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A study on the Types of Students' Perceptions of Engineering Education Accreditation

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Abstract

This study explored university students' perceptions of engineering education accreditation using Q methodology and targeted 15 engineering students. The PC QUANL program was employed for data analysis. Based on the data analysis, university students' perceptions of engineering education accreditation were classified into three types. Among a total of 15 subjects, 10 belonged to type 1, three to type 2, and two to type 3. The three types were named "complaint avoidant type", "value recognition participatory type", and "supplementation demand type", respectively, depending on their individual characteristics. The avoidant complaint type were skeptical about engineering education accreditation. This complaint originated from the difficulty in participating in diverse extracurricular programs because of excessive credit hours. The value recognition participatory type recognized the need for engineering education accreditation and was positive about being provided an opportunity to obtain a job and learn. In particular, upper graders found the program more valuable than lower graders. The supplementation demand type found engineering education accreditation valuable and necessary; however, they wanted to quit owing to the heavy workload of credits and expressed dissatisfaction with the supplementation of the program. We expect that these study results will serve as basic data to improve the quality of accreditation programs in future by helping to understand the perception structure of engineering education accreditation.

Keywords: engineering education, accreditation, Q method, engineering students, perceptions

1. Introduction

Engineering education accreditation is a system created for evaluating the education curriculum in engineering colleges and certifies that the graduates who complete the curriculum can competently satisfy the demands of the industry and the global standards. The Accreditation Board for Engineering Education of Korea enacted the accreditation standard on its establishment in 1999 and implemented demonstration authentication in two universities and started engineering education accreditation the same year(1). Engineering education accreditation in Korea suggested program standards and guidelines for imparting engineering education in universities and implemented accreditation and consultation to promote its development. Through this, efforts have been made to deploy and foster engineering personnel with the practical engineering skills required by companies(2).

Additionally, the number of companies granting benefits to graduates participating in the accreditation program increases substantially, and connections were established with certificate systems. From the students' viewpoint, engineering education accreditation entails benefits that can help them gain opportunities, such as enhancing their creative problem-solving abilities through program learnability and

achievement, securing dominance in employment competitiveness, and creating an equivalence of academic degrees among various countries through demand-oriented education. However, in reality, the conditions are strict and difficult as the departments maintain and operate the accreditation system with regular assessment, and the students have to complete it to graduate with the accreditation. Nevertheless, certain restrictions cause the students to doubt the accreditation's effectiveness and necessity. Owing to insufficient social awareness and a lack of understanding about the effectiveness of the accreditation system, fewer universities are participating in it and the programs are also decreasing(3).

Since the Fourth Industrial Revolution, both our future and present industries have been changing. Accordingly, school education should also change in line with this transformation. There is a limit to only delivery of knowledge. At this juncture, there is a need for individuals capable of creative problem-solving. The education curriculum of engineering colleges utilizes the engineering education accreditation program to fill out teaching portfolios or CQI reports to systematically manage the students' academic achievements based on their learning goals and performances(3).

However, such a system is heavily reliant on knowledge achievement, and cannot evaluate the formative degree of the affective domain, such as learning motivation, learning attitude, and values (4). To date, the quality of engineering education was controlled and managed by the certification center of the institution or government agencies at the national level (5). Engineering education accreditation should be a program that can not only fulfil the current requirements but also foster students with future competence as engineering specialists. Earlier research performed on engineering education accreditation includes a study on the attitudes toward convergence with engineering education accreditation (4) a recognition study on the way engineering students understand engineering (6),

Diagnosis research on engineering education accreditation (7), analysis of the current education scenario for engineering education accreditation (8), study on the effective operational plans of engineering education accreditation (9), consideration of the improvement points of engineering education accreditation, an analysis research about the improvement point of engineering education accreditation, an analysis research about the curriculum of engineering education accreditation (10, 11), an outcomes research about engineering education accreditation (12, 13), and research on the academic improvement of under-achieving students and a research about learning abilities and interpretation of engineering education accreditation (14 -17). As most of the preceding research focused on the present status of engineering education accreditation and an institutional approach to its operation, it was difficult to find research that explored the subjective perception of students who have personally participated in the program and become its autonomous subjects. In particular, qualitative research that can function as a basis for evaluation tool development and identify the essence of the experiences of university students in the engineering education accreditation system is lacking. For the effective operation of the engineering education accreditation system, prior research on the students' experiences and their perception of the engineering education accreditation program is desirable. Based on this, institutional improvement and systematic operation can be applied in line with reality, help achieve the goals of the engineering education accreditation program, and enhance the students' satisfaction levels.

