How to Teach Industrial Design? : A Case Study of College Education for Design Beginners

Joomyung Rhi, Yonsei University, Wonju, Korea(South), jmrhi@yonsei.ac.kr

Abstract

Industrial design education has existed for a long time as part of the university system, but the curriculum and contents of each subject vary considerably from school to school. In recent years, the introduction of new concepts that change the definition of design has blurred the boundaries of design, making the curriculum different. Establishing a standard curriculum to address these challenges is an important task, but it is necessary to fully understand how design education actually takes place and to share content with educators. This paper aims to contribute to the debate on industrial design education by fully disclosing the process and results of the first stage of industrial design education of a university by autobiographical method. The first course, Product Design Practice 1, is a studio class based on a task feedback iteration system. Students are required to submit assignments showing weekly progress. The instructor reviewed the assignments submitted before the class and gave written comments in class. In addition, details of the design process and method that are difficult to identify as novice students are learned through twelve case studies and applied to the project. This Task Feedback Repeating Class system gives students the opportunity to implement design ability while gaining detailed skills with a comprehensive view. Through this process, the researcher got a reflection on the class and implications for the improvement of the class.

industrial design; design education; task-feedback recurring system

Unlike secondary education, university education is very autonomous, which is operated according to the intentions and abilities of the instructor. The academic department of universities seeks to build formal curricula and educational content that shares common values through explicit and tacit agreement between academics and researchers in academia. However, in disciplines where the system of research has not been established yet, the autonomy of the instructors may increase and the variance between schools also does. In this case, sharing examples of individual pedagogical methods has a positive impact on knowledge formation in the field.

Study Goal and Methodology

In the past, the curriculum of industrial design that planned form elements of mass-produced products aimed at fostering stylists with expression-centered education. In recent years, the industrial design curriculum has been changed to train strategists who develop concepts and strategies for new products through creative thinking-oriented education. (Bu,

S., 1994, pp. 12- 25). The progress of this phenomenon differs from country to country. (Lee, S., 1998, pp.19-20) Despite the slow changes in the curriculum, Korea has already begun to blur the boundaries of the design field. (Rhi, J., 2007, pp.85-87) With the decline of traditional manufacturing industries and the emergence of intangible interaction and service design, the scope of objects of industrial design is expanding. As industrial design curriculum blends existing contents with new ones, industrial design is becoming increasingly confused with identity. The emergence of the term 'design thinking' that seem familiar but still unfamiliar is contributing to this confusion. It is time to discuss the future of industrial design education and establish common goals based on current education situation.

Many studies on design education are about proposing and analyzing advanced curriculum (In, C. 2009, Jung Y. 2011, Kim, H. 2011, Kim, G. 2011, Chung, W. 2012, Shin , H. 2012, Lee, J.
2013 and Lee, S. 2013). Few studies have shown the actual operation and training results of existing curricula. The purpose of this study is to elaborate the individual instructional structure of industrial design majors and describe in detail how students respond to given steps and guidelines. This is a form of autobiographical research, and follows four stages of the Currere method consisting of a degenerative, progressive, analytical, and synthetic step. This type of research allows researchers to have a positive reflection on themselves and can provide insights and suggestions for future classes to instructors in the same field.

Characteristics of Design Education: Studio Lessons

The objectivist epistemology that knowledge exists objectively regardless of human will is replaced by constructivism in which individual experience constitutes knowledge and meaning. This change in paradigm places emphasis on the will of the learner in education. It is recognized as a teacher's role to create a place where learners can think for themselves, rather than one-sided knowledge transfer to learners because it is universally agreed that learners constitute their own knowledge. In other words, learning is a process of actively constructing meanings based on subjective experiences and social interaction of learners in a given situation and context. In particular, it is a common practice for a college or university to teach design courses in a studio style that encourages learner self-reflective thinking and creative problem solving.

This seems to be similar to the traditional apprenticeship method, in which the teacher sets an example and the student imitates and follows it to acquire the master's expertise. However, apprenticeship training is an inevitable education method for the transfer of tacit knowledge, while the studio teaching of industrial design differs from that of apprenticeship education by the nature of knowledge to be delivered and the way of obtaining, accumulating, transmitting, and reproducing knowledge. As IDEO Tom Kelly mentioned, industrial designers are not experts in all areas of the project and are experts on how to solve problems. (Kelley’s interview, 1993.7.13.).

