Engineering Design Education in a Hybrid Way, Combining Face-to-Face Instruction with e-Learning Collaboration

- Incorporating e-Learning Collaboration to Break the Cultural Barrier in Students' Work Dynamics -

Masakatsu Matsuishi, Dr. Eng., Kazuya Takemata, Dr. Eng., Toshiyuki Yamamoto, Ph.D.

Division of Engineering Design
Kanazawa Institute of Technology
ISHIKAWA 921-8501 JPN

Abstract

This paper presents one of many effective ways to overcome instructional issues while conducting Project-based Learning in Engineering Design courses targeting lower classmen in engineering institutions in Japan.

The Kanazawa Institute of Technology (henceforth, KIT) is a pioneering university that began Engineering Design Education in 1996. Engineering Design courses are characterized by project-based learning in groups. A group, consisting of 5 students, chooses an engineering topic relating to daily life, defines its domain, and solves its problems that may have multiple solutions.

Although project-based group learning is an important instructional concept, students have not experienced any type of project-based group learning in their pre-college education. In order for students to become used to such courses, our courses are based mainly on face-to-face in-class instruction, activities, and outside-class group exercises to conduct projects. About 60 teaching staff members are in charge of 1,800 freshmen. The decision for conducting the courses in such a manner was heavily due to the fact that most Japanese students are introverted in nature. The following areas of needed growth have been observed by the instructors:

(i) Discussions in groups cannot be conducted effectively in the classroom due to the introverted nature of students.

(ii) Students tend to spend more time outside the class than the instructor expects. Since most students cannot clearly define needed roles for a project, assign responsibilities to those

roles, and perform those roles effectively within a group when meeting outside the class, the result is that the work-load is unevenly distributed among the members. Many members of the group may consider mere attendance in the group as their qualified contribution to the group's efforts. Only the brightest and most extroverted students end up completing the necessary project.

(iii) Setting up time for a group meeting is getting more and more difficult due to the fact that most students have extra curricular activities or part-time jobs.
This paper reports how KIT hopes to address and solve the problems above by incorporating the collaborative communication functions of e-Learning in order to achieve higher learning outcomes in the courses.

Background

Before directly addressing the primary concerns of this paper, it may be beneficial to know a little about the Kanazawa Institute of Technology (henceforth, KIT) first. KIT is located in Kanazawa City. The population of Kanazawa is around 450,000, so it has the characteristics of a mid-size city in Japan. KIT is a fully accredited private technical university and one of the largest institutions specializing in engineering and technology in Japan. KIT was founded in 1965 and was a member of the Japanese University Accreditation Association and the International Association of Universities. The total number of undergraduate students is 7,513, seventy-one per cent of which were from out of prefecture. They are from all over Japan.

KIT's job placement rate is ninety-nine point one per cent. Besides the undergraduate School of Engineering, the Institute includes a graduate school and a number of specialized research laboratories, as well as the affiliated Kanazawa Technical College, a five-year extended senior high school specialized in engineering.

KIT was selected in this case study because of the size of the institution as well as its nine years of history as being a laptop institution for higher engineering education. Since its first implementation in 1995, the curriculum had been changed since it became a laptop institution. Facility-wise, almost all classrooms have power and network connections for the students' desks. The depth of the students' desktops has been modified for ease of the laptop use during the class. KIT's infrastructure on campus have been well-established. For example, a study lounge with computer network is open 24 hours a day, seven days a week. Each cafeteria has section called an Internet café, where students can netsurf as well. Over 5000 network connections are installed in major tea lounges in instructional buildings as well as publicly accessible areas. Network printing services are also available. Due to the institutional efforts to transform KIT into a laptop institution during the past nine years, the IT skill level of the students as well as the faculty have been roughly standardized. All users are well accustomed to using academic software programs, including Microsoft Office Suite, email, and net surfing software.

KIT is also the pioneering university that began Engineering Design Education Program in 1996[1]. The Engineering Design Education Program is characterized as project-based learning in groups[2]. The goal of the Engineering Design courses is to offer students the opportunity to work in groups to tackle an engineering topic relating to daily life. Each group chooses an engineering topic related to daily life, defines its domain, and solves problems that may have multiple solutions. After choosing a topic, the students in a group hold brainstorming sessions, define the domain of the topic, work on the most optimal solution and its design, refine the design, present the results in class, and evaluate each group member's contribution by peer evaluation. Most group activities go beyond the in-class meeting hours. The following photos are snapshots taken in the study lounge. Students are actively engaged in their projects.

