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A Study on the Perception and Improvement of Creative-Design Course by Level

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***Abstract*— In the absence of concrete support plans for extra curriculum programs since the PRIME project has started, the College of Engineering has established regular courses to operate design programs efficiently. It links and operates creative-design curriculum by level: IT-engineering for freshman, basic creative design for sophomore, major creative design for junior, and integrated capstone design for senior. This study aims to find efficient operation and improvement plans for creative-design courses through the questionnaire survey and focused group interview (FGI) on the satisfaction of creative-design courses and the composition of the curriculum for students taking project-oriented creative-design courses. To this end, a survey and group interviews were conducted for 176 students taking creative-design courses, and the survey results and group interview results were analyzed. As a result of the analysis, the absolute evaluation method was preferred, and a curriculum that could be done consequently rather than a short-term project. Satisfaction with the creative-design courses was higher in the upper grades than in the lower grades. In addition, when satisfaction for the creative-design courses is high, it showed positive recognition of the satisfaction of the curriculum of creative-design courses. In this paper, I propose four suggestions for efficient operation and improvement for creative-design courses; different goal-setting of creative-design courses at each level, an appropriate form of feedback, the fairness of team setting and evaluation methods, and the grade linkage for creative-design courses.**

***Keywords*— engineering curriculum; PBL; higher education; FGI; survey.**

I. INTRODUCTION

Recent trends in engineering education are shifting to design-based education aimed at improving the creative, practical skills required by industry and fostering practical human resources that can be directly put into work with minimal retraining [1], [2]. As a result of these changes, the interest in the creative-design courses is increasing in many college educations, and efforts are being made to develop project-based learning (PBL) courses and design-oriented courses [3]-[8].

When analyzing the existing design-oriented curriculum operation and results, the lower grade students did not have enough knowledge of majors in design projects, so they had limitations on the implementation method, and they could not fully implement their ideas. In situations where the primary knowledge and design experience are insufficient, the curriculum has no choice but to focus on idea-driven design, so good ideas with good development potential are dead after a semester. In the upper grades, the intention to take project-based design courses is very weak due to the burden on other major courses.

In this study, it is necessary to investigate and analyze the perception of creative-design courses in order to solve these problems and also to investigate the perceptions of grades in design-based courses and analyze them to promote effective management and improvement of design-oriented courses [9]-[13]. To this end, this study seeks to collect student opinions from various perspectives such as linkage methods by level or grade, separate rewards or credits for course

management, and grade evaluation methods, and to find directions for development.

In this study, freshmen usually don't have much experience in designing projects. In addition, there are many cases where an engineering approach is used to solve the problems encountered in the process of deriving and implementing ideas from the high school curriculum or personal interests because they didn't learn a major knowledge such as hardware control yet. For example, they implemented an electric fan using Bernoulli's law learned in the high school curriculum, but hardware control is only limited to a pen rotation using motor control. Of course, they have an idea to rotate automatically in the direction of the person, but they could not solve the problem due to the lack of major knowledge. In another case, there is a design work that tries to be utilized variously by adjusting the position of the hologram freely. In this work, the automatic control using the controller was not applied, and the position adjustment was made manually. The idea of expanding the display space using the principle of light reflection was a very good project, and it has been evaluated to have a high possibility of development. The last example is a small drone that can operate by using a small propeller. Since the propeller is small, it is not able to get enough buoyancy, so it made various attempts to make the body of the drone as light as possible.

As shown in the examples above, in the lower grades, they did not have enough knowledge of major, so they could not apply the technology such as automatic control or wireless control using controllers. However, it was an opportunity to present various kinds of ideas and improve problem-solving ability. Therefore, it is expected that most students would want a process-based assessment rather than the final level of completion in the design project courses. In addition, since there is a difference in experience in the high school curriculum, it is expected that the absolute evaluation is more likely to be preferred than relative evaluation. As for the possibility of development, if students take a major course such as design experience or hardware control using a controller in the upper-grade course, they will be able to envision and implement the overall control method, which will enhance the completeness, creativity, and differentiation.

In the case of design works presented in the upper-grade design curriculum, the degree of design difficulty tended to be relatively high due to the accumulation of significant knowledge in various fields and the experience of the projects. In addition, they have knowledge and experience in the latest technologies such as machine learning, deep learning, and cloud services, open-source and open frameworks, and could utilize these technologies for designing works. In terms of completeness, the degree of perfection was higher than that of lower grades. However, there were some problems in teamwork when there were some gaps between individual students' abilities. This is similar in the lower grades, but the differences in outcomes tended to become larger.