The knowledge required to carry out projects in the field of industrial design cannot be summed up in one or two textbooks. It requires wide range of knowledge in various fields

such as society, culture, economy, management, production. In addition, emerging new technology and the new trends in information use require learner's constant access to relevant knowledge. Furthermore, the knowledge and information they need is literally new, whenever they begin a project with a new context. Therefore, students need to learn how to get knowledge and information and build meaningful frameworks rather than being given piecemeal knowledge and information. The constructivist thinking mentioned above constitutes the background of this educational approach. Lee suggested that the following five factors are necessary for conducting the studio lesson. (Lee, D. 2008, p.150)

(1) Self-directed learning about learning objectives, contents, method and evaluation. Active problem solvers with voluntary control

(2) Context-based learning environment

(3) Improvement of design expertise through exchange, dialogue, and cooperative learning using various human resources rather than personal ability.

(4) Self-reflective learning environment. The opportunity to reflect on himself/herself

(5) Transforming the role of the instructor into a student's coach, mentor, information provider, and senior expert rather than a one-sided knowledge transferor.

Industrial design education system of 'A' university

'A' university in Korea consists many academic departments including science, engineering, management, social sciences, liberal arts, and design courses. Design course of the university selects 50% of new students by reflecting mainly the result of the art practical skill test at entrance examination, and the remaining 50% is selected by the results of GPA and Korean SAT. The first year students are required to select five subjects from these basic courses such as basic design, digital expression, drawing, expression technique, digital modeling, coloring, design and idea, human and design, science and design. When they start second year, students have to choose one major from three different majors including industrial design. The curriculum of the industrial design major consists of a total of 60 credits, and the number of courses is total 19, which is 3 ~ 4 courses per semester. In order to deepen the comprehensive abilities of design, most of main courses such as product design studio 1, product design studio 2, system design studio, emotion design, interaction design, interdisciplinary research and graduation research are conducted through studio project. The remaining elective courses provide students with the necessary knowledge and skill to help them succeed in the above studio courses. The lower grades are generally related to basic knowledge and skill acquisition. As students move up to the upper grades, they can view the outline of industrial design from an expanded perspective and participates in various courses to help them adapt to society after graduation. All subjects are linked to a prerequisite system to form the entire curriculum.

