and emotions. For example, a sentence containing the word “beautiful” is almost always positive, no matter what its object is. Sentences containing the

words “easy to do” often have positive emotions. However, when the object of the sentence is an event that should not happen, such as “missing,” “leakage,” or “broken,” the emotion is typically negative. Therefore, the extraction of sensory information that considers word dependency is more accurate than extraction by word matching using a polarity dictionary.

4. Results

4.1 Comparison of Current and Graduation Questionnaires

Figure 1 shows the class names responded in each questionnaire, with the number of responses in parentheses next to the class names. The order in parentheses refers to the Current and Graduation Questionnaires. The number of liberal arts courses classes that left a lasting impression was 50 in the Current Questionnaire, and 35 in the Graduation Questionnaire. Figure 1 shows the class names noted only in the Current Questionnaire (21 classes), those noted in both questionnaires (29 classes), and those noted only in the Graduation Questionnaire (six classes). In the Current Questionnaire (A), 50 classes left a lasting impression, with one class name noted only in the Current Questionnaire (A $\wedge$ ¬B), “Introduction to Intellectual Property,” mentioned by 16 respondents. In the Graduation Questionnaire (B) 35 classes left a lasting impression, with one class noted only in the Current Questionnaire (B$\wedge$¬A), “Basic Chinese 1A,” with four responses. One class noted in both the Current and Graduation Questionnaires (A$\wedge$B) was “Introductory Seminar,” which had 75 responses from the Current Questionnaire and 10 responses from the Graduation Questionnaire. The number of responses to both Questionnaires (Figure 1, (A$\wedge$B)) is ordered by the number of Current Questionnaire followed by the Graduation Questionnaire.

The 21 classes mentioned in the Current Questionnaire comprised of subjects that students do not have the opportunity to study in high school. These include the role of intellectual property, the use of science and technology, and understanding data science and selecting information tools.

The correlation coefficient calculated for the 29 classes selected in both the Current and Graduation Questionnaires was found to be as high as 0.37. In particular, the top classes in both questionnaires, the “Introductory Seminar” and “Yamaguchi and the World,” were highly rated as classes that helped students acquire the basic skills necessary for university, as well as the ability to think, judge, express, act, and speak for themselves. Moreover, university classes such as “Philosophy,” in which students consider human existence and truth, and “Historical Studies,” in which students think about how historical facts are clarified and what significance they have, rather than memorizing facts, are likely to be new perspectives for high school graduates, and thus more likely to be memorable.

Classes related to languages such as English and Chinese were also selected in both the Current and Graduation Questionnaires. In high school, most language classes, such as English syntax and vocabulary, are designed to prepare students for university entrance exams. In contrast, university language classes focus more on practical usage, such as daily life conversations, which can leave a lasting impression on students.