Figure 1. Snapshots of Group Activities in the 24-hour Study Lounge

Engineering Design in the Traditional Way

Engineering Design is a mandatory course for all freshmen. Every year, over 1800 freshmen take Engineering Design I during the second term of their freshman year. Since its first implementation in 1996, Engineering Design courses have been modified and refined frequently to meet the needs of students[3,4]. Originally developed textbooks by the teaching staff have been constantly modified each year to raise the quality level in Engineering Design courses[5,6]. See Figure 2.

Figure 2. Originally developed textbooks have been modified for improvement every year.

Because one of the mottos of education at KIT is based on communication between the instructor and students in the classroom, the course has been taught based on 100% face-to-face instruction in the classroom. After eight years of tuning, content-wise, there is not much room for improvement any more. However, when it comes to the learning outcome of the course, it is not without problems.

Before introducing these problems, let us take a look at the Engineering Design courses in the traditional way first. The syllabus for Engineering Design consists of seven major components. They are Main Topics of the Course, Instructors, Brief Description of the Course, Goals, Evaluation, Textbook, Notes, and Detailed Description of Learning Activities. (Please refer to the syllabus in Appendix A.) For ease of exposition, the main points in the syllabus are summarized.

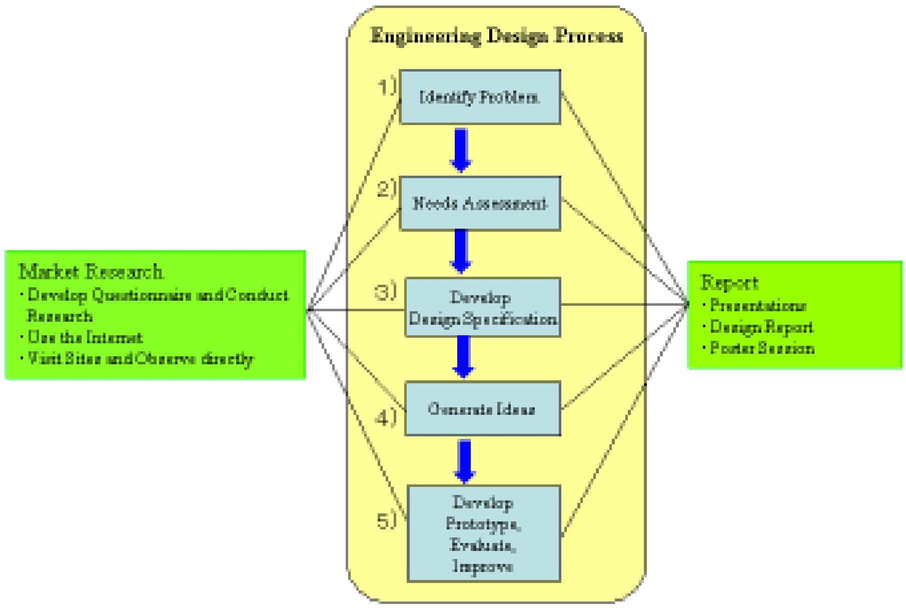
Engineering Design I is an introduction to the engineering design process. The main topic of Engineering Design courses is to have students tackle an engineering design problem related to daily life, which may not have a clearly defined domain of its own, and which may have multiple solutions. Students are offered opportunities to choose an engineering design project of their interest, conducting a needs assessment and analyzing the results, determining the design specifications, and reaching fundamental solution. In addition, Engineering Design I also focuses on acquiring effective presentation skills and developing skills to work in a team. Going through the group project in the course, students will have confidence in tackling difficult engineering problems, and understand and appreciate the importance of organizing a team to work on engineering design.

In order to maximize students' learning, in-class learning activities and homework assignments are issued every week. Major activities are diagramed in Figure 3. By conducting introductory design projects[6], students go through the entire engineering process. First, students conduct market research and identify a project topic. Once the project topic is chosen, students research the market and evaluate products, systems, or software programs which are on the same line of their project topic. By conducting a needs assessment and analyzing the results, the needs of clients are incorporated into solutions. After this, students have brainstorming sessions to generate fundamental solutions, out of which the most optimally practical solution is selected.

The entire process of the engineering design process by the group is reported in an oral presentation and in the form of a written report at the end of the term.