A research method that is appropriate for achieving the research goal is Q Methodology. Q Methodology is based upon a premise that human experiences have special meanings and suitability structure in the society, so the essence of human beings and the social phenomenon cannot be understood properly if human subjectivity is excluded, and an approach of understanding internally is selected rather than explaining

externally about the social reality(18). While positivism research focuses on the principles of objectivity and explains the world quantitatively, analytics, phenomenology, and critical theory which are grounded on antinaturalism have been focused on aiming to understand the world qualitatively. Q Methodology is a way of understanding to overcome the limits and errors of empiricism and it is distant from ambiguous and at times, fascinating interpretation methods like analytics or phenomenology while it functions as a bridge between quantitative and qualitative research. It is considered that Q Methodology is an exceptional research method to measure the subjectivity of humans(18, 19).

Accordingly, Q methodology, which is fitting to deeply identify human experiential structures and components, was used to plan a recognition study on civil engineering students' perceptions of engineering education accreditation. The purpose of this study was to identify the types of perception and analyze and describe the properties of each type.

2. Contents

2.1. Research Method

2.1.1 Research Design

We conducted an exploratory research to identify the perception types of university students in the Department of Civil Engineering regarding engineering education accreditation by applying Q methodology.

2.1.2 Q Population and Q Sample Constitution

For statement extraction, prior domestic and foreign research during the period December 1, 2020 to December 31, 2020 was included, and personal in-depth interviews were conducted with five students in the Department of Civil Engineering.

Professors in the engineering education accreditation center of the Department of Civil Engineering recommended the subjects for the interviews, each of which spanned 2–3 h.

The interviews were conducted in empty lecture rooms and a seminar room in the accreditation center, and comprised the following questions: "Do you know about engineering education accreditation?", "Do you think that engineering education accreditation is necessary? If yes, could you explain why?", "What did you experience while you participated in the engineering education accreditation program?", "Could you explain about how engineering education accreditation was helpful to you?", "How can engineering education accreditation program improve?", "Please be honest and describe whether you think that engineering education accreditation program is required for enhancing the competence of students majoring in engineering". The interview was conducted until the contents reached a saturated state, and, the research subjects were re-interviewed to clarify their intended meaning in case of any additional post-interview queries. The interview contents were analyzed on the day of the interview.

Using the central meaning and literature review extracted in the interview, we derived 88 statements of the Q population, which were reviewed by two professors to arrange the Q sample. The researcher organized the statements that were considered to best represent the research topic, and the validity was reviewed by specialized engineering professors with considerable operational experience in engineering education accreditation, and 34 statements (Q samples) were finally selected, as shown in Table 1.

Table 1. Q Statements

Number	Statement
1	Engineering education accreditation is very helpful for practicum.
2	Engineering education accreditation makes the education curriculum of the department systematic.
3	Engineering education accreditation is helpful for getting a job.
4	Engineering education accreditation is not necessary.
5	Engineering education accreditation creates a big burden about credits.
6	Engineering education accreditation causes restrictions to study broadly for my major.
7	Engineering education accreditation makes it possible to gain different experiences (nonsubject program).
8	Engineering education accreditation provides detailed attention from the academic adviser.
9	Engineering education accreditation enhances coping skills in the employment field.
10	There is separation because the education does not reflect on the situation of the site.
11	I am proud of my department for implementing engineering education accreditation.
12	The professors in my department are putting in a lot of efforts because of engineering education accreditation.
13	There isn't a large variety of nonsubject programs.
14	Engineering education accreditation is helpful for studying abroad because it is recognized overseas.
15	My knowledge about my major improves through engineering education accreditation.
16	The education curriculum of engineering education accreditation is organized by stages.
17	Engineering education accreditation can improve in many ways.
18	I hope engineering education accreditation can improve into an education curriculum that can cultivate global insight.

19	I hope that there will be more electivesubjects to improve on diversity.
20	There are not enough elective subjects, so I hope it can expand.
21	There was a time when I wanted to give up on engineering education accreditation halfway.
22	It is difficult that there are many group assignments for engineering education accreditation.
23	Engineering education accreditation is helpful for the public promotion of admission.
24	Engineering education accreditation is effective for adapting to social changes.
25	I hope I can learn the newest trends in the field.
26	There are many major credits to take, so it is hard to participate in nonsubject programs.
27	I hope more convergence-based courses like civil engineering and new materials will be offered.
28	I hope that detailed major courses track will be established to cultivate students as the experts of the field.
29	Engineering education accreditation developed my teamwork and leadership.
30	Engineering education accreditation provides systematic management for students from freshman year.
31	Engineering education accreditation adds some additional points for employment, but it is not very helpful.
32	There should be a program to help students who fall behind or struggle along the process.
33	Group assignments are more interesting and helpful than individual assignments.
34	The value of engineering education accreditation can be learned as students advance to the higher academic year.