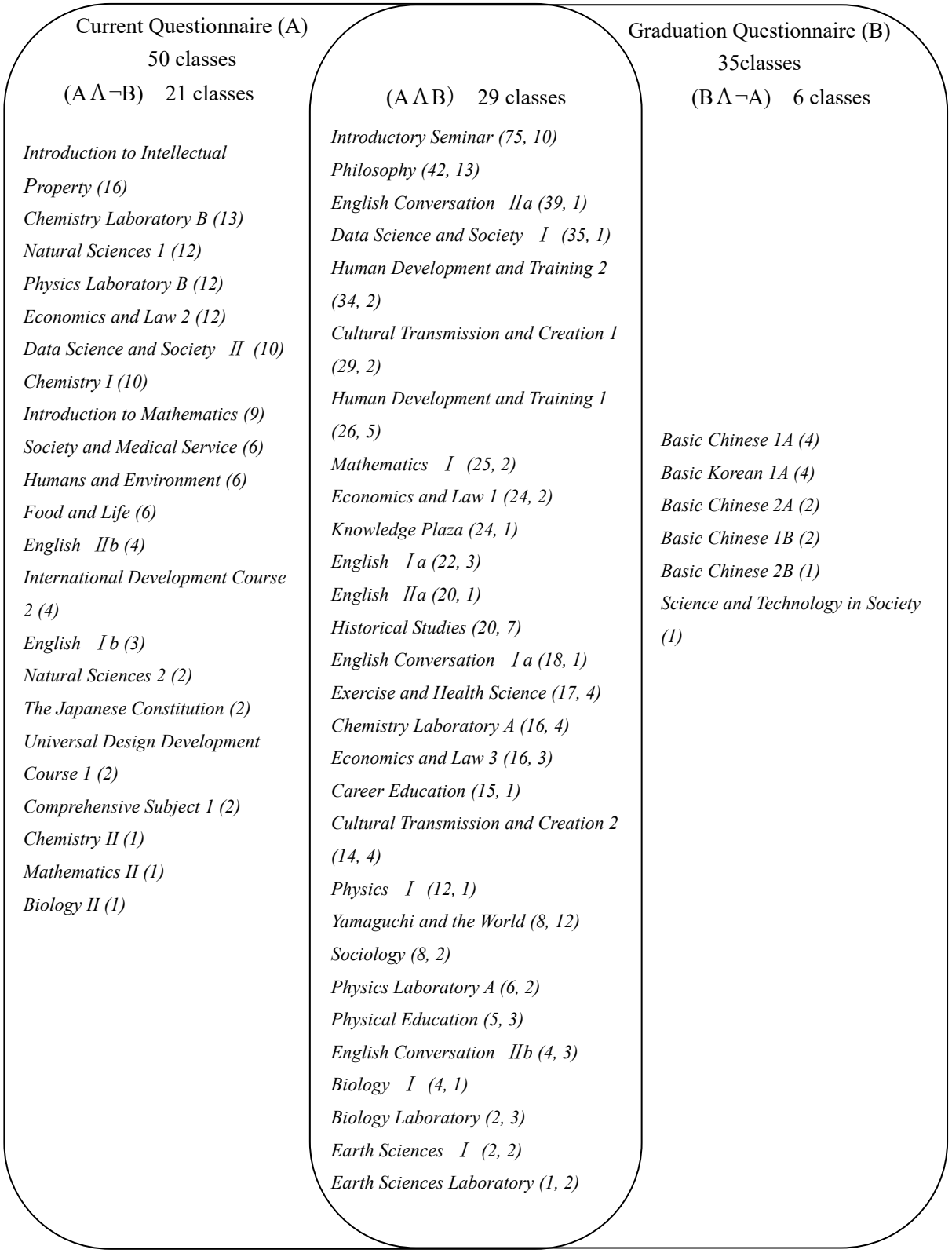

Figure 1. Relationship between Current and Graduation Questionnaires

Both the Current and Graduation Questionnaires included questions about the learning outcomes of liberal arts and foreign language classes in Categories 04 and 05. The results are shown in Figures 2 and 3. The Graduation Questionnaire also asked about the level of satisfaction with the two points of view in Category 03, the results of which are shown in Figure 4. In particular, the results show that the percentage of students who responded "Considerably acquired" or "Slightly acquired" for foreign languages was 10-20% lower than those for liberal arts courses. However, the difference in satisfaction, "Extremely satisfied" and "Satisfied" was approximately 5%. In other words, although students did not acquire these skills, their level of satisfaction was high.

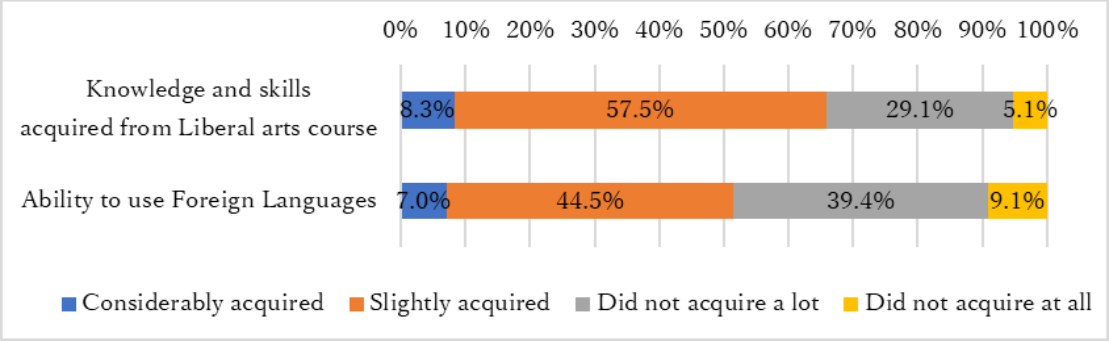

Figure 2. Questions on Learning Outcomes for "Liberal arts" and "Foreign Language" in the Current Questionnaire

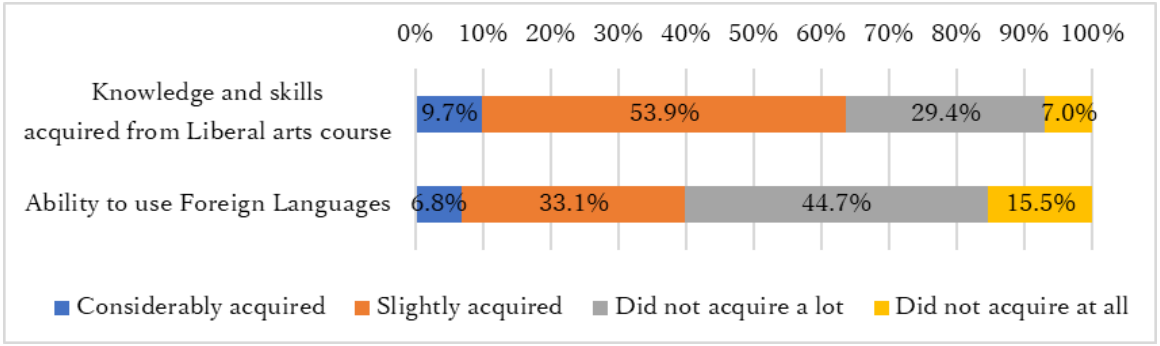

Figure 3. Questions on Learning Outcomes with "Liberal arts course" and "Foreign Languages" in the Graduation Questionnaire

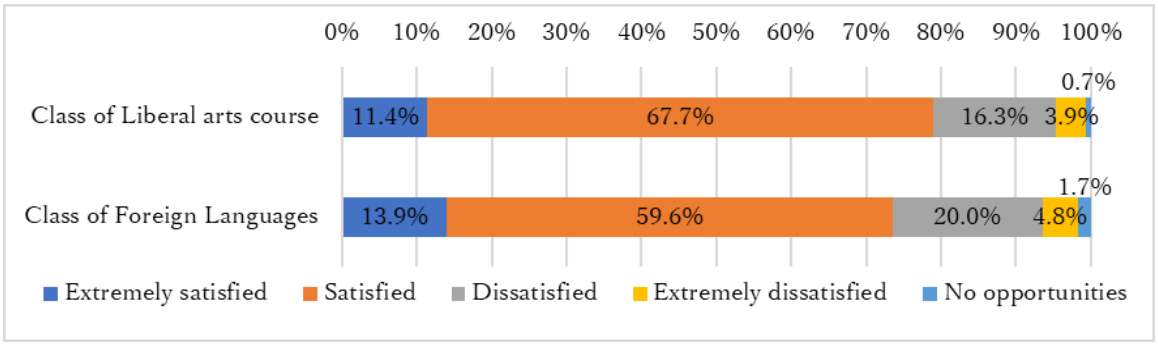

Figure 4. Questions on Satisfaction with "Liberal arts course" and "Foreign Languages" in the Graduation Questionnaire

4.2 Analysis of Factors Making up Impressive Classes

4.2.1 Data

In both the Current and Graduation questionnaires, students were asked about the reasons for their impressions, along with the names of the classes that left an impression on them. Therefore, sentiment analysis targeting co-occurrence was used to analyze why students found certain classes impressive. As shown in Table 2, the Current Questionnaire had 697 free description responses and 744 emotions, while the Graduation Questionnaire had 112 free description responses and 135 emotions. Table 2 shows the number of positive and negative comments in the free descriptions, and their respective percentages of the total number of comments.