Engineering Design has to be based on face-to-face in-class instruction due to the incoming freshmen's educational background. All students have not experienced any type of project-based group learning in pre-college education. Thus, in order for the students to become used to such project-based courses as Engineering Design, the courses are based mainly on face-to-face in-class instructions and activities to offer the students enough group work experience so that they can work well in outside-class group activities. Furthermore, most students are introvert in nature because they are from high schools in rural areas and thus do not have good social skills. In spite of the well-founded qualities in the curriculum, students' characteristics seem to hinder their progress in project-based group learning.

<u>Figure 3</u>. Flow of Engineering Design Process and Activities



Teaching staff members have observed negative factors in the students' learning activities in groups. They are:

(i) Group discussions in groups cannot be conducted effectively in the classroom due to students' introverted personalities. The curriculum allows for in-class group activities in groups to discuss the pros and cons of a chosen design specification as well as candidate solutions when choosing the most optimally practical solution. However, students' introverted nature prevents them from active discussion. Furthermore, most students had no training in discussing ideas to reach a solution before entering college. Although 30% of the course grade comes from their contribution to class and team activities, most students do not know how to function in teams.

(ii) In out-of-class activities, students tend to spend time more than the instructor expects them to spend. Since most students cannot clearly define roles for the project, assign those roles to the members, or perform tasks within a group when meeting outside class, "being there with group members" is the main goal of the group meeting instead of being productive in the project. As a result, the workload is unevenly distributed among the group members. Only the students with natural aptitude end up completing the project. This type of dependency on brightest members in a group is observed in all groups, especially in the portion of the course grade where the group grade reflects on its members' individual grade for the course.

(iii) Setting up time for a group meeting is getting more and more difficult due to the fact that most students have extra curricular activities and side jobs outside the university. Due to the economic down fall, most students have part-time jobs to help their finance situation. Furthermore, KIT offers students evening workshops for certification exams. KIT believes that students with certifications in special engineering fields will gain an additional plus when applying for jobs. Thus, most students are busy in the evening hours. It follows that a group meeting on campus in the evening is not possible for them. It seems that the evening hours are not available for group meetings any longer.

Another change are the students' learning habits. The students tend to read and write more frequently on the computer screens than on the paper. For example, a recent trend among young generation is to read Internet novels using a cell phone with netsurfing capability. They do not seem to feel uncomfortable obtaining information from the screen any longer.

To summarize, it is getting more and more difficult for students to have outside-class group activities in the evening due to the change of the student lifestyle. Due to the fact that most students are from rural high schools, they tend to be shy and introverted in nature and cannot develop active communication and social skills. Because of the change of the student dynamics as well as the students' learning habits, the current curriculum for Engineering Education seems to have reached a plateau. Attempts to break the introverted nature of students through face-to-face interaction in the classroom have failed. The carefully worked-out curriculum for Engineering Design in the past seems to be getting obsolete.

Proposal

In order to overcome the shortcomings of the current curriculum for Engineering Design and to achieve a higher instructional effectiveness and learning outcome, a case study was conducted to compare the level of learning activities between the traditional course and one with new learning strategies[7].

The new learning strategies included collaboration functions in e-Learning, namely, group-based asynchronous communication (email and discussion) and group-based synchronous communication (chat and whiteboard) [8]. In this way, each student group has opportunities to communicate among themselves asynchronously and synchronously. It was hoped that the students' introverted nature would be overcome by introducing indirect communication and discussion in a virtual situation. By removing the time restriction of sharing the same space to meet in groups outside class, it was hoped that the students could have opportunities to communicate "anytime, and anywhere."

The only difference between the traditional Engineering Design and the proposed course incorporating the collaboration functions in e-Learning was that outside class group activities were replaced by collaboration functions in e-Learning. The rest of the components in the traditional Engineering Design remained the same between the two courses. Figure 4 is a screen snapshot of the syllabus. Only differences from the traditional course are presented. The rest is the same as the traditional classes. Since students used a learning management system for the first time, the first lesson focused on learning how to use the collaboration functions.

Figure 4. The Hybrid Group Specific Learning Activities

Figure 5 shows the main menu of the collaboration in e-Learning.

Figure 5. The Main Menu of the Collaboration in e-Learning.

In addition to the links to group email, group discussion, chat and whiteboard, the menu includes such items as brief explanations of the collaboration functions, a list of outside class learning activities which are different from the traditional course, a list of assignments, and a user manual for the learning management system.