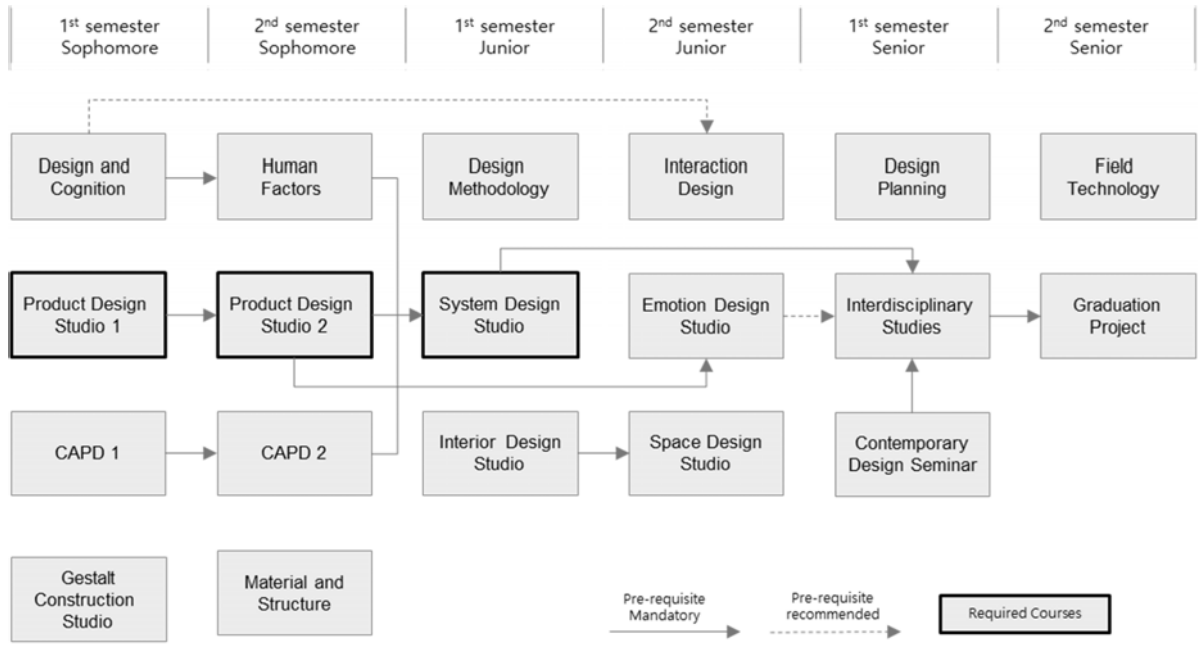

Figure 1: Industrial Design Curriculum of 'A' university

The core of the first semester of the second year is Product Design Studio 1, which runs concurrently with other courses such as CAPD, Cognition and Design, and Gestalt Construction Studio. Other classes unintentionally support the work of students in Product Design Studio 1. Because students use knowledge and skills learned from other courses to create their works of Product Design Studio 1 class. CAPD (Computer Aided Product Design) is a course for students' ability development for 3D modeling. They can learn the basics of NURBS modeling and practice the techniques of the Alias and Rhinoceros programs. The cognitive and design class is a theoretical subject that learns human characteristics, including cognitive ability. Based on this class, they study the ergonomics course to be opened in the next semester. Compared to the product design process dealing with real products, Form Practice Studio naturally learns Gestalt principles and creative attitudes by handling relatively light topics. Students are usually complete 3 to 4 courses(9 to 12 credits) from their major out of a total of 6 to 7 courses(18 to 21 credits) in a semester, because it is not easy to deal with many design subjects at the same time. Sometimes, students do graphic design, business administration and etc. as their minor courses.

Outline of Product Design Studio 1

As the first core class of industrial design, Product Design Studio 1 has the following instructional goals.

① To understand basic concepts of industrial design: Students understand the definition of industrial design that is responsible for the emotional realm of the artifact world. Students will understand the scope and content of industrial design through an overview of the world and an understanding of the areas of design including industrial design and its subdivisions.

② To understand the principles, processes, methods, terms and significance of industrial design: Students will understand the basic principles of industrial design to extract and combine the conditions that objects must meet. Students understand design process and also acquire a number of related terms.

③ To learn how to create concepts: Students understand the process of how the industrial design forms a new concept. Students will be able to combine creative thinking, logical thinking, and data-seeking skills and make presentations that convey them and increase their persuasiveness.

④ To understand significance and method of sketch: Students understand the significance of a sketch, a circulating tool of thought that visualizes ideas and triggers thinking again. In addition, students are taught the three principles of accurate, structured, and inquisitive industrial design sketches to utilize such sketches as a tool.

⑤ To understand the significance and method of model making: Students understand the significance of prototyping, a key method of design thinking as well as concept formation. Students have the ability to create models in three-dimensional sketches. Especially, they use soft model as an appropriate material to make quick circulation tool of thought.

⑥ To improve capability of related software operation: Students develop the ability to use a variety of related software in view of the growing importance of digital simulations.

Classes consist of four hours of common time that is conducted by the instructor and two hours of practical training guided by teaching assistant to expand sketch capacity. Four hours of common time consist of case discussions, lectures based on submitted tasks and weekly instructional goals, individual task guidance, and other progress explanations. At the beginning of each week, instructor delivers 1 to 3 sheets of weekly 'Lesson Points' that contain comments based on the tasks submitted by the week. Table 1 shows the 4-hour common time plan that was presented at the top of each weekly handout. Actual time management may be somewhat different, but it has been generally followed as planned. Critique used to need time more than planned, because individual task guidance for more than 30 students takes quite a long time.

Therefore, there were many cases in which the students used the additional time after the class or the individual instruction was performed in the corner of the classroom for 2 hours during the sketch class. The sketch exercises were conducted only for the students who need more practice. The mandatory participants for the training were selected from a sketch test held in the first week.