Table 2. Summary of Analysis Data for Free Descriptions

	Current Questionnaire	Graduation Questionnaire
Number of emotions	744	135
Positive comments (%)	571 (76.75%)	101 (74.07%)
Negative comments (%)	152 (20.16%)	28 (20.00%)
No emotion demonstrated (%)	23 (3.09%)	8 (5.93%)

4.2.2 Analysis of Positive Emotions

The degree of positive emotions in the sentiment analysis of the Current and Graduation questionnaires is presented in Figure 5. In both questionnaires, "class," "content," and "lecture" were at the top of the list, ranking at 51.3% in the Current Questionnaire, and 36.4% in the Graduation Questionnaire, respectively. Both questionnaires also included the reason of "teacher," which was marginally higher in the Graduation Questionnaire.

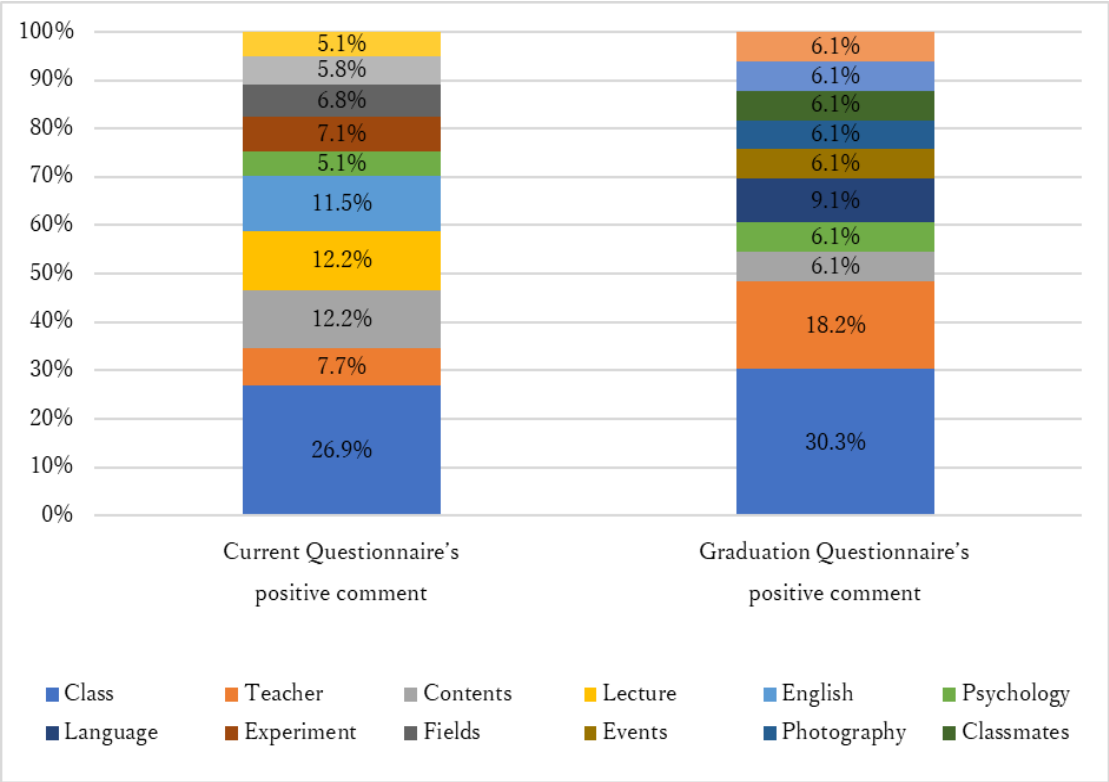

Figure 5. Positive Comment Details of Current and Graduation Questionnaires

4.2.3 Analysis of Negative Emotions

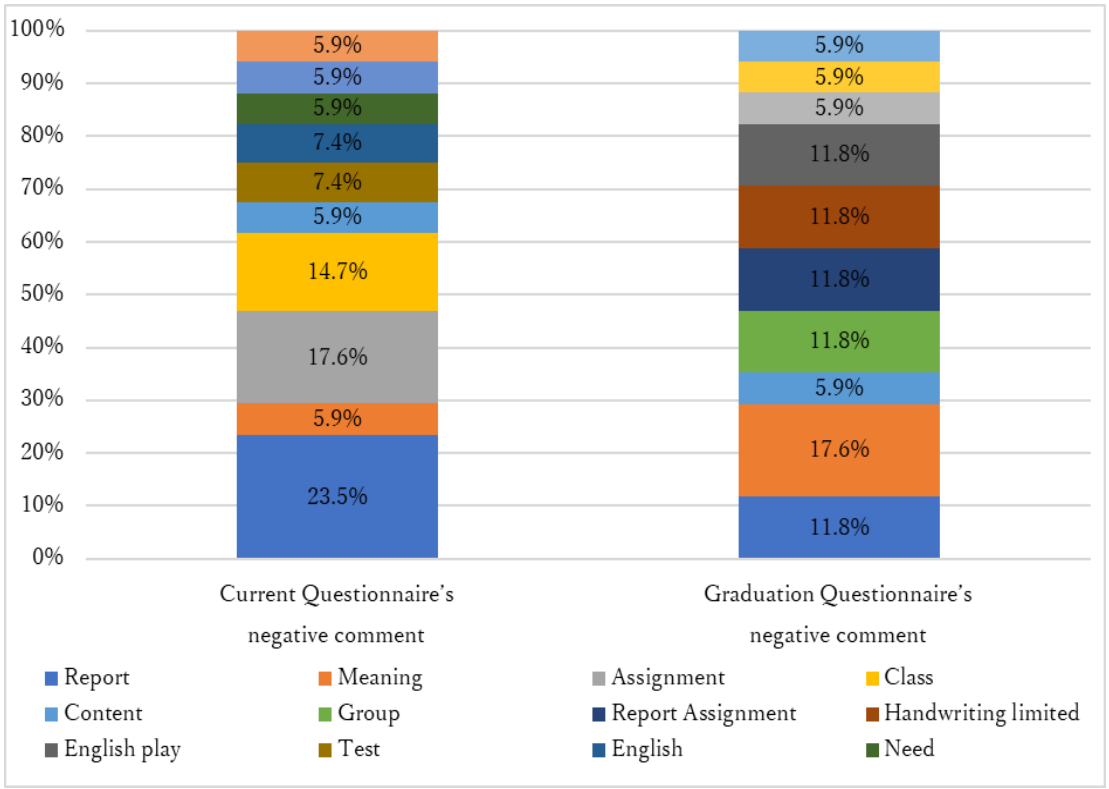

Figure 6. Negative Comment Details of Current and Graduation Questionnaires

The degree of negative emotions in the sentiment analysis of the Current and Graduation questionnaires are shown in Figure 6. In the Current Questionnaire, complaints about "report" and "assignment" feature predominantly, suggesting that this impression will remain even after a few years.

4.3 Characteristic Analysis of Impressive Classes

4.3.1 Classes That Impressed Students or Did Not

Figure 1 analyzes the classes surveyed in the Current and Graduation Questionnaires. As shown in Figure 7, other liberal arts course classes did not appear in both questionnaires. This section also examines classes that did not receive a response to the questionnaires, to determine any significant