nPBL(non-Problem Based Learning) by using Marketing Patent Map

Sung W. Cha[1], Dae-eun Kim[2]

[1,2] Yonsei University, Seoul, Korea

swcha@yonsei.ac.kr [1], kimde@yonsei.ac.kr[2],

Abstract

Engineering colleges have expended much effort to develop a variety of education models for improving a creative problem-solving ability of students. Generally, nPBL(non-Problem Based Learning) means that the students raise the question by themselves under the condition that they don't know what the problem is and study the method of solving the problem through planning, designing and producing the project. Capstone design is a typical example of the nPBL model. This research presents the way to raise the question by using the MPM(Marketing Patent Map) which is new method, and it is the first step of nPBL. MPM helps the students raise the questions by themselves and evaluate the marketability of the final product. Through this process, this research also shows the ways to judge whether the project is successful or not. The effect of the nPBL model with MPM is checked through Creative Design Project [3] (a core subject in engineering design).By considering marketing factor and patent searching by using WIPS, student defines what the problem of nPBL is. And it is ascertained that marketability improvement of the final product proceeded by using MPM.

Introduction

PBL (Problem-Based Learning) is an educational approach which structuralizes learning situations to present and solve practical problems. In this approach, learners participate in the small group learning to solve problems in a cooperative and self-driven way, and develop problem-solving and critical thinking capability. PBL is defined that learning where learners learn while they try to understand and solve problems. PBL started to solve the problems of traditional education environments such as passive learners, knowledge unrelated to situations, and school knowledge inapplicable to society, and was presented as a way to develop knowledge integration capability required for the information age.

In mechanical engineering, the purpose of PBL is to provide experience-base learning experience for learners to learn basic knowledge about mechanical engineering and develop creative design capability. While they don't have full knowledge about major courses on mechanical engineering, with PBL-based projects, learners are to define the problem, figure out solutions, select materials, analyze functions and develop plans to reduce errors. With this, it is expected that learners will develop conclusions through discussions and cooperation, experience error arising in actual production, understand the importance of conclusion, prepare presentation materials, and demonstrate their work. At the same time, in the process of PBL, learners will receive motivation for mechanical engineering and have eyes to see mechanical engineering situations and applications.

Compared to PBL, n-PBL aims at more developed learning. While learners learn as they try to find solutions to their problem in PBL, learners are to come with their problem by themselves in n-PBL. They will learn how to define a problem exactly. Among many ways to introduce problems, learners can analyze existing patents. By analyzing patents, they can understand what problems the previous product has, and how such problems were solved. Based on this, they can compare various problem-solving methods.

One of the best-known n-PBL methods is the capstone design course. In this course, to enable engineering students to solve problem in the field, instead of writing the graduation paper, they are to plan, design, and produce work based on what they learn from college curriculum. As one of engineering certification education, it started to be used widely in the 1990s in the US. In Korea, the course was introduced in 2002 by the Ministry of Commerce, Industry and Energy and Korea Industrial Technology Foundation to raise field-oriented designers capable of using CAD/

CAM programs, train creative engineers with user-oriented engineering education, and establish the design education and design information systems. Now, this course is well established as a program to educate engineers who can satisfy industrial needs timely and work on the actual project, and improve national competitiveness by upgrading the educational quality of engineering colleges.
In this paper, the MPM (Marketing Patent Map) is introduced to present the method about the early stage of nPBL, question raising. With the MPM, students are to raise questions by themselves and decide whether the project was successful by assessing their project marketability. Based on the Creative Design Project (3), the effect of the nPBL model with MPM is checked. In this course, students raise nPBL questions by searching patents with WIPS and considering marketing factors, and confirm this process improves the marketability of the finished product.

Introduction of the Creative Design Project (3)

a. Overview

The Creative Design Project (3) is the mandatory course for mechanical engineering seniors at Yonsei University. This course has 3 credits, two-hour class for all registered students, two-hour class by group, and two or four-hour class for practice. The focus of this course is to enable students to understand systematically the whole process from basic idea, design, and production through sales. The focus is not only placed on design and production, but also on early planning and marketing and promotion. Therefore, students can experience the product development process in the real industry. As the value of the product is evaluated by customers, students can understand how important it is to develop products for customers as well as how important it is to develop new, creative, and unique products. Finally, students learn the importance of intellectual property rights for new ideas.

b. Features

Currently, at Yonsei University, creative design engineering is applied to Creative Design Projects (1), (2) and (3). Creative Design Projects (1) and (2) are related to problem-based learning or small project-based learning. And Creative Design Project (3) is project-based learning or non-PBL (Problem Based Learning) where students solve problems to question raised by themselves not given by the professor. This course maximizes the ill structure of PBL and non-PBL where no problem is given to students. The most distinctive feature of non-PBL is problem creation. Students are encouraged to think intensively as they are asked to find problems in their life by themselves.

c. Goals

The following are the goals of this course.