For ease of exposition, let us call the proposed course incorporating the collaboration functions in e-Learning “a hybrid course,” and the student group which employed the collaboration functions in e-Learning “a hybrid group.”

The experiment was conducted in the fall term of 2003. One thousand eight hundred freshman students enrolled in the course. The students were divided into 56 classes. Each class consisted of five to six groups. The instructor-student ratio was, on the average, one to thirty-two. Instructors in charge chose the curriculum for the assigned classes. 53 classes employed the traditional face-to-face discussion outside the class; and the other three classes, discussion occurred via e-Learning. Out of the classes, one class with the current curriculum was randomly selected. Also one class with hybrid groups with the collaboration functions in e-Learning was randomly selected. This case study reports the results of comparison between the traditional group and the hybrid group. An analysis was made based on the discussion log. In the traditional group, the log was taken by a group member for the group activity report. In the hybrid group, the log was automatically archived by the learning management system.

Both traditional and hybrid courses were evaluated according to the evaluation scale shown in Table 1.

Table 1. Course Evaluation

Grade	Criteria
A	Most optimal for a project for Engineering Design II
B	Potential to be optimal for a project for Engineering Design II
C	Possible to be optimal for a project for Engineering Design II. However, a success depends on the result of the teamwork efforts in Engineering Design II.
D	Least possible to be optimal for a project for Engineering Design II
E	Inappropriate for a project for Engineering Design II

Furthermore, the frequency and the quality of the discussion between the two classes following the oral presentation on the fourth week were compared. In order to analyze the quality of discussion, the rubric in Table 2 was developed to evaluate each thread's level of contribution to the discussion.

Table 2. Rubric for Evaluating Threads

	4	3	2	1
Evaluation	Extremely valid opinion is mentioned and rationalized. Also proposes a new idea or perspective.	Valid opinion is mentioned and rationalized. Contributes to the discussion	Cliché opinion is mentioned	No opinion is mentioned

Findings

Results of the analysis of threads in the traditional class and that of the hybrid class are stated in this section. First, the results of the traditional class are described and then the results of the hybrid class are stated.

Traditional Class

The randomly selected class consisted of 30 students with 5 groups. Ten students raised new topics and ten students replied to them. The total number of topics and their replies were twenty. The rate for participation to the discussion was .67. That is, each student in the group participated in the discussion .67 time. Only 3.4 members per group participated in the discussion.

Table 3 shows the frequency distribution of each thread's score in the rubric to evaluate the level of contribution to the discussion. High frequencies in low scores were observed. The average score was 1.42.

Table 3. Number of Participants to Discussion in the Traditional Class

Total number of students	30
Number of students who raised a new topic	10
Number of students who replied to topics	10
Total number of new topics and their replies	20

Table 4 shows the frequency distribution of each reply's score to evaluate the level of contribution to the discussion. High frequencies in low scores were also observed. The average score was 1.43.

Table 4. Frequency Distribution of each Score in Raised Topics

Score	4	3	2	1
Frequency	0	2	8	20

Average score = 1.43

Table 5 shows the frequency distribution of the scores of both topics and replies. Here again, high frequencies in low scores were prominent. The average score was 1.43.

Table 5. Frequency Distribution of each Score in Replies to the Raised Topics

Score	4	3	2	1
Frequency	0	3	7	20

Average score = 1.43

Table 6 summarizes the frequency distribution of each score with both raised topics and their replies combined.

Table 6. Frequency Distribution of each Score in both Raised Topics and their Replies

Score	4	3	2	1
Frequency	0	5	15	40

Average score = 1.42

As seen in Table 6, the frequency highly skewed toward the score "1." This shows that most students did not participate in the discussion.

It should be noted that the grade for the traditional course was a C on average. It was reported that the grade for the traditional courses in the last few years was consistently a C on average in Table 1. Thus, the traditional course in this experiment represented a traditional sample.

Hybrid Class

The randomly selected hybrid class consisted of 32 students with 5 groups. Thirty-two students posted new threads to which forty replies were posted. The total number of threads and their replies were seventy-six. The rate for participation to the discussion was 2.38. That is, each student participated in the discussion 2.38 times.

Table 7 shows the frequency distribution of each thread's score in the rubric to evaluate the level of contribution to the discussion. High frequency distribution in high scores was observed. The average score of the posted threads was 3.19 out of 4-point scale.