characteristics. Given that none of the questionnaire items included options for why classes did not make a lasting impression, this aspect was analyzed through the free descriptions in the Class Questionnaire. As shown in Table 1, 5 290 of the 27 351 responses to the Class Questionnaire had a free description which was analyzed using sentiment analysis, targeting the co-occurrence of classes classified as Current Questionnaire, Graduation Questionnaire, and Other classes. There were 66 classes with no responses in both Questionnaires (¬AΛ¬B), including classes such as "Mathematics III" and "Regional Development Course." It is also noteworthy that the Current and Graduation Questionnaire students differed in their data, given that classes taken by the final-year 2022 students who responded to the Graduation Questionnaire included classes that are not currently offered.

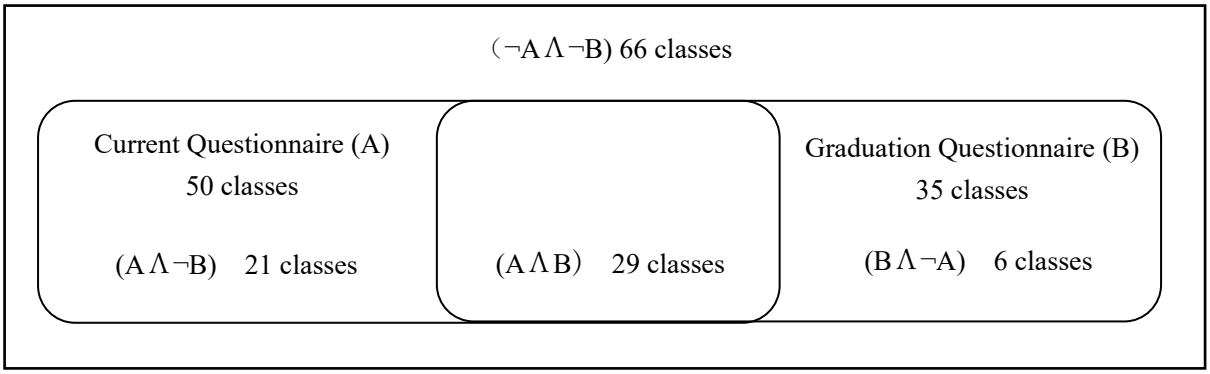

Figure 7. Relationship between Current and Graduation Questionnaires, and Other Classes

4.3.2 Classes Selected in Current Questionnaire

This section analyzes the free descriptions in the Class Questionnaire for the classes selected in the Current Questionnaire (A), and for Other classes (BΛ¬A, ¬AΛ¬B). Table 3 shows the number of positive and negative comments in the free description and their respective percentages of the total number of comments.

Table 3. Summary of Analysis Data for Free Descriptions (Current Questionnaire and Others)

	Classes selected in Current Questionnaire （A）	Other Classes (BΛ¬A, ¬AΛ¬B)
Number of emotions	12 085	482
Positive comments (%)	8 276 (68.48%)	286 (59.34%)
Negative comments (%)	2 999 (24.82%)	164 (34.02%)
No emotion demonstrated (%)	810 (6.7%)	32 (6.64%)