1) Systematically understand the whole production development process: Students understand the importance of planning, marketing and promotion as well as design and production by doing the real projects.
2) Develop imagination, creativity and internal motivation for engineering with various teaching methods
3) Build a new perspective for valuable products: As well as creative and unique products, products for customers are also important.
4) Learn basic operations of machines with actual projects: Participate in the real project.
5) Improve communications between team mates and problem-solving capability with the team project.
6) Enhance the ability to express ideas with presentation.

Patent Search Method: WIPS

a. Patent Search and Patent Analysis

Patent search and patent analysis must be done in the early stage of product development to verify validity. Therefore, in this Creative Design Project, the program is developed to help students to learn the importance of patents, patent search methods and patent analysis methods.
Before a lecture on how to search patents, students are to understand the general aspects of patents such as type and patent life.
At the same time, to write actual patent claims, students learn how to read, understand and write patent claims. With

this, students write patent claims for their own products.

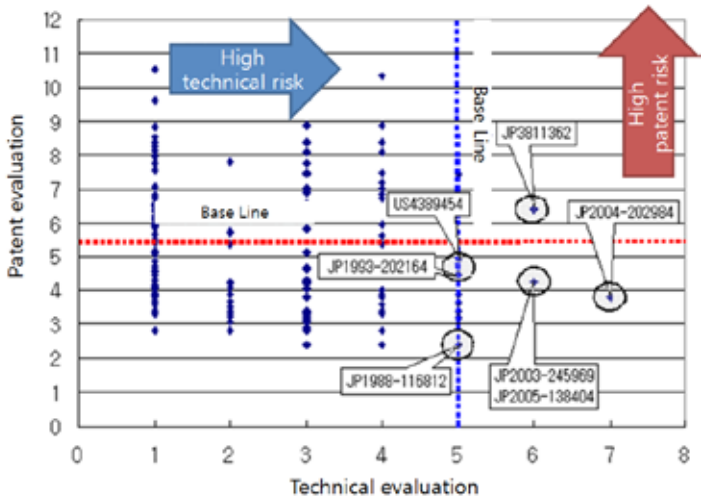
After understanding patents generally, students are to learn how to search and analyze patents. Though there are many patent databases, in this program, WIPS is selected to teach students how to find out whether there are patents related to their ideas. To this end, educational materials are developed to enable students to use WIPS.

Figure 1 is the main page of WIPS. WIPS contains various patents from the US, Japan and Europe as well as Korean patents, and provides search service for users.

Fig. 1 WIPS and Search Results (www.wips.co.kr)

To search patents, you should understand keyword and operators first. It is important to learn how to search patents by combining key words with operators such as “and”, “or”, “not”, “adj”, “near”, “*”(asterisk), and “?”. The educational materials explain such operators sufficiently, provide examples, and enable students to search patents on their own. Along with this, according to users’ information, they can use basic search, field search, number search, step search and comprehensive search. Explanation and examples for such search options should be provided so that students can use search options fully. The educational materials developed in this project describe that students can search patents easily after learning basic knowledge on patent search step by step. The second goal of patent class is to teach students how to search and analyze patents. After learning search methods, students learn patent analysis. With patent maps on various fields, students learn various analysis methods and apply them to searched patents. Figure 2 shows the patent map presented to students. With lectures on patents, students have a general understanding of patents and their importance, and learn how to search and analyze patents. And then, students carry out projects to practice patent search and analysis and to write patent claims.