Table 7. Number of Participants to Discussion

Total number of students	32
Number of posted thread	36
Number of replies to threads	40
Total number of new threads and their replies	76

Table 8 shows the frequency distribution of each thread's score according to the level of contribution to the discussion. High frequency distribution in high scores was also observed. The average score of the posted threads was 3.19.

Table 8. Frequency Distribution of each Score in Posted Threads

Score	4	3	2	1
Frequency	10	23	3	0

Average score = 3.19

Table 9 shows the frequency distribution of the scores of replies to the threads. Here again, high frequencies in high scores were prominent. The average score was 3.18.

Table 9. Frequency Distribution of each Score in Replies to Posted Threads

Score	4	3	2	1
Frequency	8	31	1	0

Average score = 3.18

Table 10 summarizes the frequency distribution of each score with both posted threads and their replies combined.

Table 10. Frequency Distribution of each Score with Posted Threads and their Replies Combined

Score	4	3	2	1
Frequency	18	54	4	0

Average score = 3.18

Most scores are distributed on scores "3" and "4." This shows that the students have learned to logically organize ideas and opinions to express in words.

It should be pointed out that the grade for the hybrid was a B+ on the average in Table 1. This shows clearly that the discussion skill as well as the quality of projects has improved, compared with the traditional course.

Discussion

In the traditional class, the total number of raised topics and their replies were twenty. The rate for participation to the discussion was .67. That is, each student participated in the discussion only .67 time. In other words, only 3.4 members per group participated in the discussion.

On the other hand, in the hybrid class, the total number of posted threads and their replies were seventy-six, almost four times more than the traditional class. The rate for participation to the discussion was 2.38. That is, each student in the group participated in the discussion 2.38 times. All six members in the group participated in the discussion. This figure is 3.55 times more than the traditional group.

It was observed that the students with introverted characteristics actively participated in the on-line discussion. It was proven that given the right learning situation, the students who were not able to function well in a traditional learning situation were able to contribute to a group work.

Furthermore, the hybrid group's average score of threads and their replies was 3.18 while the traditional group's average score was 1.42. Although the traditional team spent, on average, 25 hours in face-to-face discussion, their experience there did not reflect on their performance in the discussion on the forth week. This proves that the time for discussion was spent wastefully in the class with the current curriculum. On the other hand, the hybrid class spent much less time in face-to-face discussion outside class. This proves that the hybrid class was more productive in class discussion. It can be concluded that the students' experience in on-line discussion helped them cognitively realize their ideas by means of written communication.

It should be noted that in addition to on-line discussion time, the hybrid class also spent a few hours to meet and discuss face-to-face outside class. These few hours were needed to establish strategies to use the collaboration functions in e-Learning prior to the on-line discussion throughout the course and to complete the group activity log for the final project report. Once the hybrid class established these strategies, the members stopped meeting face-to-face for discussion. It seems that this strategy is essential to lead the hybrid class to success.

In order to accommodate the group learning situation to meet the needs for the students' lifestyle, asynchronous communication methods seem to be the best solution. Students no longer have to physically meet at the same place for discussion. By sharing virtual learning space asynchronously, one of the hurdles in the traditional model can be removed. In addition, by offering such asynchronous communication methods as email and discussion, the students developed their communication skills to express their ideas in words. Compared with the face-to-face discussion, where opinions and ideas are spontaneously presented, the asynchronous discussion allows students to have some time to think carefully about a posted thread and to organize opinions or ideas in words. This process seems be a necessary step for those students who have never trained to conduct a face-to-face discussion.

Conclusion

This paper proposed one of the effective ways to remedy negative instructional issues while conducting Project-based Learning in Engineering Design in an engineering institution. It was presented that the shortcomings of the traditional Engineering Design course could be augmented by incorporating the collaboration functions in e-Learning. It was observed that in the collaboration of e-Learning, even students with introverted nature, who cannot conduct an effective discussion in the face-to-face situation, can actively participate in discussion in e-Learning. It was also observed that the students spent less time than the students in the traditional class in the discussion and displayed more productivity in raising contributable ideas.

Future

A hybrid Engineering Design course will be continued to be offered. Incorporating Engineering Design II courses for sophomores, the hybrid style will go through modifications to maximize students' learning outcome. Because this experiment was a snapshot research looking at Engineering Design courses offered in the fall term of the year 2003, a longitudinal research must be conducted to prove that the incorporation of the collaboration functions of e-Learning to Engineering Design does indeed increase learning outcome.