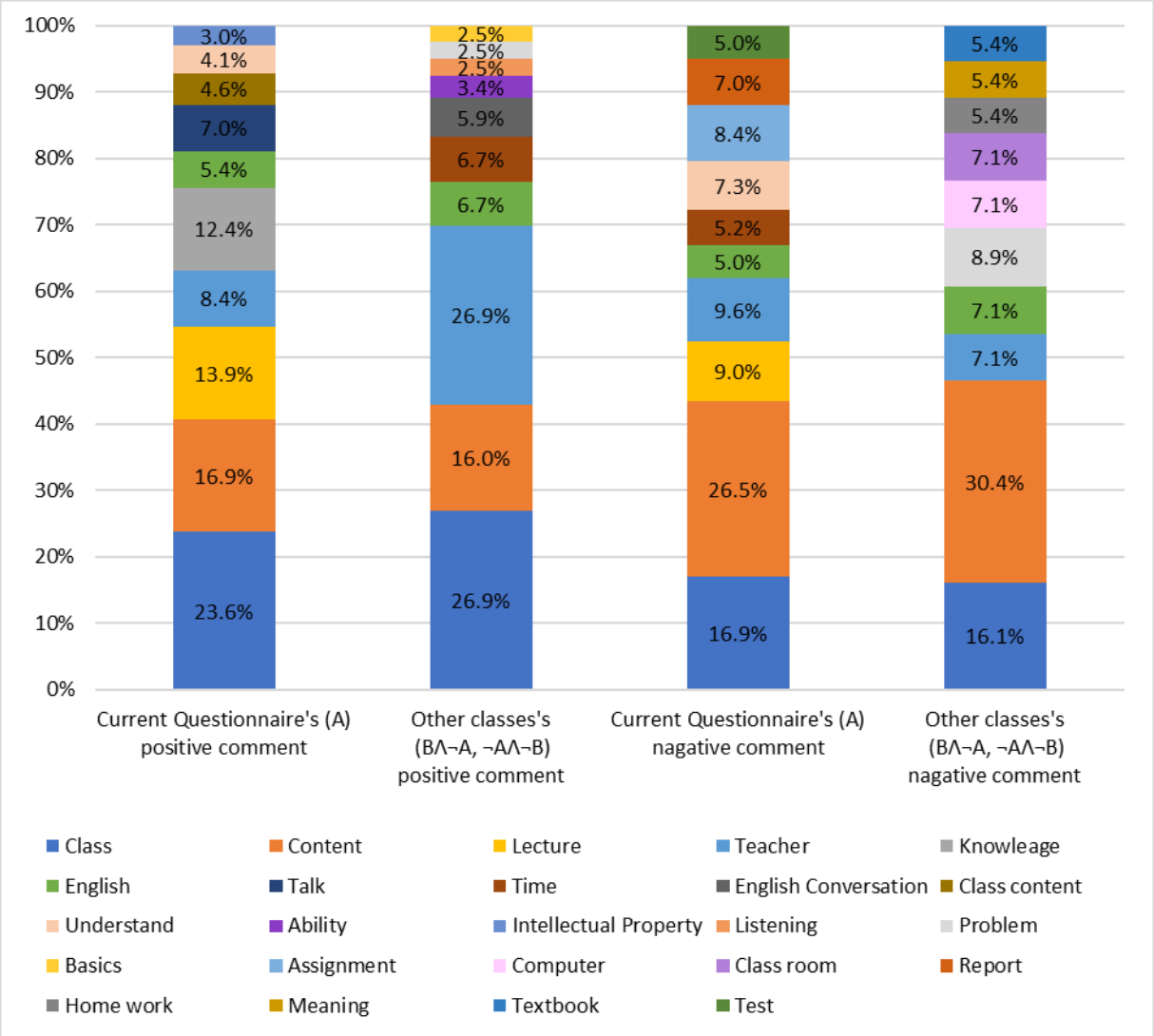

Figure 8. Positive and Negative Comment Details of Classes Selected in Current Questionnaire and Other Classes

This section confirms the degree of positive and negative emotions in the sentiment analysis of the Current Questionnaire classes (A) and Other classes (BΛ¬A, ¬AΛ¬B). Figure 8 shows

the results for positive and negative emotions words. Presenting the results for positive emotions indicates that for Current Questionnaire classes (A), "class," "content," and "lectures" are ranked at 54.4%, while they are ranked at 42.9% for Other classes (BΛ¬A, ¬AΛ¬B). In Other classes (BΛ¬A, ¬AΛ¬B), "teacher" ranked higher than "class" and "content". For negative emotions, "computer," "classroom," and "textbook" tended to be included in the content for Other classes (BΛ¬A, ¬AΛ¬B).

4.3.3 Classes Selected in Graduation Questionnaire

This section analyzes the free descriptions in the Class Questionnaire for the classes selected in the Graduation Questionnaire (B) and for Other classes (AΛ¬B, ¬AΛ¬B). Table 4 shows the number of positive and negative comments in the free descriptions, and their respective percentages of the total number of comments.

Table 4. Summary of Analysis Data for Free Descriptions (Graduation Questionnaire and Others)

	Classes selected in Graduation Questionnaire (B)	Other Classes (AΛ¬B, ¬AΛ¬B)
Number of emotions	7 305	5 262
Positive comments (%)	5 025 (68.79%)	3 537 (67.22%)
Negative comments (%)	1 787 (24.46%)	1 376 (26.15%)
No emotion demonstrated (%)	493 (6.75%)	349 (6.63%)

This section confirms the degree of positive and negative emotions in the sentiment analysis of Graduation Questionnaire classes (B) and Other classes (AΛ¬B, ¬AΛ¬B). Figure 9 shows the results for positive and negative emotion words. Presenting the results for positive emotions with "class," "content," and "lecture" ranking at 58.6% for Graduation Questionnaire classes (B), and 46.6% for Other classes (AΛ¬B, ¬AΛ¬B), all of which are high. For negative emotions, "content," "class," and "teacher" appeared more frequently in Graduation Questionnaire classes (B) and Other classes (AΛ¬B, ¬AΛ¬B), with no significant differences.