Table 1: Configuration of Class Hours

weeks	2nd	3th	4th	5th	6th	7th	9th	10th	11th	12th	13th	14th	15th	total	%
Case study	1	1	1	1	1	1	1.5	2	1	1	1	-	-	12.5	23.4

lecture	2	1	0.5	0.5	0.5	-	1	2	3	1	1	1	1	14.5	27.1
critique	0.5	2	3	3	3	3	-	-	-	3	3	3	3	26.5	49.5
total	3.5	4	4.5	4.5	4.5	4	2.5	4	4	5	5	4	4	53.5	100

The process of completing two projects for each of the eight weeks in a total of 16 weeks is the most important component of this course. Project 1 (hereafter referred to as "P1") is a project in which team members work together to develop knowledge and skills through team work. .
Project 2 (hereinafter referred to as "P2") was intended to provide individuals with independent design skills, with a focus on enhancing the individual's overall ability to be missed easily during team work.

The subject of P1 is 'container of simple form' and it is created through process that consists of idea, sketch, model and presentation panel, evaluation. The reason for choosing such subject for the first project was to take into account the simplicity of production, structure, the material, and the function so that students could grasp the whole process within a set time and fully handle the object to experience completion. By completing P1's tasks, students gain confidence that they will be able to proceed with the project as well as the ability to proceed with the rudiments, thereby enabling them to play a role as a preparatory course for the full-fledged process P2.

P2's subject was 'headgear for various purposes'. The theme 'headgear' was a generic term for wearing on the head. It was a comprehensive naming so that students could try various things while considering the human element of the head. Subject 'Headgear' is similar to P1's 'Container', but it is a more complex task than a container because the human element of the head is deeply involved. The process is almost similar to P1's, but a research phase for the user and basic usability has been added. In order to make sure that the human element is more accurately reflected in the result, they were required to test of fitting with the head of several colleagues in the middle of process, and to present it wearing a helmet mock-up on their head at the final presentation. Through this process, students were able to find logical ways to satisfy many human dimensions.

Core elements of the course

Class points, weekly assignments and individual guidance

During the 16-week period, students need to do a weekly assignment. Students uploaded the assignment to the official university’s internet storage two days earlier of the class day and shared the contents of the assignment with each other. Instructor prepared the Lesson Points that contains the comment about the assignment submitted for this week and students' progress shown, and uses it to lead the class. Also it provides guidance on individual tasks to students.

Individual instruction to task were not only for the individual but for all students in the class to learn from the comments for colleagues. These kind of sharing knowledge in the

classroom is quite efficient to convey many things within a short period of time. Thus, comments on individual assignments were shared by all students so that they could learn common lessons. (All material is kept on the storage for 2-3 weeks.) Instructors' comments lead to students' questions, responses and discussions. The content of the comments took the form of encouraging best practices rather than pointing out the wrong parts. Various kinds of praise communication were made, such as adding G (good), VG (very good), EX (excellent) to the assignment file name as an indication of encouragement. The Lesson Points also contained a note in the form of a key word and a question, which enabled the student to identify key points by color, letter size, and underline.

Table 2: Comments Example for Weekly Assignments

Individual Comments, Mar 25, 4th week
Give it a title. / Observe their eating habits. / Try to draw a more detailed picture of how it works. / Structure is needed. How do you make a transparent model? / Too much to consider. / There is no problem definition, reason for solving, solving method. / Making a bowl of noodles made of square. / We have to make some progress. / You are improving! / Please review your schedule. / See ideas like # 9. / I think you are going to make something, but the concept is still obscure. / Think of a more natural solution. / Create a model. The concept is not evident. Good explanation. There are many ways to hang tea bags. Request for Modeling. / Please think about various solutions. How to make a Styrofoam model. / Organize your ideas. / Good ideas do not come out at once. I would have told you to develop it through a sketch. / Let's take a look at your friends' presentation. / Carefully review the assignment before submission. / Additional explanation required. / What is the real advantage? I want to keep egg shell ideas. / Modify the presentation format simply and clearly.