2.1.3 P Sampling

The Q methodology does not require a significant number of samples based on the small-sample theory. The samples were extracted randomly, and 15 university students from the Department of Civil Engineering were selected as the P samples.

2.1.4 Q Sorting

Fifteen students in the Department of Civil Engineering selected as the P samples were instructed to closely read the 34 statements selected as the Q sample and classify the statements into three groups based on if they agree or disagree with them, or are uncertain. Afterwards, the students read the three groups again, and classified the statements in order of agreement level (the most strongly agreed first). After similarly arranging the statements for disagreement, they were asked to arrange the statements where they had a neutral stance.

Based on the level of agreement with each statement, it was classified on a 9-point scale. Finally, the students had to record reasons for their selection of the most or least agreed statement. The students completed the survey questionnaire in approximately an hour.

2.1.5 Data Analysis Method

Data analysis was performed using the PC-QUANL program. For the data collected from the P samples (15 students), the relevant statements were identified and numerically scored as follows: -4 points as 1 point, -3 points as 2 points, -2 points as 3 points, -1 points as 4 points, 0 points as 5 points, +1 points as 6 points, +2 points as 7 points, +3 points as 8 points, and +4 points as 9 points. The results were divided into three types.

2.1.6 Ethical Considerations

Before interviewing the 15 research subjects, the research objectives and methods were explained to check for voluntary agreement. Confidentiality was ensured and the students were assured that the interview contents will be used for research purposes only. It was explained that the data collected during the research period will be encoded and saved in the computer, and deleted permanently after the research ends.

2.2 Research Results

2.2.1 Q Type

Three different types of results were identified after the analysis. Among the 15 subjects, 10 belonged to type 1, three to type 2, and two to type 3. Based on their characteristics, the types were classified as “complaint avoidance type”, “value recognition participatory type”, and “supplementation demand type”. Subjects displaying a high weight value for the characteristics of a specific type represent that type. The total variation was 0.4321, and it was identified that it had 43.21% explanation power of the entire variation.

The variables were 23%, 10%, and 7% for type 1, type 2, and type 3, respectively, and type 1 represented the highest student subjectivity about the engineering education accreditation program.

The factor weights for each type are listed in Table 4. The subjects consisted of 10 participants in type 1, 3 participants in type 2, and 2 participants in type 3; in each type, subjects with higher factor weights displayed typical characteristics of their affiliation type.

Table 2. Eigen value and variation percentage for each factor

	Factor 1	Factor 2	Factor 3
Eigen value	7.1406	4.1817	2.5062
% of variation	.2231	.1307	.0783
Cumulative frequency	.2231	.3538	.4321

Table 3. Correlation with types

	Type 1	Type 2	Type 3
Type 1	1.000		
Type 2	.137	1.000	
Type 3	.435	-.322	1.000

Table 4. General characteristics and factor weights of P sample for each type

Type	Rank	Subject	Factor weight	Age	Gender	Grade level	Participation period
I (n = 10)	1	8	1.5118	25	Male	3	2 years 9 months
	2	9	1.0094	24	Male	3	2 years 9 months
	3	14	.9561	24	Male	3	2 years 11 months
	4	10	.9550	25	Male	3	2 years 9 months
	5	15	.8782	24	Male	3	2 years 9 months
	6	3	.6976	24	Male	3	2 years 9 months
	7	6	.6238	25	Male	3	2 years 9 months
	8	4	.5251	25	Male	4	2 years 10

							months
	9	12	.3003	25	Male	3	2 years 10 months
	10	2	.2143	24	Male	4	2 years 9 months
II (n = 3)	1	13	1.4946	23	Male	3	2 years 9 months
	2	7	1.0587	24	Male	3	2 years 9 months
	3	1	.5792	25	Male	3	2 years 9 months
III (n = 2)	1	5	.8780	25	Male	3	2 years 7 months
	2	11	.3494	24	Male	3	2 years 9 months

2.2.2 Characteristics for Each Type

The following are the subjectivity characteristics of each type among the civil engineering students with regard to the engineering education accreditation program.

1)Type 1: "Complaint Avoidance Type"

The items most strongly agreed with by Type 1 subjects were: "26. There are many major credits to take, so it is hard to participate in nonsubject programs (Z-score = 2.114); "16. The education curriculum of engineering education accreditation is organized by stages (Z-score = 1.755)"; and "25. I hope I can learn the latest tendencies in the field (Z-score = 1.406)". The items that the subjects of this type disagreed with most strongly were "7. Engineering education accreditation makes it possible to gain different experiences (nonsubject program) (Z-score = -2.426)"; "22. It is difficult that there are many group assignments for engineering education accreditation (Z-score = -1.633)"; and "29. Engineering education accreditation developed my teamwork and leadership (Z-score=-1.614)".