For the case of the lower grade design courses, in order to give experience on project design, we repeat the process of presenting ideas, identifying problems, and solving them. As a result, it seems to have had the results of improving problem-solving ability by giving the experience of project design and implementation through teamwork. However, due to the lack of completeness, student satisfaction is expected to be negative. Especially for sophomores, there is a burden as a major course, but it would be difficult to find improvements in how to improve student satisfaction or in the teaching of design curriculum because they did not complete the major yet. In the case of senior students, they are generally expected to show relatively high satisfaction by designing and implementing work with high completeness through voluntary participation based on various design experiences.

The above contents would be verified through surveys and group interviews, and based on these findings, efficient management of the creative-design courses would be explored to derive suggestions for maximizing the educational effect of future project-based creative-design courses.

II. Material and Method

The purpose of this study is to evaluate and improve the operation of creative-design courses by gathering the opinions of students in order to operate the creative-design courses of engineering colleges effectively and to increase students' satisfaction and to achieve the goals of course that it aims for [2], [14]-[17]. Therefore, this study aimed to analyze various angles such as the attitudes, the perception, the operation and evaluation of the courses. To this end, a survey was conducted on the attitudes toward learning, perception of the courses taken, and perceptions of the curriculum for design courses. The operation of design courses was investigated through group interviews by grade. The sub-items were derived by dividing into four categories. The questionnaire about learning attitudes, design courses, and the curriculum was answered using a 5-point scale. The interview question about the operation method was selected as the multiple-choice method. In addition, each item was presented to describe subjective opinions as needed.

A. Participants

This study conducted a questionnaire survey of students taking creative-design courses which are operated at the College of Engineering. The subjects to be studied are IT Engineering for freshman, Creative Basic Design for sophomore, Creative Major Design for junior, and Capstone for senior. The total number of test subjects was 196: 72 freshmen, 74 sophomores, 23 juniors, and 27 seniors. Since the number of students in each grade varies, the results were analyzed by applying weights to enable the statistical analysis of the same parameters by grade.

The experiment manager continuously guided the design-based curriculum and extra-curriculum program, and five professors in the creative-design courses of this semester participated. Those professors have experience of operating the design-oriented courses in advance. Therefore, through the experience of operating previous courses and interviewing with a few students, I was able to grasp students' perceptions of the creative-design courses and each grade's characteristics. After surveying the students participating in the creative-design courses, the characteristics of each grade were analyzed.

B. Development of the Questionnaire

For the survey, the sub-items were derived by three categories: learning attitudes toward the classes, perceptions of registered courses, and perceptions of the creative-design curriculum. Table 1 shows the final questionnaire.

TABLE I
QUESTIONNAIRE

Section	Questions	Related Works
Learning Attitude	1. I am always interested in the contents of any class.	Hassan [18], Kim [19], Jeong [20]
	2. I always concentrate on class.	
	3. I actively participate in-class activities such as questions and practice work in class.	
	4. I always study by myself.	
	5. I tend to ask questions if I don't know something in class.	
	6. I am interested in new fields of study and activities.	
	7. I like to study with my friends.	
	8. I think that project classes are helpful for my major.	
	9. I like to practice or project classes than theory classes.	
Class Satisfaction	1. I registered for this course because I wanted to study it.	Chen [21], Fatos [22], Guifang [23], Jung [24]
	2. I think I must take this class before graduation.	
	3. I want to study more about it even after finishing this class.	
	4. I enjoyed this class.	
	5. I would also recommend this class to friends and juniors.	
	6. I think this class is very helpful for my major.	
	7. I was happy with the class overall.	
	8. I want to continue taking classes similar to this one.	
	9. I think the credits currently assigned to classes are appropriate.	
Creative-design Course Recognition	1. I think creative-design courses help me improve my knowledge in major.	Shin [25], Kim [26] Razali [27]
	2. I think creative-design courses help improve collaboration with team members.	
	3. I think creative-design courses are good for friendships.	
	4. I would like to recommend creative-design courses to friends and juniors.	
	5. I think creative-design courses are useful for my major.	
	6. I think I could focus more on creative-design courses rather than other classes.	
	7. I think creative-design courses help improve problem-solving skills.	
	8. I think that creative-design courses should be linked by level from the lower grades.	
	9. I think creative-design courses are better for study than in other classes.	
	10. I think that the participation level of the creative-design courses is higher than that of other classes.	
	11. I am generally satisfied with the creative-design courses.	