Lecture and sketch practices

The lecture focused on the core theory of industrial design, which is a core curriculum. The instructor delivers the same sub-message several times over several weeks until the students are fully aware of the content. Instructor used carefully selected case studies to illustrate the theory to make it easy to understand. (See Table 3)

Table 3: Lecture Keywords

weeks	Theme	contents
1	Outline	Class summary. About Me. Project 1 Overview
2	Idea and sketches	Relationship between form and function (finding the reason of form) / emphasis on creativity of individual goal / definition of container, kind / characteristic / starting from basic form, learning of form principle / utilization of diagram

3	Modeling and Drawing	Function is the utility for the user (it is important to judge whether it is actually useful) / Context based characteristics of utility / solution and limitation / Problem solving process / Importance of prototyping / Importance of innovation and differentiation / Sensory appeal (immediate recognition) / Diagram utilization
4	Model making 1	innovation and differentiation (the original meaning) / the value of setting goals / utilizing diagrams / sketches should be able to explain your concept. (If not, you need to show your concept in other possible ways) / start modeling process
5	Panel	Representation of the average value / Design is the process of creation, and the process of valuation / panel evaluation criteria: Appropriateness of content and format of concept / Panel content: Goal and background, solution, rational design process / model Evaluation criteria:
6	Model making 2	Panel contents (goal and background, solution, rational design process) / panel making (content organization, elimination of meaningless decoration, what is good image) / Learn value through good image and case. / Models Evaluation Criteria
7	Project 2 initiation	Project 2 Description / Headgear type and human head shape characteristics
9	Usability	Head size measurement method (Ergonomics issue)
10	Concept and context	Mass production and standardization, Target users, Mass-customization. Universal design. The difference between invention and design. Discussion of intimacy and uniqueness. / Importance of maintaining the unique characteristics of self-ideas / How to make models (Individual process, CAD application, reflection of research results)
11	Concept development	what is the value of this proposal? / Raising and answering self-questioning about the value / relativity of values / Prototyping / Importance of maintaining the proprietary nature of self-ideas / Satisfying the needs of a large number of people / Using the tablets to make it possible to write on the head
12	P2 Model making 1	How to develop ideas : Develop user-centered concepts and design requirements as a design brief. Self-questioning and experimental prototyping. Benchmarking on the competitors / Questioning and Answering: Setting Goals. Ask questions to accomplish your goals. Collect as many answers as possible. Find meaningful answers among them / Which one is more valuable between traditional values and
		future-oriented values? / Condensation through Photoshop / Adding ideas on the pictures and images
13	Concept and Panel making	Competitor Benchmarking / What kind of design technique is most important?
14	P2 Model making 2	Elements of the presentation panel for evaluation: Goals and Background, Solutions. Rational Design Process / Organize contents of the panel and remove meaningless decoration. What is good image?

After the class, in the afternoon, 2 hours of hands-on teaching experience was taught by a teaching assistant. Students who have difficulty sketching are designated to attend, and unspecified students are allowed to participate if they wish. In general, about 4/5 of the students were assigned in the beginning, and about half of the students participated in the end of the term. Sketching exercises mainly focused on line drawing exercises, ellipse drawing exercises, perspective, shadow and contrast, and layout techniques. However, it was more important to understand and practice the three principles of the industrial design sketch that the instructor set up empirically, namely 'principle based sketch', 'structural sketch', and 'inquisitive sketch'. 'Principle based sketch' means a sketch that understands and applies the visual expression principle such as perspective and projection. 'Structural sketch' refers to a sketch of three- dimensional expressions with the invisible back side of things or phenomena to be described. It is important to draw on the three-dimensional structure even in the two-dimensional representation, because industrial design differs from the two-dimensional expressive sketch in the field of graphic design, as it depicts the structure and state of an object or phenomenon. The 'inquisitive sketch' is not a picture to show a shape on a piece of paper, but a sketch in which the trajectory of one's own idea is revealed naturally. Such a principle is not necessary for sketches to be a simple image depiction but rather as a medium to record the flow of thoughts and generate new ideas from it. The exercises were checked through a short test with emphasis on speed, and the overall progress was confirmed through a sketch test on the midterm exam.

10 weeks of case study presentations and discussions

A case study is a very useful way in which students can extract suggestions to look at their work from an already conducted case. A total of 10 cases were reviewed during the period from 3 to 7 weeks to 9 to 13 weeks. The case used a well-organized case in the "Design Secrets" series, which was designed and published by IDSA. Despite the advantages of students finding cases on their own, the intention was to save time on the case search process. The weekly allocation of the cases was structured so that similar examples could be examined according to the progress of the project (1. vessel, 2. helmet). The students read about 4 pages of the English version of the case that was assigned to the team and shared the key contents and implications in the class. Given the limited data available, recent cases, or recent activity of the company, and related product lineup have been reviewed to add depth to the case to complement the current view.