Subject 8 had the strongest representative nature of type 1, with the most agreed items being "26. There are many major credits to take, so it is hard to participate in nonsubject programs" and "20. There are not enough elective subjects, so I hope it can expand", and the subject testified that it is because he cannot take the preferred elective courses, and although he wants to meet students in other departments, he cannot meet them because he has numerous credits to take. The subject disagreed most strongly with "3. Engineering education accreditation is helpful for getting a job" and "7. Engineering education accreditation makes it possible to gain different experiences (nonsubject program)" because the subject considered himself under control several times because of the engineering education accreditation and not being able to set up his time schedule freely. Although there are several programs, such as special lectures, it felt the difference

between the time it was promoted and when he actually attends the program.

In the case of subject 9, who showed the next highest representative nature, the items that the subject agreed with most strongly were “6. Engineering education accreditation causes restrictions to study broadly for my major” and “26. There are many major credits to take, so it is hard to participate in nonsubject programs”. While sharing his experience, the subject explained that he was restricted from taking the courses that he wanted because of the engineering education accreditation and, occasionally, he had to forego his credits, which made it hard for him to sign up for courses arbitrarily. The items that the subject disagreed with most strongly were “27. I hope more convergence-based courses like civil engineering and new materials will be offered” and “7. Engineering education accreditation makes it possible to gain different experiences (nonsubject program)”; because the subject believed that engineering education accreditation restricts students from gaining various experiences as it forces them to forego credits; he testified that it is important to operate the system in line with the major of the department and employment in the future instead of using a convergent curriculum and hoped that a preparation class will be started for the qualification of certificates.

The type 1 subjects expressed doubts about the engineering education accreditation, and mostly complained that they had to obtain numerous credits because of being a part of the engineering education accreditation. They perceived more negative than positive aspects to the accreditation and believed it hard for them to participate in various nonsubject programs because of the large number of credits required for engineering education accreditation. Their responses are in completely contrast to those of type 2, and a big difference was observed in the responses of subjects in the lower grade level who lacked understanding about the engineering education accreditation, and hence were unaware of its importance, and those in higher grade levels who perceived the value of the engineering education accreditation more strongly. However, as 10 out of the 15 subjects were type 1, this type had the largest number of students. Students were unaware of the reasons for the necessity of engineering education accreditation and expressed complaints; therefore, type 1 was named as “complaint avoidance type”.

Table 5. Type 1: “Complaint avoidance type”

Statement and standard score for type 1 (above ± 1.00)				
Number	**Statement**	**Standard score**		
		Z-score	**Average**	**Difference**
26	There are many major credits to take, so it is hard to participate in nonsubject programs.	2.114	.245	1.869
16	The education curriculum of engineering education accreditation is organized by stages.	1.755	-.265	2.020
25	I hope I can learn the newest trends in the field.	1.406	.996	.410
13	There isn't a large variety of nonsubject programs.	1.119	-.214	1.334
23	Engineering education accreditation is helpful for the public promotion of admission.	-1.110	-.444	-.666

29	Engineering education accreditation developed my teamwork and leadership.	-1.614	-.458	-1.156
22	It is difficult that there are many group assignments for engineering education accreditation.	-1.633	-.281	-1.352

2)Type 2: "Value Recognition Participatory Type"

The items that the subjects of Type 2 agreed with most strongly were "12. The professors in my department are putting in a lot of efforts because of engineering education accreditation (Z-score = 1.853)", "34. The value of engineering education accreditation can be learned as students advance to the higher academic year (Z-score = 1.643)", and "3. Engineering education accreditation is helpful for getting a job (Z-score = 1.489)"; the items that they disagreed with most strongly were "6. Engineering education accreditation causes restrictions to study broadly for my major (Z-score = -1.861)", "31. Engineering education accreditation adds some additional points for employment, but it is not very helpful (Z-score = -1.853)", and "4. Engineering education accreditation is not necessary (Z-score = -1.563)".

Subject 13 had the strongest representative nature of type 2, and the items that the subject agreed with the most were "12. The professors in my department are putting in a lot of efforts because of engineering education accreditation" and "11. I am proud of my department for implementing engineering education accreditation". This is because of the subject's opinion that participating in the engineering education accreditation was helpful and a pride of the department; however, the professors appeared to be facing difficulties because of the larger number of things to do. The items that the subject disagreed with most strongly were "4. Engineering education accreditation is not necessary" and "31. Engineering education accreditation adds some additional points for employment, but it is not very helpful". This is because engineering education accreditation is a necessity for the department, and even if the engineering education accreditation does not provide immediate support to the graduated students, the subject was convinced that it would be helpful in the long run.