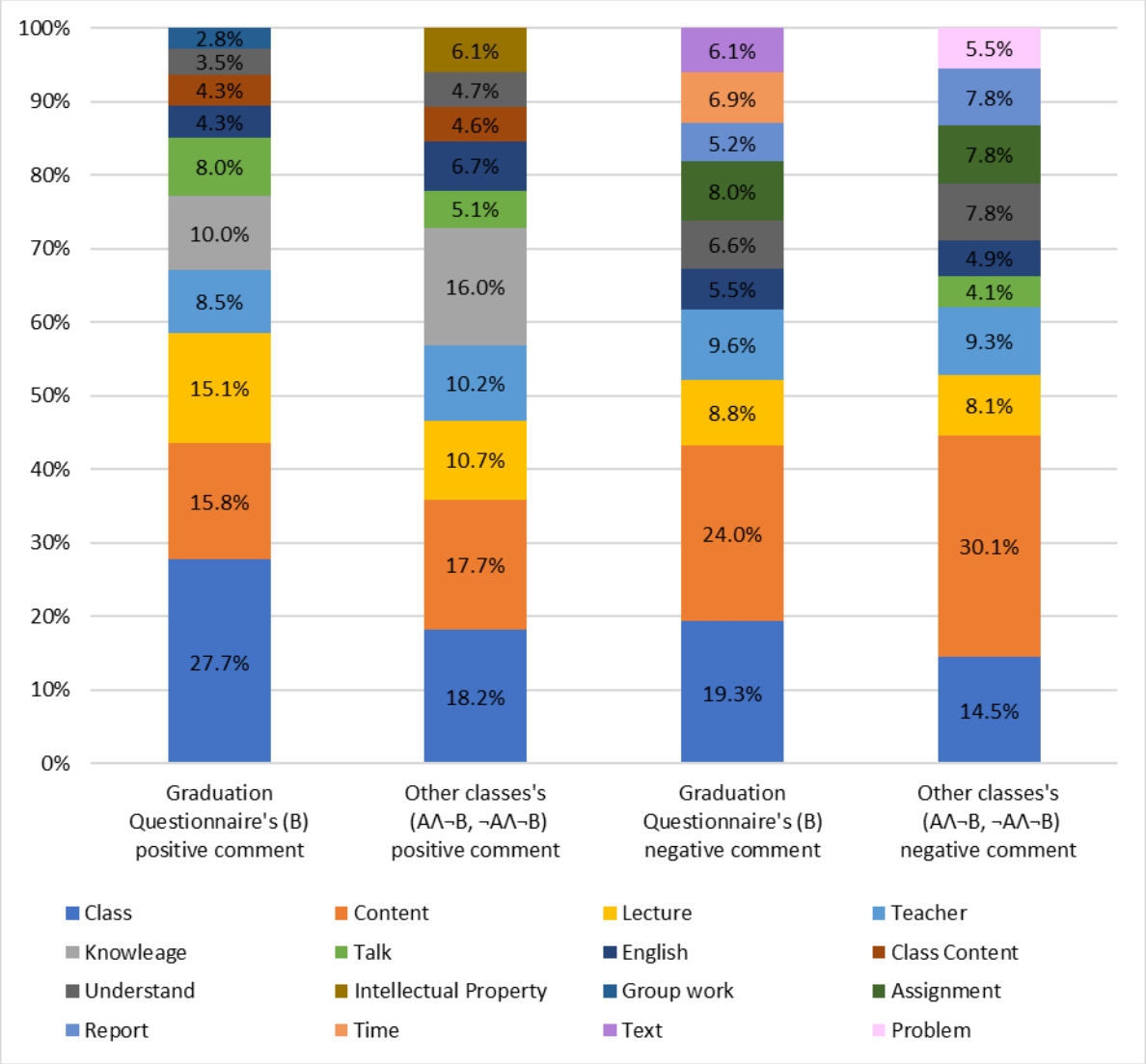

Figure 9. Positive and Negative Comment Details of Classes Selected in Graduation Questionnaire and Other Classes

5. Characteristics Analysis of Classes Selected in Current Questionnaire and Graduation Questionnaire

5.1 Comparison of Classes Selected in Current and Graduation Questionnaires by Gender

Given that there were no clear differences between the classes that were selected and those that were not, this study conducted a gender analysis on the Current and Graduation Questionnaires. The results are shown in Figure 10 for males, and Figure 11 for females. The top five class name responses in each survey are presented, together with the number of responses in parentheses. The order in parentheses is Current Questionnaire followed by Graduation Questionnaire.

"Mathematics" was selected by males in both questionnaires, but not by females (Figure 10,

(AΛB)). Foreign language classes were selected by both males and females in the Current and Graduation Questionnaires. Here, some difference was found between the male and female students.

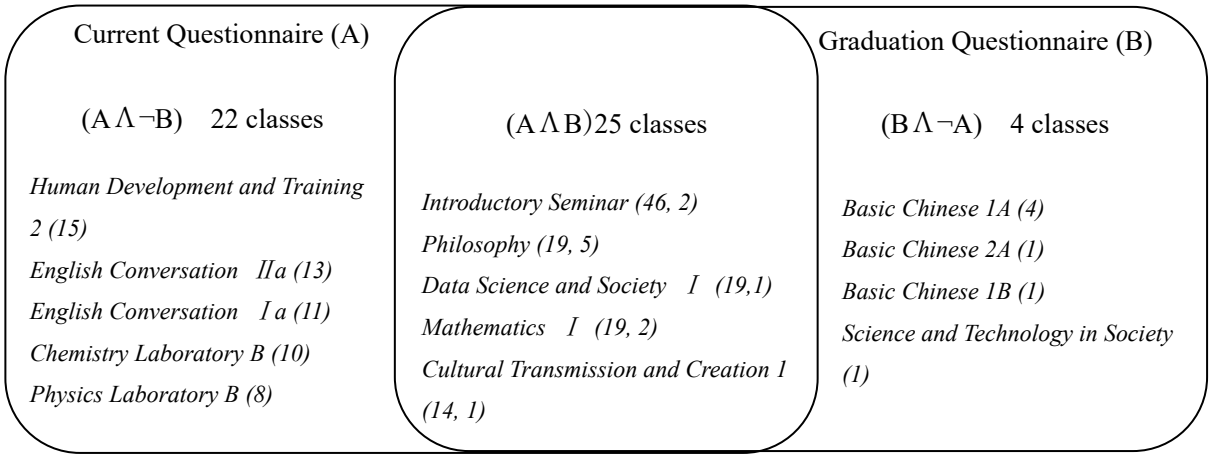

Figure 10. Relationship between Current and Graduation Questionnaires (male)