The case study session lasted about one hour per week. First, when the presentation team explained the results of the case study for about 15 ~ 20 minutes, three designated questioners first raised questions, and after the discussions came, naturally, all the participants participated in the discussions. But the discussions were not easy and needed a lot of encouragement. Therefore, the question group was appointed weekly separately from the presentation team, and the group was encouraged to discuss the case with the presentation team by reviewing the case in advance and raising further questions or discussions. At the end of each weekly case study session, the instructor will arrange the relevant key content. After the class, the students posted three new words and testimonials on the online class bulletin board. In addition, the contents of the case were presented in the regular examination so that students could concentrate more on participating in the

discussion. The team that published the case summarized the contents of the presentation and the discussion on the day, and submitted a comprehensive report on the case at the end of the semester.

Testing and evaluation

Submitting a weekly assignment and reviewing it is a great help in understanding the progress of students and preparing for the lesson. Therefore, submitting the assignment in good faith is very important for maintaining the education system, so the submission is counted in the student's credit calculation. However, the contents of the assignments may vary widely depending on the characteristics of individual students and individual subjects, and the quantitative evaluation was not carried out because untimely assessments may undermine their characteristics. Only qualitative and integrated comments on the assignment were continuously given and shared so that all members of the class could refer to it. This feature of the weekly evaluation of the task was guided to the students at the beginning of the class so that the students could judge the value of the task contents themselves.

The final results of the two projects were evaluated. At the end of each project, the results were presented through panels and models, and presentations were held in the classroom or in the exhibition hall while other professors attended. In Project 2, which has the subject of a headgear that could be used on the head, students were asked to wear a headgear of their own to prove that they had properly checked the physical use of the person.

Even though this class is a studio-based class, midterm and final exams were held. The midterm exam was a written test including a sketch exam, and it was mainly aimed at confirming the contents related to the product development that was found in the case study. The results of the sketch test were also used to identify those who would continue to participate in the additional 2- hour sketch class. The final written examination required understanding of the core issues revealed in the case study after the midterm exam and describing the detail of their design process so that they could reflect and establish their own method.

Discussion

Product Design Practice 1 consists of 15 weeks of continuous interaction between sharing and teaching through weekly classes and students' assignments. Weekly assignments (projects, examples, etc.) were a good way to see students' understanding and progress. Through it, the instructor reconfigured the weekly schedule by supplementing the original plan. The students were able to participate in the class after they had compared each other by preliminarily reviewing previously submitted assignments on the web. The project serves as an important device for synthesizing individual exercises. Project 1 of the preliminary nature also provides the framework and skills training opportunities needed for Project 2. In addition, midterm and final exams are conducted to evaluate the degree of theoretical learning and sketching abilities. At the end of the semester, the final goal of presentation and exhibition is presented, inspiring students' enthusiasm. All elements of this class, ie, tasks, comments, projects, tests, presentations and exhibitions, are linked

together to form a structure that promotes student development. This structure is referred to as the task-feedback recurring system.