Subject 7, who showed the next highest representative nature, agreed most strongly with "34. The value of engineering education accreditation can be learned as students advance to the higher academic year" and "27. I hope more convergence-based courses like civil engineering and new materials will be offered", because of his opinion that the value of the engineering education accreditation can be realized at a higher grade level. Sharing his personal experience, the subject stated that he was also unaware of the value of the engineering education accreditation back in his time as a freshman because nobody had explained it to him; however, after advancing to a higher grade level, he felt a strong need to complete the engineering education accreditation. He also stated that convergence-based courses such as engineering and new materials will expand the knowledge on majors and career choices and will be helpful for students.

The subject disagreed most strongly with "6. Engineering education accreditation causes restrictions to study broadly for my major" and "32. There should be a program to help students who fall behind or struggle along the process". This is because students study considerably for their major through the engineering education accreditation, and with programs already available for students struggling with their studies, any additional program is unnecessary.

The subjects in type 2 responded that engineering education accreditation is necessary and perceived

that although engineering education accreditation requires a considerable effort from the professors, it was helpful for employment and the accreditation provided various opportunities to learn. Specifically, as they responded that the value of the engineering education accreditation can be better recognized as students advance in their grade level, and actively participate in the engineering education accreditation program, type 3 was named the "value recognition participatory type".

Table 6. Type 2: "Value Recognition Participatory Type"

Statement and standard score for type 2 (above ± 1.00)				
Number	**Statement**	**Standard score**		
		Z-score	**Average**	**Difference**
12	The professors in my department are putting in a lot of efforts because of engineering education accreditation.	1.853	.693	1.159
34	The value of engineering education accreditation can be learned as students advance to the higher academic year.	1.643	-.777	2.420
3	Engineering education accreditation is helpful for getting a job.	1.489	-1.496	2.985
2	Engineering education accreditation makes the education curriculum of the department systematic.	1.462	-.174	1.636
27	hope more convergence-based courses like civil engineering and new materials will be offered.	1.016	-.414	1.430
13	There isn't a large variety of nonsubject programs.	-1.271	.981	-2.252
20	There are not enough elective subjects, so I hope it can expand.	-1.317	.626	-1.943
10	There is separation because the education does not reflect on the situation of the site.	-1.462	-.536	-.926
4	Engineering education accreditation is not necessary.	-1.563	.499	-2.062

3)Type 3: "Supplementation Demand Type"

The items that the subjects of type 3 agreed with most strongly were "5. Engineering education accreditation creates a big burden about credits (Z-score = 1.841)", "32. There should be a program to help students who fall behind or struggle along the process (Z-score = 1.610)", and "17. Engineering education accreditation can improve in many ways (Z-score = 1.457)"; the items disagreed with most strongly were "3. Engineering education accreditation is helpful for getting a job (Z-score = -2.147)", "24. Engineering education accreditation is effective for adapting to social changes", and "33. Group assignments are more interesting and helpful than individual assignments (Z-score = -1.226)".

Subject 5 had the strongest representative nature of type 3, and agreed most strongly with "14. Engineering education accreditation is helpful for studying abroad because it is recognized overseas" and "5. Engineering education accreditation creates a big burden on credits", because of the belief that the biggest merit of engineering education accreditation is the benefits accrued when advancing overseas, several credits are required to graduate because of the engineering education accreditation, and the heavy course work restricts the students from joining in nonsubject programs or other experiences.

The subject disagreed most strongly with "7. Engineering education accreditation makes it possible to gain different experiences (nonsubject program)" and "3. Engineering education accreditation is helpful for getting a job". The subject explained that although engineering education accreditation help in employment, excess participation in nonsubject programs caused difficulties in completing academic work and it would be fair if the improvement points of the engineering education accreditation can be supplemented. Subject 11 strongly agreed with "25. I hope I can learn the newest trends in the field" and "28. I hope that detailed major courses track will be established to cultivate students as the experts of the field". He reasoned that students have to be aware of the recent trends in the field and customized education must be provided to assist in employment; therefore, the education content of the engineering education accreditation should include the newest trends.

The items that the subject disagreed with most strongly were "3. Engineering education accreditation is helpful for getting a job" and "31. Engineering education accreditation adds some additional points for employment, but it is not very helpful", with the subject explaining that he was unsure of the helpfulness of the accreditation in getting a job and is not easily identifiable, which makes its recognition difficult to achieve.

The subjects of type 3 recognized the value of the engineering education accreditation and the necessity of the program because of its overseas accreditation. However, program places a large burden on the students for achievement of credits and makes them want to give up during its duration; therefore, they perceived that the current engineering education accreditation program should be maintained, but supplemented and improved. Simultaneously, as the subjects did not consider engineering education accreditation contributing to a sure enhancement in the quality of education, they were not fully convinced about the reason for participating in engineering education accreditation in their department. Therefore, type 3 was named the "supplementation demand type".