If the learning attitude is bad, it may be considered that the attitude toward the major courses is not good or there is no active intention to participate in the courses. It can be interpreted that the reliability of the response verified in this study is also low. However, if the overall learning attitude is more than the basic level, the results of the questionnaire on the recognition of creative-design courses can be judged as reliable.

The class satisfaction questionnaire is a satisfaction survey on creative-design courses. The result of the class satisfaction survey is the result of satisfaction with the creative-design courses because all students participating in the survey registered the creative-design courses. The results of this questionnaire can be used to directly or indirectly analyze what students need in the creative-design courses.

The items of creative-design courses are questions to grasp the general composition of the creative-design courses and how to operate them. Through this questionnaire, it is possible to grasp the satisfaction of creative-design courses and analyze them to derive students' perception and improvement of design courses.

C. Development of FGI

Interview questionnaire about the creative-design courses management method was developed to answer multiple-choice and subjective questions about the current operation of creative-design courses and how to improve them. Focused group interviews by grade can be used to find ways to efficiently manage creative-design courses in the future.

TABLE II
FGI QUESTIONS

Questions	Related Works
1. I think that the evaluation method of design courses should be ①absolute evaluation ②relative evaluation ③professor discretion.	Hong [28], Sin [29], Lim [30]
2. I think design courses should be offered in ① semester ② grade units.	
3. I think design courses should be taken ①from the lower grades to the higher grades at each level ②independent of each grade ③once before graduation.	
4. I think that design courses should be operated by ①major deepening courses ②major elective course ③general elective course.	
5. The credits for design courses should be ①2 credits ②3 credits ③4 credits.	
6. If design courses are not mandatory, would you like to register? If you are applying or not applying for a course, please write down the reasons.	
7. When you take a design course, do you think you need special rewards besides credits? If yes, please indicate what kind of compensation you need.	
8. Are you burdened with credits in design courses? Please answer "yes" or "no" and explain why.	

III. RESULT AND DISCUSSION

A. Questionnaire

Table 3 shows the results of the survey on learning attitudes based on university classes. It shows the average and standard deviation of each question about 9 items. Participants evaluated their learning attitude by themselves. The average learning attitude of the test participants was 3.3,

which means more than average. Cronbach's alpha analysis was performed to analyze the reliability of 9 items of learning attitude, and it showed high item reliability with 0.893. Items 6 to 9, which had a high correlation between the average score of the entire item and the creative-design courses, showed slightly higher than the average score. In the reliability analysis results, it can be seen as the result of the statistical analysis of the creative-design courses responded by the participants who showed a high level of reliability and the learning attitude more than 'normal'. It can be interpreted as a reliable result.

TABLE III
DESCRIPTIVE STATISTICS OF LEARNING ATTITUDE

No. of Q.	Mean	SD	Cronbach a
1	3.5306	.87359	.893
2	3.4082	.88679	
3	3.2347	.93700	
4	3.3265	.97429	
5	3.0561	1.05340	
6	3.5255	.90262	
7	3.6224	.93387	
8	3.4745	1.06427	
9	3.3163	1.15111	
All of Q.	3.3883	.71942	

Likert scale is 5-point, the minimum value is 1, the maximum value is 5, and N is 196.

Table 4 shows the results of the survey on the satisfaction of creative-design courses. It shows the average and standard deviation of each question about 9 items. The students' satisfaction on the creative-design courses was analyzed as 'normal' with 3. Cronbach's alpha analysis was performed to analyze the reliability of 9 items of creative-design courses and showed high reliability with 0.93.

TABLE IV
DESCRIPTIVE STATISTICS OF SATISFACTION OF CREATIVE-DESIGN COURSES

No. of Q.	Mean	SD	Cronbach a
1	2.9490	1.07056	.930
2	3.4286	1.07178	
3	3.2449	1.02843	
4	3.0255	1.02999	
5	3.1684	1.09882	
6	3.5867	.95414	
7	3.2194	.97551	
8	3.0306	1.06655	
9	3.0510	1.12202	
All of Q.	3.1893	.83909	

Likert scale is 5-point, the minimum value is 1, the maximum value is 5, and N is 196.