Acknowledgement

The authors acknowledge the efforts and endeavors of the engineering design taskforce headed by Dr. Yoichi Hattori, Director of Engineering Design Education Center for the development of the original engineering design course. Further development of the engineering design course into a hybrid course was made possible through the efforts of the authors of this paper. The authors further recognize the support of the e-Learning team in the Center for Informational Services and Processing who have been contributing to the management of the learning management system.

References

1. Ishikawa, K. (1996). Principles and Perspectives in Educational Reform at Kanazawa Institute of Technology, Changing Knowledge to Wisdom. *KIT Progress, Vol.1*, 5~10.
2. Kaneko, S., & Watanabe, T. (2002). Report on Overseas PBL Programs. *Journal of Japanese Society for Engineering Education. Vol. 50, No. 3*, 29-33.
3. Matsumoto, S., Maekawa, H., Kubo, T., & Matsuishi, M. (2001). The Courses of Engineering Design I & II at Kanazawa Institute of Technology. *Journal of Japan Society for Design Engineering. Vol. 36, No. 8.* 25-31.
4. Matsuishi, M., Kubo, T., & Matsumoto, S. (2002). *Engineering Design Education at Kanazawa Institute of Technology*, ASEE/SEFI/TUB Colloquium.
5. Matsumoto, S., Matsuishi, M., Takemata, K., Furukawa, T., & Kubo T. (2002). Educational Achievement in Introductory ENGINEERING Design Courses at Kanazawa Institute of Technology. *Journal of Japanese Society for Engineering Education. Vol. 50, No. 2,* 76-82.
6. Matsuishi, M., Takemata, K., Furukawa, T., Matsumoto, S. (2002). Introductory Design Project in Engineering Design Course to Freshmen at Kanazaawa Institute of Technology. *ASEE. Session 2793.*
7. Yamamoto, T., & Guan, S. (2000). *Interpersonal Needs and Students' Interaction Preference in Distance Learning.* National Convention on the Association of Educational Communications and Technology, Long Beach, CA.
8. Tamaki, M., Kuwabara, T., Yamada, K., Muto, M., & Shimura A. (2003). Technology Trends in Human Interaction Conscious e-Learning. *The Journal of the Institute of Electronics, Information and Communication Engineering. Vol. 89, No. 11.* 826-833.

Biographical Information

DR. MASAKATSU MATSUISHI
Education: 1969, Doctor of Engineering, Naval Architecture, Osaka University.
Professional Experience: 1999-Present, Professor, Kanazawa Institute of Technology. 1966-1999, Hitachi Zosen Corporation.

DR. KAZUYA TAKEMATA
Education: 1998, Doctor of Engineering, Information and Computer Engineering, Kanazawa Institute of Technology.
Professional Experience: 2001-Present, Assistant Professor, Kanazawa Institute of Technology. 1987-2001, Assistant Professor, Kanazawa Technical College.

DR. TOSHIYUKI YAMAMOTO
Education: 2002, Ph.D. in Media Technology, School of Education, Indiana State University.
Professional Experience: 1992-1998, Assistant Professor, Rose-Hulman Institute of Technology. 2002-Present, Professor, Kanazawa Institute of Technology.

Appendix A

Syllabus for Engineering Design I

Engineering Design I (2 Credits)

Main Topic of Engineering Design Course

Students will learn how to tackle an engineering design problem related to daily life, which may not have a clearly defined domain of its own, or which may have multiple ways of solutions. By going through the group project in the course, students will have confidence in tackling difficult engineering problems, and understand and appreciate the importance of organizing a team to work on engineering design.

Engineering Design I focuses on the initial stages of the engineering design process, offering opportunities for choosing an engineering design project, conducting a needs assessment and analyzing the results, determining the design specifications, and reaching fundamental solutions.

Engineering Design I also focuses on acquiring effective presentation skills and developing skills to work in a team.

Key Words

1. Clients' Needs
2. Design Specifications
3. Solutions
4. Team Activities
5. Presentation Skill

Instructors

Over 30 instructors engage in teaching Engineering Design.