Table 7. Type 3: "Supplementation Demand Type"

Statement and standard score for type 3 (above ± 1.00)				
Number	**Statement**	**Standard score**		
		Z-score	**Average**	**Difference**
5	Engineering education accreditation creates a big burden about credits.	1.841	.061	1.780
32	There should be a program to help students who fall behind or struggle along the process.	1.610	-.166	1.776
17	Engineering education accreditation can improve in many ways.	1.457	.136	1.321

14	Engineering education accreditation is helpful for studying abroad because it is recognized overseas.	1.383	-.125	1.508
19	I hope that there will be more elective subjects to improve on diversity.	1.304	.537	.768
21	There was a time when I wanted to give up on engineering education accreditation halfway.	1.073	.036	1.037
30	Engineering education accreditation provides systematic management for students from freshman year.	-1.073	.758	-1.831
2	Engineering education accreditation make the education curriculum of the department systematic.	-1.152	1.133	-2.285
33	Group assignments are more interesting and helpful than individual assignments.	-1.226	-.280	-.946
24	Engineering education accreditation is effective for adapting to social changes.	-1.457	-.541	-.916

4)Consistent Items Among the Types

Table 8 displays the statements with common high or low scores for each type. The subjects of all types agreed with the items “25. I want to learn the newest trends on the site (Z-score =1.13)” and “18. I hope that it can be improved into an education curriculum that can foster global insight (Z-score =.20)”; the items disagreed with most strongly were “23. Engineering education accreditation is helpful for promoting entrance examination (Z-score =-.67)”, “9. Engineering education accreditation improves the response to cope in the employment field (Z-score =-.35)”. Accordingly, the students anticipated that the engineering education accreditation would help them learn the newest trends in the field and also provide opportunities to foster global insight; however, they did not consider it as helpful for employment or promotion of entrance examination in reality.

Table 8.Consistent Items among the Three Types

Number	Q-statement	Average Z-score
25	I want to learn the newest trends on the site.	1.13
18	I hope that it can improve into an education curriculum that can foster global insight.	.20
9	Engineering education accreditation improves the response to cope in the employment field.	-.35
23	Engineering education accreditation is helpful for promoting entrance examination.	-.67

3. Discussion

This study targeted university students (freshmen to juniors and seniors) participating in an engineering education accreditation program in the Department of Civil Engineering, and applied Q methodology to explore how they recognize engineering education accreditation. Fifteen students participated in the study, and in-depth interviews were conducted with five to derive the statements. The interviews were conducted until the content reached a saturated state, and were then integrated with previous research data to derive 34 statements. The students in the Department of Civil Engineering selected as the P samples were instructed to closely read the 34 statements selected as the Q sample and first divide them into three groups: statements that they agree with, disagree with, or are uncertain about.

Afterwards, the students repetitively read the three groups and further classified the agreement group in a decreasing order of strength(starting with most strongly agreed statements). A similar process was followed for the disagreement and neutral statement groups. The data was then analyzed using the PC-QUANL program. The results were classified into three types. Among the 15 subjects, 10 were analyzed as type 1, three as type 2, and two as type 3. Based on their characteristics, the three types were classified into “complaint avoidance type”, “value recognition participatory type”, and “supplementation demand type”, respectively.

Type 1 (complaint avoidance type) subjects were skeptical about the engineering education accreditation because of feeling tremendous pressure to obtain several credits and complete numerous group projects as part of the accreditation program, and did not think that it improved their leadership or teamwork. Instead, they considered taking multiple credits placed restrictions on them to participate in nonsubject programs, leading to grievances. They perceived that engineering education accreditation had more negative than positive aspects and that it was not very helpful for promoting entrance examinations. The subjects in type 1 were mostly in the higher school year, such as juniors and seniors.

Subjects of types 2 and 3 did not include seniors. The earlier results totally contradict those for type 2. Type 2 subjects claimed that students in lower school years lacked an understanding of engineering education accreditation and were ignorant of its importance; however, its value was acknowledged as they advanced to higher school years and recognized the necessity of the accreditation. From these responses, the significant differences between the two types are evident. However, 10 out of 15 subjects were type 1, which comprised the largest number of students. Students were not convinced about the necessity of engineering education accreditation and were doubtful and complaining about the program. In contrast, type 2 (value recognition participatory type) subjects considered engineering education accreditation as necessary, and despite being hard for the professors owing to the considerable workload, they recognized its helpfulness for employment, and the provision of various opportunities to learn through the program. They believed that students realized the value of engineering education accreditation more after advancing into higher school years and actively joining the program.