Question 1, which has a relatively low average among the statistical statistics on the creative-design courses, is a question about course registration, which is relatively low because there are some ratios selected to complete the major credits. However, the rate of students who enrolled in the courses with understanding these courses' goals was higher than the one who enrolled for the required credits. In the case of question 4, the burden on the creative-design courses was high, indicating that the figure was relatively low. Question 8 is a figure about whether to take similar courses, and question 9 is about the number of credits assigned. Based on these results, overall, there is a negative view that creative-design courses have lower grades than investment time. In addition, if there is no connection, there is a high possibility of another burden. In comparison, the score of question 6 is the highest, which is about whether the creative-design courses are helpful for the major. This is a result of showing that they are fully aware of the necessity of taking a course to strengthen their major.

Table 5 shows the results of the survey on creative-design course recognition. It shows the mean and standard deviation of the 11 items. The score for creative-design course recognition was analyzed as 'normal' with 3. It is the result of Cronbach's alpha analysis for reliability analysis of 11 creative-design course recognition items and showed high item reliability of 0.946.

TABLE V
DESCRIPTIVE STATISTICS OF CREATIVE-DESIGN COURSE RECOGNITION

No. of Q.	Mean	SD	Cronbach a
1	3.5000	1.03031	.946
2	3.4439	1.10566	
3	3.1633	1.06885	
4	3.1173	1.09146	
5	3.3571	1.08368	
6	3.0408	1.14057	
7	3.5459	.98324	
8	3.7704	1.06378	
9	3.1071	1.07358	
10	3.3724	1.10433	
11	3.1327	1.02919	
All of Q.	3.3228	.86250	

Likert scale is 5-point, the minimum value is 1, the maximum value is 5, and N is 196.

Question 8, which shows a relatively high number, is a question about the linkage of creative-design courses, and most of the participants answered that they hope to link the creative-design courses by grade. Question 7 also showed that it helps to improve problem-solving ability. Question 1 and 2 showed that it is helpful in improving the knowledge of the major and collaboration skill. Through this, creative-design courses are required to reinforce major knowledge, problem-solving, and collaboration skill. When looking at the items with low statistics (items 5, 6, 9, 11), they responded that the creative-design course was helpful for the ability to use the previously acquired major knowledge, but the contribution was low in learning new major knowledge. It can be seen that. In particular, the proportion of participants in the lower grades is relatively high, so it was found that the tendency of focusing on improving design experience rather than major knowledge was higher. Through this, to increase the efficiency of the curriculum management in the future and to maximize the educational effect, it is necessary to train the major knowledge partially.

Lastly, the correlation between items was analyzed. As a result, learning attitude and class satisfaction showed significant correlation, and class satisfaction and creative-design course recognition showed a significant correlation. However, since the correlation coefficients 0.631 and 0.666,

it is difficult to say that it has a high correlation. Table 6 shows the correlation coefficient for each item to see the correlation between the items.

TABLE VI
CORRELATION BETWEEN ITEMS

Section	Correlation coefficients	Learning attitude	Class satis-faction	Creative design course
Learning attitude	Correlation coefficient	1	.631**	.514**
	Significance probability (both)		.000	.000
	N	196	196	196
Class satis-faction	Correlation coefficient	.631**	1	.666**
	Significance probability (both)	.000		.000
	N	196	196	196
Creative design course	Correlation coefficient	.514**	.666**	1
	Significance probability (both)	.000	.000	
	N	196	196	196

**. The correlation is significant at 0.01 (both).

B. Focused Group Interview

Opinions on the operation of creative-design courses consisted of grade-level focused group interviews in the form of multiple-choice and short answer. First, grade-specific traits are analyzed based on the answers to multiple-choice questions such as evaluation method, continuity of opening semesters, class method, curriculum classification, intention for a continuous register, additional reward, and burden of credit. Then, the overall trend was analyzed by weighting the entire grades.