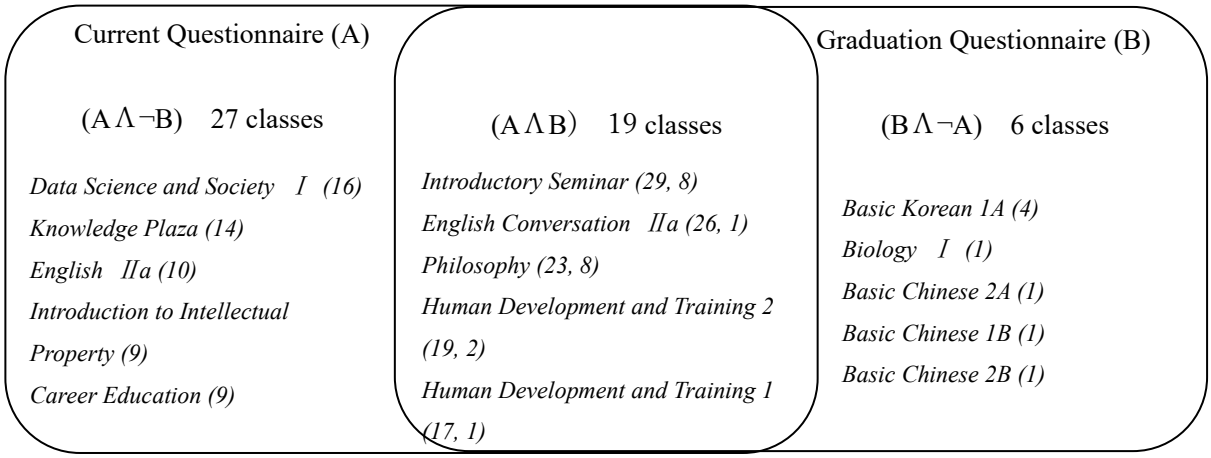

Figure 11. Relationship between Current and Graduation Questionnaire (female)

5.2 Comparison of classes selected in Current and Graduation Questionnaires by faculty

To find differences between classes, the Current and Graduation Questionnaires were analyzed by categorizing the respondents according to their faculty. Faculties of Humanities and Economics were categorized as "Humanities and Social Sciences," while those of Engineering and Science were categorized as "Natural Sciences." The results are shown in Figure 12 for Humanities and Social Sciences, and Figure 13 for Natural Sciences. The top five class name responses in each survey are presented, together with the number of responses in parentheses. The order in parentheses is Current Questionnaire followed by

Graduation Questionnaire.

Students from Humanities and Social Sciences selected foreign language classes in the Graduation Questionnaire (Figure 12, (B)), while Natural Sciences students selected language classes in the Current Questionnaire (Figure 13 (A)). This was a difference between the two types of students.

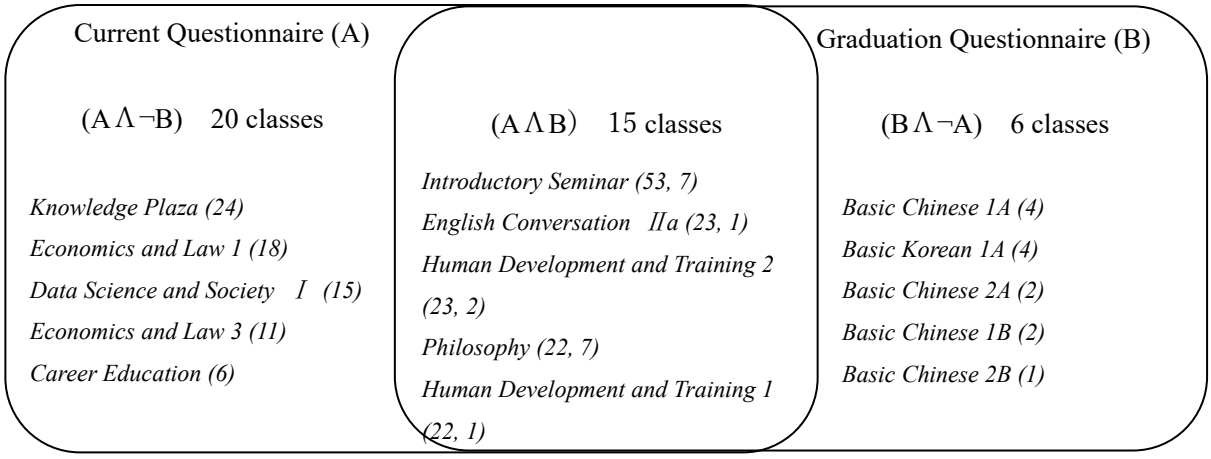

Figure 12. Relationship between Current and Graduation Questionnaires (Humanities and Social Sciences)