Type 3 (supplementation demand type) subjects recognized the value of engineering education accreditation and the necessity of the program because of its overseas acknowledgment; however, they had problems with the heavy workload associated with taking credits and had even considered quitting midway through the program. Therefore, although they wanted the engineering education accreditation program to continue, it should be supplemented and improved. Simultaneously, in their opinion, the engineering education accreditation did not significantly contribute to enhancing the education quality, and hence were

doubtful about the need for learning engineering education accreditation in the department.

This research finding is consistent with the skeptical research results (20) in the field of civil engineering regarding current education. According to a report, new employees that entered companies after completing their school education satisfied only 26% of the companies' requirements based on the knowledge and techniques acquired in university when they were evaluated for their work capabilities. ,This indicates that engineering education is irrelevant to real working environments, causing companies to mistrust universities, because they have to spend tremendous amounts to re-educate their new employees (20).

To solve this problem, an engineering education accreditation program was introduced, and since 1999, program standards and guidelines have been designed and applied to engineering education. However, students appear to be unaware that the present engineering education accreditation program is key to solving the skill discrepancy between universities and industrial enterprises. Engineering education accreditation programs should be matched appropriately to education values and have measurable educational goals, which in turn should properly reflect the demands of the participants in terms of the program properties and demand-oriented educational achievement. Additionally, the program must regularly evaluate the educational goal achievement, to check whether the program is improving and being appropriately supplemented (21). Despite such justification, absolute support is required from the university headquarters in terms of the teaching staff, facilities, and funds, as each university is in a different situation, the willpower of the university headquarters and professors in the engineering major and their understanding of engineering education accreditation are highly vital.

In a study by Sung (2009), where the findings were contrary to the results of this study, a survey was conducted on university graduates and university officials about the outcomes for each subject in the engineering education accreditation program (22). The results showed a positive feedback that the engineering education accreditation program was helpful for employment, with a higher satisfaction level for major subjects (63.0%) than specialized liberal arts (42.5%). The students and university officials recognized the positive effects of the engineering education accreditation program on employment, work performance, and skill enhancement, and perceived that major subjects are more helpful than specialized liberal arts (23). Regarding the cause of the contradictory research results, it can be assumed that the cooperation and willpower of the instructors managing the programs and the cooperation of the university headquarters are crucial factors in the engineering education accreditation program. The participating professors in the engineering education accreditation program should not only continuously develop an innovative education curriculum that reflects the newest industry trends and apply it to student instruction but also unceasingly contemplate the direction of development.

The university headquarters should maintain their support to help realize these efforts. Outstanding cases can be identified from the new education model development research on architectural engineering education accreditation by Lee (2011). The research demonstrated how engineering education accreditation programs are introduced, and the department and professors consider improvement in education quality as their top priority and make efforts to settle it in the department (24).

Engineering education accreditation programs should develop into an education model that progress forward, and it is anticipated that our research findings will contribute toward that goal.

4. Conclusions

This study was an attempt to explore the perception of university students in the Department of Civil Engineering about engineering education accreditation, and by analyzing the research findings, the subjects were classified into three types. Among the 15 subjects, 10 subjects were classified as type 1, three as type 2, and two as type 3. The three types were classified as “complaint avoidance type”, “value recognition participatory type”, and “supplementation demand type”, respectively. According to the research findings, the students participating in the accreditation program were expecting a reduction in the overwhelming credits and active development of new field-centered programs, which they could join and apply it to their program to become employed in domestic and overseas companies and also increase their work efficiency.

Although students in the lower grade levels cannot recognize the necessity of engineering education accreditation, they realize its value as they advance to higher levels. Therefore, their perception of the engineering education accreditation should be reinforced from lower grade levels themselves and interviews should be conducted between the professors and students for systematic management until the students graduate to actively provide them opportunities to learn about engineering education accreditation. We suggest that various studies should be attempted by targeting students to improve the quality of the engineering education accreditation program, and necessary follow-up measures be taken to encourage students to join the result management of the engineering education accreditation program.

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References

Accredition board for engineering education of korea, www. abeek. or.kr

YS Jang, YW Kim, After the symposium on educational development and engineering certification in the civil engineering field, Journal of the Koreansociation of civil engineers 51,1.(2004), 70-73.

SH Han, JH KIM,Accreditation Board for Engineering Education of Korea for Architectural Engineering, Journal of the Architectural Institute of Korea, 57, 7.(2013), 26-29.

JK Lee, S Shin, ArifRachmatullah, MS Ha, “The Relationship of Engineering Education Accreditation Program”, Journal of the Korean Association for Science Education. 37.1, (2017) 113～123Application of Latent Class Analysis.