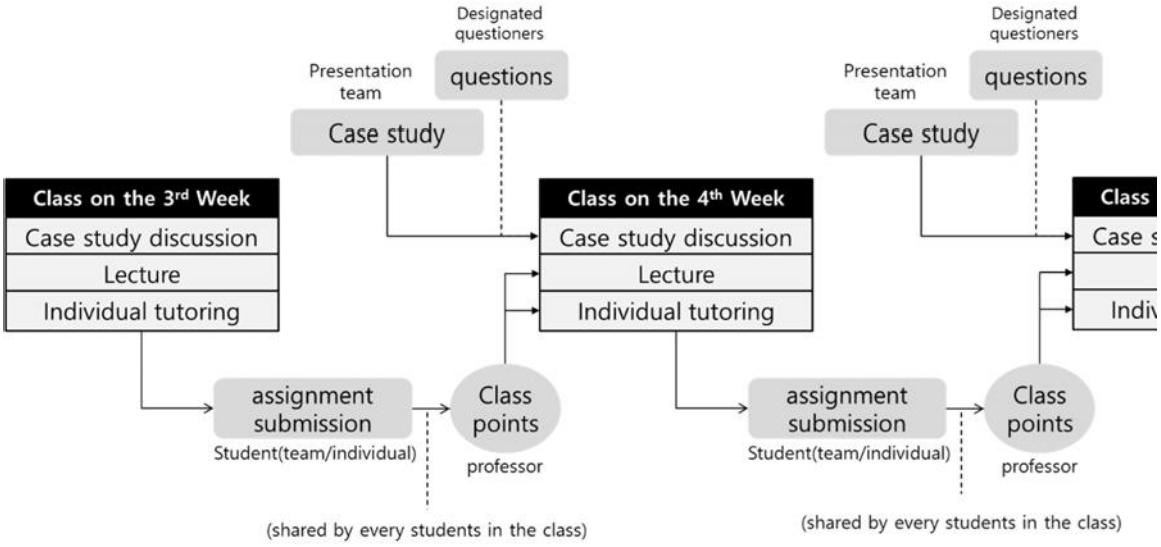

Figure 2: Task-Feedback Recurring System

At the end of the semester, a review process was conducted to see what ideas students had as a result of the lessons. Two questions were asked. The first question was asking what is the most important design ability for designers. Students wrote two items that they thought were important. They emphasized the importance of expressive power and the need to grasp what people want. Particularly, students thought that it was important to draw out user research questions, to observe and write notes, to observe, and to record using mobile phones. Sensitivity, creativity, user understanding and consideration, and the importance of repetitive attempts are also presented by a few students. It can be explained that students have a general understanding of the core concepts of industrial design, principles, and concept formation, which are the objectives of Product Design Studio 1.

Table 4: Students' Thought about What is the Most Important Design Capability

Students' No.	The most important design capability (1)	The most important design capability (2)
1	Listen to others	Express means (sketches, software)
2	Understand what people want to use	Actually expressing your thoughts
3	Record using mobile phone	Sketch with 3D programs
4	Survey methods that begin with questions	Simulation with 3D programs
5	Observation and thought memo, sketch habits	Listen to other people's opinions about things
6	How to identify user needs	-
7	How to explain the concept	-
8	Repetitive attempts	Various experiences and feelings
9	Model making to feel directly	-
10	User observations for in-depth access	-

11	Express ability of my thought	Seeing, Thinking, and Developing Lots
12	Ability to communicate based on understanding and care	Expression skills that can convey your thoughts
13	Expression that clearly shows intent	Designer's sensibility and sense
14	Show the concept!	Feel the reaction of people!
15	Comprehensive expressiveness	Effective delivery of ideas in your mind
16	How to express yourself	Record with your mobile phone
17	The process of thinking out of obscurity	-
18	Develop a Great Idea	-
19	Expressions that others can understand	There are ways to suit each individual

The next question was a more comprehensive question: what are the characteristics of a desirable design, and how do you think about design? The students described the answer more narratively than the previous question. From the concept of design to the ability of design, to the conditions of the design outcome, opinions came out, and the level of opinion was very high compared to the learning period of only 3 months.

Table 5: Some of Concepts of Design Suggested by Each Students

What do you think about design? A: Every design is the result of a big goal backed by a lot of small ideas.
B: The designer's capacity is to recognize the need for new design in his life and design it for many people. C: When I was a very young boy, I remember that my grandfather made a basketball hoop for me in his handmade yard. Could design for one person be the most beautiful design in the world? D: I think that the design for each person's personality will make the design more enriched. No one wears Haute Couture's clothes in everyday life. But the clothes make it feel more fashionable and richer. "

As mentioned earlier, the class of industrial design has a constructivism characteristic. But it would be more appropriate to describe it as training in a more comprehensive thought process than in traditional apprenticeship training. In addition, this class was operated in a more tightly structured way, with the aim of developing autonomous reflective thinking. According to a constructivist in education field, the learner needs self - directed learning, situational contextual learning, self - reflective learning and cooperative learning, and the instructor needs to function as a learning facilitator.

One of the characteristics of this class is that all the schedules are planned and tightly organized. In the process of solving the tense design problem, the student develops the basic ability of the individual to understand and synthesize the characteristics of the design

object. In other words, it was a process of training that gave the students the skills and attitudes necessary to carry on their own tasks. However, students are likely to feel fatigue in such a process, and are likely to become somewhat inadequate in their self-initiated aspects. Some students commented on the situation as follows. "I did not know that the semester would go on without such a break." “I could not afford to read other books.” Providing students with a loose course gives them a chance to contemplate their work, which can be a good strategy for students to lead their own reflection. There is still uncertainty as to which of the basic intensive training and reflection times is more appropriate. It seems to be a task to examine through more empirical research in the future.