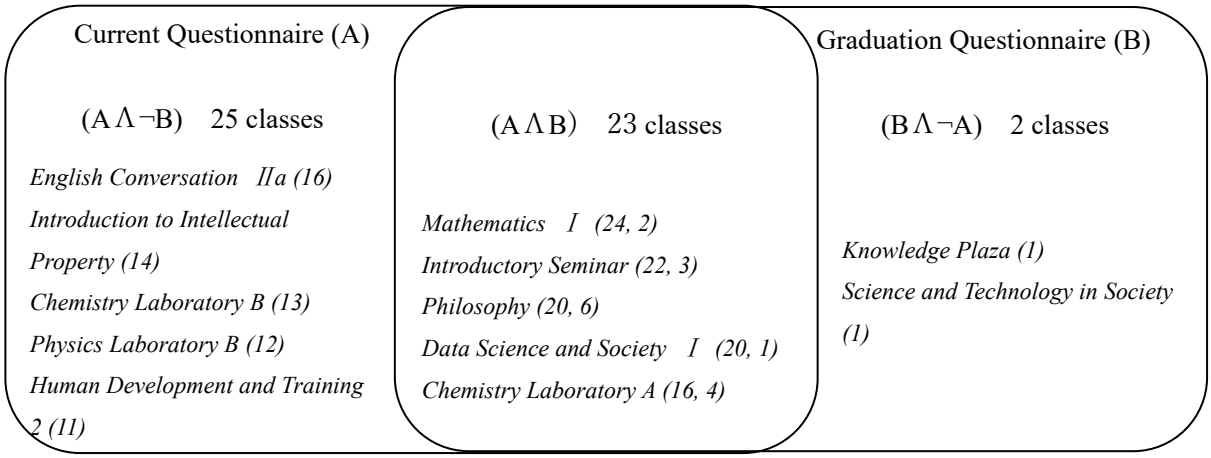

Figure 13. Relationship between Current and Graduation Questionnaires (Natural Sciences)

6. Discussion

6.1 Characteristics of Impressive Classes

This study aimed to understand the characteristics that make classes memorable and useful

for university students. Students questioned a few months after their class (Current Questionnaire) ranked highly classes in which they conducted experiments and in which they tackled content for the first time after entering university. The classes selected in both the Current and Graduation Questionnaires tended to include skills to be acquired by university students, classes that allowed for deeper study based on previous knowledge, and language-related classes. The results of the Graduation Questionnaire showed that language-related classes accounted for most highly rated classes. These results suggest that classes most memorable in the long term tend to be those in which students apply their knowledge, rather than those in which they acquire one-way knowledge. In addition, 29 classes were selected for both the Current and Graduation Questionnaires; indicating that it is possible to determine which classes leave a lasting impression on students and remain in their long-term memory from a Current Questionnaire, rather than waiting for the Graduation Questionnaire. Resultantly, if learning outcomes are discovered early, the perspectives can be used to encourage good elements and improve bad points.

6.2 Factors of Impressive Classes

When examining the reasons students were impressed with classes, no significant differences were observed between the Current and Graduate Questionnaires. However, the frequent occurrence of “class,” “content,” and “lecture” in the positive emotions of both surveys suggests that class content is important.

Similarly, when comparing differences in positive and negative emotions between the classes selected or not selected in each questionnaire, “class” and “content” tended to appear in approximately half of the positive content. As such, class content was found to be the most important factor in creating a lasting impression.

6.3 Comparison of Impressive Classes by Category

When students' impressions of classes were categorized by gender (male vs. female) or faculty, (Humanities and Social Sciences vs. Natural Sciences) no major differences were found. However, even when categorizing classes from different perspectives, many of the classes overlapped between the Current and Graduation Questionnaires, which is similar to the results of Section 4.1. From this perspective, it is possible to identify classes that leave a lasting impression at an early stage of the program.

6.4 What Are Impressive Classes

Thus, classes that leave a lasting impression are often the same between the Current and Graduation Questionnaires, and it is possible to find classes to be improved at the Current Questionnaire stage. Alongside analyzing teachers' impressions, as in previous studies, it was found that it is possible to find impressive factors by analyzing classes. Numerous positive comments in the free description could be used as points of improvement for classes that were not selected. There was no difference in the negative comments between the classes that were selected and those that were not, indicating that the points requiring improvement in all classes are fundamental regardless of whether they are memorable or not.

In this study, it was possible to use questionnaires answered by students in the same academic year for the Class and Current Questionnaires. However, the Graduation Questionnaire contains data relating to three years before the current academic year and was administered to a different student cohort. It also included significant changes in the classes over time. By continuing this study, it will be possible to compare the results of the Graduation Questionnaire with those of the same students, and to capture changes over time in each subject area. In the future, we will analyze the free descriptions in greater depth to discover areas and directions for improvement.

7. Conclusion

This study was conducted to define classes in which students did not forget what they had learned even after a long period of time and considered these as highly rated classes. Highly rated classes and their characteristics were found in existing questionnaires rather than in new questionnaires, which would have been burdensome for students. Therefore, “not forgotten even after a long period of time” was substituted for “classes that left a lasting impression on students” in the existing questionnaire.

To determine the characteristics of classes that left a lasting impression on students, Class Questionnaire (immediately after taking a class), Current Questionnaire (several months after taking a class), and Graduation Questionnaire (several years after taking a class) were analyzed. Through this analysis, the factors that contributed to students' lasting impressions of classes were identified.

Many classes that left a lasting impression on students were the same in both the Current and Graduation Questionnaires, and classes that left a lasting impression after several months were often still memorable several years later. If the learning outcomes can be discovered at an early stage, rather than several years later, as at graduation, it can contribute to decision making for educational improvement. The most common factors that remain impressive are the descriptions of class content. It is possible to use the positive content written about these as good points and the negative content as points for improvement and use them to design better classes.

If the results of this study are used effectively, efforts such as improvements in classes that do not remain in long-term memory can begin in a few months and can be implemented in the following year.

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No additional data are available.