MY Ali1, SR Ya’akub, R Singh, “Quality Assurance in Engineering Education: Accreditation and Its Global Influence”, Proceedings of the 11th annual international conference on Industrial Engineering and Operations Management Singapore. (2021), 7-11.

Emily Towers, Jennifer A Simonovich, V Yevgeniya, Zastavker ‘Students’ Perceptions of the Engineering Profession and Implications for Interest in the Field’, 41st ASEE/IEEE Frontiers in Education Conference. (2011), 12-15.

SW Han, JH Kim, “Accreditation Board for Engineering Education of Korea for Architectural Engineering”. Architectural Institute of Korea. 57,7. (2013), 26-29.

SG Moon, “Survey and Analysis of the Present State of Education in Regard to the Accreditation in Engineering Education”. The Convergent Research Society Among Humanities, Sociology, Science and Technology. 6,1, (2013) 271-280.

Oh Teresa, “A Study on the Effective Managerial Schemes of an Accredited Engineering Program”. Cheongju

Univ. 29, 2. (2012), 289-294.

KJ Hwan, “Analysis of the Undergraduate GIS Course for Accreditation”. KOREA Spatial Information Society. 17, 1. (2009), 145-157.

HJ Chang, “A Study on Curriculum Development for General English for the ABEEK Program”, The English Teachers Association in Korea. 15, 1, (2009) 327-348.

JM Sung, SC Kang, DG Min, “A Survey Study on the Performance of Accreditation Program for Engineering Education”, Journal of Engineering Education Research. Korean Society for Engineering Education. 12.4, (2009) 102-114.

MJ Park, SJ Hong, “Engineering Students’ Perceptions of Accredited Engineering Program Performance”, Journal of Engineering Education Research. 18.4, (2015) 57-65.

DG Park, CB Sim, CS Kim, “KEC2005 Program Outcomes: Sound Interpretation and Understanding”. Korean Society for Engineering Education. 18, 3. (2015), 33-38.

CS Cho, JS Park, TS Kim, “Comments on Mathematics Diagnostic Tests and Education by Level for Under Achieving First Year Engineering Students”. The Korean Society of Mathematical Education. 25, 3. (2011), 593-606.

CS Cho, JS Park, TS Kim, “Comments on Mathematics Diagnostic Tests and Education by Level for Under Achieving First Year Engineering Students”. The Korean Society of Mathematical Education. (2012),1, 33-39.

JJ Jeon, “Requirement Analysis and Implementation of an Engineering Certification Program, CQI System”. The Korean Association of Computer Education. 17, 1. (2013), 131-134.

HG Kim, 8. Q Methodology and Theory: Political adequacy and applicability of Q Methodology, Journal of KSSSS, (2003), 5-19.

SU Kim,Theory and philosophy of Q methodology, Korean society and public administration 21,1. (2010), 1-25.

SS Kim, “A Study on the Teachers’ Perceptions of Error Correction”, Asia-Pacific Journal of Convergent Research Interchange. 5.2, (2019) 1-9.

X Li, “The Comparative Study on Management of School-Based Curriculum in South Korea and China”, Asia-Pacific Journal of Convergent Research Interchange. 5.3, (2019) 2508 (Online), http://dx.doi.org/10.21742/apjcri.2019.09.02.

JM Sung, SC Kang, DK Min, “A Survey Study on the Performance of Accreditation Program for Engineering Education”. Korean Society for Engineering Education. 12.4. (2009), 102-114.

SS Lee, SG Park, “A Study on Parenting Sense of Competence in Relation to Parenting Counselin”, Asia-Pacific Journal of Convergent Research Interchange. 5.3, (2019) 53-62.

SS Lee, “Integrated Education Program for Building Engineering with Architecture Based on ABEEK”, Review of Architecture and Building Science. 55.6, (2011) 50-54.

Gill, Mukti. "Empowering Quality Higher Education using Information Technology." *International Journal of Educational Science and Research (IJESR) 4. 6, Dec 2014, 9* 14.

Albina, Erlito M., and Jasmin D. Niguidula. "Mining Rating of University Performancein Academic Programs and Services."International Journal of Computer Science Engineering and Information Technology Research (IJCSEITR) 7.4, Aug 2017, 7-18

Joseph, Benny. "An Empirical Study on Knowledge Management in Higher Educational Institutes: A Case Study of Christ Campus, Rajkot." *International Journal of Humanities and Social Sciences (IJHSS)* 6.3 (2017): 111-120.

Uranga, Juan JesúsAlgravez, et al. "Perception of The Industry About Study Plans And Teaching

Methodologies of The Engineering Education Programs at Universidad Politécnica De Baja California, Mexico." *International Journal of Humanities and Social Sciences (IJHSS) 7.4 (2018): 37* 46.