Conclusion

This paper intends to reveal a scene of the first stage of industrial design class at university level. College classes should reflect dynamic research results in the field, and design education, in particular, places importance on embodying rather than simply retaining knowledge. Especially, it is not appropriate to transmit fixed contents depending on textbooks because it requires the embodiment of methods separately from the embodied knowledge. Therefore, rather than adopting a single exemplary design knowledge delivery system, it is highly necessary for all schools to demonstrate and share various examples of design teaching methods according to individual needs and to improve them in a reflective manner. For this purpose, this paper analyzed the structure and content of 'Product Design Practice 1' which is the first major course of Industrial Design Department of University A.

This course is based on studio lessons focusing on two projects. The first project has the preliminary nature of the second project, and practices the process of visualizing the elements of the object and the process of maintaining and developing the value while changing the characteristics of the object. In the second project, students have to come to a conclusion by solving more complex problems considered human factors. Students were required to work on weekly assignments that developed the project concept, and the professor consistently conducted a weekly cycle of reviewing the contents and writing individual comments and delivering them to the students in class. This continuous cycle process is the most important characteristic of this class. In addition, ten case studies were used as a way to learn from other cases and from each other.

Thus, the project, the continuous task-feedback cycle process, and the case study were integrated into one learning system. Through this, design concept, principle, process, method, etc., which is the aim of this lesson, were communicated and taught, and other detailed technical matters could be embodied in students. Through the autobiographical way of looking at the class, the researcher was able to reflect on the strengths and weaknesses of the class system and to draw implications for future improvement. Later on, individual teaching methods need to be shared more in this form. The accumulation of the evaluation of the effect of teaching methods and contents on the basis of sharing will help build the 'knowledge system' and 'work logic' common to industrial design.

References

Chung, W., Yeoun, M. (2012). Educational Characteristics and Its Implications Based on Industrial Design Program at Carleton University in Canada. *Journal of Integrated Design Research*, 11(4), 117-128.

Chung, Y. (2011). Verification of Effectiveness on Design Education Based on Research. *Journal of Digital Design*, 11(2), 277-286.

In, C. (2009). Study on Satisfaction Factors in Design Studio Classes. *Journal of Digital Design*, 9(4), 1-12.

Jeong, J. (2011). A Study of the User Experience-based Product Design Process Of Design Education. *Archives of Design Research*, 24(1), 37-46.

Kim, H. (2011). Integrated design education framework based in transdisciplinary approach of Technische Universität München. *Archives of Design Research*, 24(6), 80-97.

Kim, J. (2008). *Korean Design History*. Seoul; Mijinsa

Kim, K. (2011). Understanding Product Design Process as it fits into the Interaction between Industrial Design and Engineering Design. *Archives of Design Research*, 24(6), 4-31.

Lee, D. (2008). Investigating Constructivist Approach to Design Studio Courses in Universities of U.S.A and U.K.
Journal of the Architectural Institute of Korea : Planning & Design, 24(6), 149-160.

Lee, J. (2013). Basic interaction design program development for better interaction exploration -focused on the exploration process of interactivity. *Design Convergence Study*, 12(5), 96-110.

Lee, S. (1998). *Study on the Actual Condition of Korean Design Education*. Seoul; KRIVET.

Rhi, J. (2007). Overview on the Global Design Issues. *21st Century Design Forum*. Bundang; KFDA

Shin, H. (2012). The Inter-disciplinary Design Education at Department of Science of Design in Musashino Art University. *Journal of Integrated Design Research*, 11(2), 51-64.

Yi, S. (2013). Case Study of Teaching Portfolio of UXD Basic for Undergraduate Students Majoring in Design. *Journal of Digital Design*, 13(2), 67-78.

Author Biography

Joomyung Rhi

Associate Professor of Industrial Design and Design Management at Yonsei University. He is also responsible for the Interdisciplinary Graduate Program in Design Management at the university. He has been interested in the nature of design research and how to teach design to various audiences. The intangible trends of industrial design and the relationship between man and the artificial world have become a topic for him recently.