In the first grade, 29 students (40%) answered that they wanted an absolute evaluation, and 28 people (39%) answered that there was no particular preference in the evaluation method. In a questionnaire about opening semesters, 60% said that they wanted to continuously upgrade the design results by year rather than a semester. This may indicate that there is regret about the final result and a strong will to improve by using the major knowledge. As a similar result, they wanted to be able to enroll in continuous classes by grade or level rather than one-time classes. I found that it is the same as why students desired separated classes per grade. Interviewees in the first grade are students in the IT Engineering project curriculum, and most of them are satisfied with the three credits. When asked if they would like to take it again, 38% (26 students) of 'take it' was higher than those who would not take it (24%, 17 students). When asked if additional compensation is needed, only 10% seem to need it. In the question of the credit burden, opinions saying that 'it is a burden' was 39% (31% unresponsive), which was the majority.

For the second graders, they preferred absolute evaluation (37%) over relative evaluation (31%). For the questionnaire about the class offering, 76% of students desired separated classes per grade. In terms of attendance, the rate of linked operations was nearly twice that of independent operations by grade. In terms of course classification, the percentage of students who wanted to be 'general elective courses' rather than major courses was 28%, which is relatively high. As for credits, about 70% of students wanted to get higher than their current credits (3 credits). This seems to be due to the opinion that the second grade's 'creative basic design' course is 2 credits and it is not fair for them because it requires relatively hard work compared to other courses. For these reasons, 54% of students suggested that they would not attend the course again. When asked if additional compensation was needed, the respondents answered that it was needed at a 46% rate. As for the burden of acquiring credit, 65% of the respondents felt that the burden was very high compared to the first-grade respondents. In general, in the second year, students took more time to take the course than other majors, but they did not intend to take the courses continuously because of the burden of credit. As the depth of projects or other major classes increases, the phenomenon may be attributed to the burden on the course.

In the third grade, the absolute evaluation method was preferred to the relative evaluation method, but the preference for evaluation at the discretion of professors was the highest at 44%. For questions about the opening semester, the students wanted to open a graded unit at a similar rate as the sophomores. The rate of the method for taking a course was similar to that of first graders. In other words, a very high rate of 65% of students requested linked operation. In terms of course classification, they prefer to use the same 'major elective course.' In terms of credits, 78% of students wanted to increase their credits above the existing 2 credits. This is the same reason for the sophomores. The question of retaking the course is higher than the second graders' response, but 48% of the respondents said they would not retake it due to the difficulty of acquiring grades. When asked if additional compensation was needed, the respondents said that they needed it at a 56% rate. Regarding the burden on credits, 78% said they felt burdened at a higher rate than in second grade. The response was similar to the sophomores, but the overall burden was higher, and the demand for compensation increased.

In the fourth grade, 57% of students preferred the absolute evaluation method. In the question of the opening semester and the linked operation, a large number of students wanted operation by grade and linked operation, and they tended to be similar to the second and third graders. The course classification was preferred as a 'major elective course' at a similar rate as third graders. In the question about credits, the senior course is given 3 credits now, which means that there is no dissatisfaction with the number of credits. However, if possible, 33% of the respondents wanted to give higher credits. When asked if they would like to take it again, 56% of students suggested that they would take it again, unlike first, second, and third graders. This is because these students are preparing for graduation, and it reflects the current situation that is required. It is also an opportunity to apply comprehensively to the major. The question of whether additional compensation is needed was characterized by a strong response of 'no need'. As for the burden of acquiring credit, 56% of respondents agreed, and it was somewhat lower than second and third graders. This

result is believed to be caused by the pressure of graduation requirements, and this course is one of the requirements.

As a result of the combined weight adjustment, the number of participating students in the upper grades (third and fourth grade) was relatively smaller than the lower grades (first grade and second grade). As shown in the above statistical analysis, high participation of the lower grades made a cluster, and the cluster made a biased representation of the survey. In order to correct this, weighting was applied. In other words, in order to contribute to the response with the same weight in all grades, the result of integration was derived by reflecting the ratio of the number of participating students, not the absolute number.