Brief Outline of Engineering Design

Students will choose an engineering project topic related to daily life within the framework presented in the main topic of the course. Students will work in teams to tackle a project topic which may have multiple solutions. Students will conduct a needs assessment and analyze the results, clearly define the project, determine the design specifications, and finally generate solutions. Students then evaluate the solutions to select the most optimal solution.

In order to maximize students' learning, in-class learning activities and homework assignments are issued every week. Major activities are as follows:

- Conducting mini-Design Projects
- Market research and evaluation for products, systems, or software programs which are on the same line of their project
- Choosing a project topic
- Needs Assessment and Analysis of Results
- Generating fundamental solutions
- Evaluating the solutions to select the most optimally possible solution
- Oral presentation
- Report on the results of Engineering Design activities

- During the post session at the end of the course, project log binders are reviewed and course evaluation is conducted.

Learning Goals

- Students can engage in an engineering design problem with multiple solutions and discover some fundamental solutions.
- Students can conduct a needs assessment to collect necessary information and then analyze the results.
- Students can create design specifications.
- Students can evaluate the fundamental solutions and select the most optimally possible solution.
- Students can function effectively in team projects.
- Students can give presentations effectively.

Evaluation Measure

Weekly Assignments	20%
Final Presentation	15%
Project Log Binder	35%
Contribution to class and team activities	30%
Total	100%

Textbook

Engineering Design I: Project Planning Manual
By Division of Engineering Design Education at Kanazawa Institute of Technology

Notes

Class activities are conducted based on the textbook, Engineering Design I: Project Planning Manual. Therefore, it is essential for students to preview the assigned reading prior to class contact hours.

Weekly Syllabus

Week	In-Class Learning Activity	Method	To Do (Preview & Review)	hr
Week 1	-Assign roles and responsibilities to team members -Read syllabus and understand course goals -Read syllabus and understand the outline of engineering design activities	-Lecture -Organize teams	-Complete Weekly Report01 -Complete team organization form -Complete a mini-project -Prepare for the first oral presentation -Complete the skills/abilities self-evaluation form (1)	5

Week 2	-Present the result of the mini-project -Read syllabus and understand the main topic of the course -List possible project topics	-Lecture -Oral Presentation -Team activity	-Complete Weekly Report02 -Create a list of possible project topics -Complete the team information sheet and upload.	3
Week 3	-Understand how to evaluate project topics -Understand how to collect information -Understand key points of the oral presentation -Exercise: how to evaluate project topics -Evaluate project topics and select one.	-Lecture -Team activity	-Complete Weekly Report03 -Complete the report for evaluating project topics -Market research -Prepare for the first oral presentation -Collect design specification samples	2
Week 4	-Conduct Needs Assessment and define clients' needs -Oral Presentation I (Report the process for evaluating project topics and the result of the market research)	-Lecture -Oral Presentation I -Team activity	-Complete Weekly Report04 -Conduct Needs Assessment and report the result -List the result of the market research on the project report form	2
Week 5	-Understand design specifications -Exercise: Creating a design specification -Create the team's design specification	-Lecture -Team activity -A survey for each team member's contribution	-Complete Weekly Report05 -Add information to the project report form -Complete the team's design specification -Prepare for the second presentation -Complete the skills/abilities self-evaluation form (2)	8
Week 6	-Generate solutions -Oral Presentation II (Clients' needs and explanation for the team's design specification. -Understand the importance of the final report binder	-Lecture -Oral Presentation II -Team activity	-Complete Weekly Report06 -List more than ten solutions -Create a rough outline of the final report binder -Add information to the project report form	10

Week 7	-Understand how to solve design project problem consisting of short questions -Generate more solutions -Understand how to evaluate and select from the solutions	-Lecture -Team activity	-Complete Weekly Report07 -Complete the form for evaluating and selecting from the solutions -Prepare for the third presentation -Add the selected solution to the project report form	5
Week 8	-Organize the final report binder -Oral Presentation III (Selected solution, explanation for the process of selecting the most optimally possible solution) -Complete the project report form	-Lecture -Oral Presentation III -Team activity	-Complete Weekly Report08 -Prepare for the final oral presentation -Complete the project report form -Complete the final report binder	5
Week 9	-Final Oral Presentation	-Final Oral Presentation -Survey for each team member's contribution	-Upload the project report form	
Week 10	-Submit the final report binder -Complete the skills/abilities self-evaluation form (3) -Course evaluation	-Review		

Note: The figures in the column headed by "hr" represent estimated time in hours to complete assignments.