Looking at the results of the integration by category, students first wanted an absolute evaluation (42%), and the rate is higher than the relative evaluation (28%). This suggests that there is a high negative view of the disadvantages of the relative evaluation because of differences by team or level. According to the interview results regarding the opening semester and the linked operation, 70% wants the opening by grade units, and 57% wants the linked operation. The high rate of the students wants the continuous courses which they could advance their design works rather than one-time courses. In the first grade, 85% of the first graders wanted the course, currently 'general elective course', to be changed to 'elective major course' or 'intensive major course. Regarding the number of credits, 52% of the students wanted 3 credits because the courses are major design courses, but 29% wanted to acquire higher credits. The question of whether to take the creative-design course next time was not significantly different: 39% for 'taking it' and 37% for 'not taking it'. This suggests that given the satisfaction level of the creative-design course is average, there is a willingness to attend when the satisfaction level is high, and there is no intention to attend the level when the satisfaction level is not high. In terms of additional compensation, currently, the second and third graders had two credits, so many of them wanted to get additional compensates. Thus, 35% of students expect additional rewards for creative-design course results. 60% of the students felt the burden for the credits. As can be seen from the results, this is the most difficult part of running creative-design courses.

IV. Conclusion

There were many opinions that the positive response to taking creative-design courses is an opportunity to utilize the major knowledge that they have designed and learned. Many comments suggested that the project is operated as a team project, which will help improve collaboration and problem-solving skills. On the other hand, the negative response to taking creative-design courses has been attributed to the burden of credit. Despite a large amount of time spent compared to other major classes, the burden on obtaining credits is high, and it takes time that makes it difficult to study other classes enough. In particular, there is a high level of objection to the evaluation based on the relative evaluation. There have been many opinions that credits are already determined when teams are made up of students with good project experience or good development ability. Negative comments were made that the entire team is not easy to harmonies and the burden of having to report the results every week.

The purpose of this study was to find out how to efficiently manage creative-design courses through surveys and group interviews on students' satisfaction in creative-design courses and curriculum composition. As a result of analyzing the questionnaire, it was found that the ratio of wanting more than three credits was high and the absolute evaluation method was preferred to the relative evaluation because the experience difference could be large in the grading method. In terms of level linkage, it was analyzed that a curriculum that can be linked by grade unit was preferred rather than a short-term, one-time project. Satisfaction with the creative-design courses was analyzed to be higher in the upper grades than in the lower grades who have less experience in design courses. However, although there were some differences by grade, there was no significant difference. In general, when the satisfaction with the creative-design curriculum was high, the students responded positively to the current curriculum and the creative-design courses. Therefore, through this study, I would like to give some suggestions for efficient operation and improvement of creative-design courses.

First, it is necessary to differentiate the goal-setting of creative-design courses by level. In the lower grades, the burden of requiring high design outcomes with little major knowledge and design experience was very high. Therefore, for the lower, the course should be constructed to focus on process-oriented evaluation and goals rather than results. In the upper grades, it is necessary to set goals that they can make full use of the knowledge they have acquired in advance and present advanced results.

Second, it should provide an appropriate form of feedback. Feedback here includes teaching some major knowledge as needed in the lower grades. This can be a burden for the professors who run the courses, but for students, it can be a way to improve the problem-solving ability by obtaining appropriate guides and solving the problems encountered in carrying out the project.

Third, there is a need to maintain the fairness of team setting and evaluation methods. One of the burdens that many students felt about obtaining credit is that there is already a difference in the level of outcomes in a team setting. In most courses, the team was autonomously set. However, in order to ensure fairness of evaluation, it may be necessary to properly coordinate team composition. In the evaluation, it is appropriate to apply absolute evaluation, but it is indeed difficult to apply. Therefore, it may be a solution to choose a small group teaching method so that it can be evaluated based on the absolute evaluation.

Fourth, the plan for level and grade linkage for creative-design courses should be prepared. A large number of students have a negative view of the operation of each semester for creative-design courses. This is because the project is executed in a short period of time, and the satisfaction with the final result was not high. There is also a burden of suggesting a new idea again. In order to solve this problem, one of the good solutions would be a method of education that induces the projects that were conducted in the lower grades as a base and suggests ways to improve and upgrade based on the projects.

In addition, as shown in the previous analysis, students with active intentions were found to have high satisfaction with creative-design courses. To this end, it is necessary to suggest ways for students to participate actively. In particular, in the design and operation of a team project, the discord between the team members or the passively participating students has a great influence on the final result. To solve this problem, it will be necessary to apply operational measures that encourage all students to participate. Lastly, since this study was operated, tested, and analyzed based on the creative-design courses of the university of engineering in Korea, it is not applicable to all design courses. This study can contribute to research that can lay the foundation for project-based class and curriculum development research to cultivate the problem-solving ability, collaboration ability, and creative-design ability.

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