Fig. 2 Patent Map

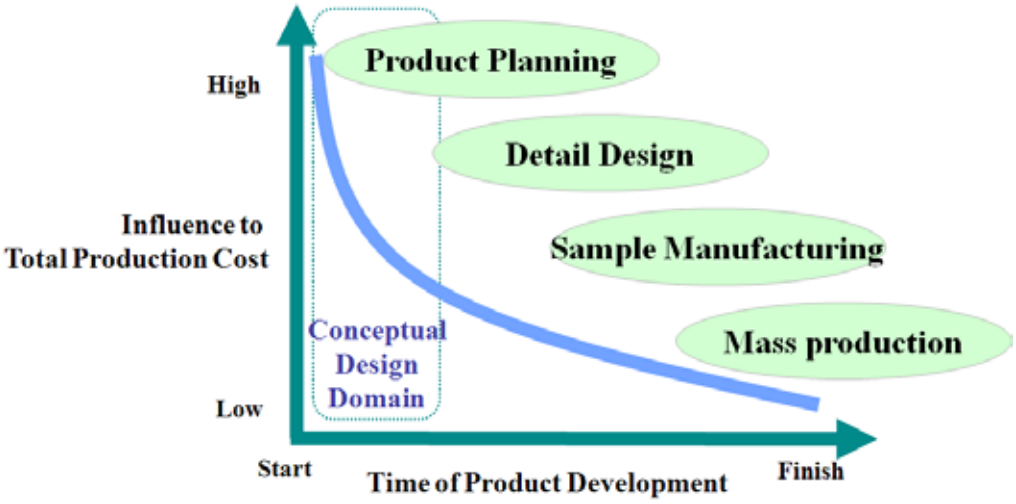


b. Concept Design & Detail Design

In the product development process, once the idea is selected and its validity is verified, product design starts. In the Creative Design Project, 11 steps of product development are carried out. Therefore, students design products before producing them. Most of the students have experienced partial design in other classes. However, they don't experience the whole design process for actual products that is covered in this class. So, lectures on total design should be given to students.

Generally, design can be classified into concept design and detail design. Concept design is the upper level design to decide basic functions and design variables. Also, detail design is the upper level design to detail products after concept design. Figure 3 shows how each design stage affects the unit price of the final product.

Fig. 3 Impact of Design Stage on the Unit Price of the Final Product



This shows concept design is very important to the final price. Since concept design has a big impact on the final price, concept design should be performed in a valid way for successful production. However, the importance and the actual method of concept design are not taught properly to students in the existing class. Therefore, in the Creative Design Project, a lecture on concept design is given to students.

Marketing Theory

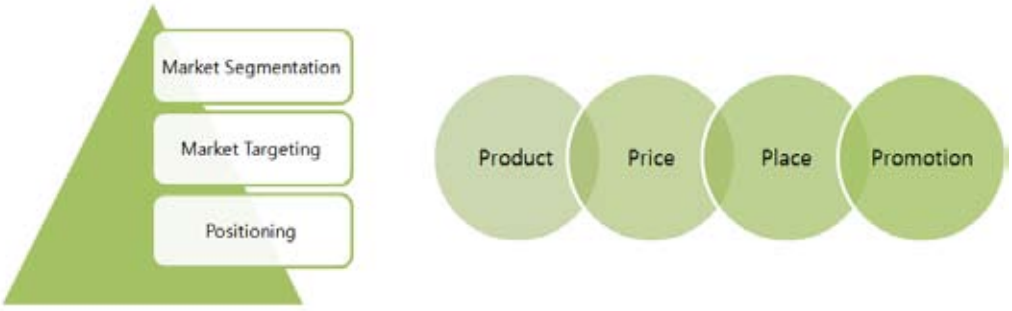
In the actual industry, what should be considered in all production and manufacturing is marketing. However, not much emphasis is placed on marketing in current engineering education. In this Creative Design Project, marketing lectures are given to students so that they take into marketing factors in their design and production.

The first purpose of this lecture is to have students understand the overall process for marketing strategy establishment.

Therefore, before giving a lecture on today's various marketing strategies, the general process for marketing strategy establishment is explained as shown in the picture and then, detailed parts are explained. In the planning stage, external and internal environments should be analyzed first. The most commonly used method for this is SWOT analysis. By analyzing company's strengths, weaknesses, opportunities and threats, data is drawn for strategy establishment. Figure 4 shows basic concepts for STP analysis and 4P mix. To market products and services efficiently, in STP analysis, the market is segmented, targeted, and then positioned. After positioning the target market, the marketing strategy, 4P mix is established. In 4P mix, products, prices, places and promotion are compared with competitors so that supplementary measures can be taken to weaknesses and strengths. The purpose of the marketing lecture is to help students not to forget the importance of marketing by putting too much focus on product functions after they graduate from university and work in the real industry. The marketing lecture is help students to make products that

satisfy customers' wants and needs.

Fig. 4 STP Analysis and 4P mix



Therefore, after lectures on marketing strategies, students are told to apply various marketing strategies to their work and are encouraged to use various PR materials for presenting their work. Understanding basic marketing principles and applying them to their work, students can understand how important it is to design products not only from engineering perspectives but also from comprehensive perspectives.

Products Developed in the Course

Based on patent analysis and marketing analysis, students can choose themes for their work. For the selected theme, students collect relevant patents and understand the features and problems of the product that they want to develop. To solve found problems, they develop various ideas and build their own products. While making their product, students take into consideration marketing factors related to STP and 4P mix. Figure 5 shows products developed by students through this process.

Fig. 5 Students' Products

(a) (b) (c)

In Figure 5, (a) is a machine that cleans shoes automatically, (b) is an improved wheel chair for seniors, and (c) is an automatic cloth-folding machine. Students brainstormed ideas and select one idea by drawing the decision matrix. Then, they understand problems in the existing products and check if their idea already exists. With marketing factors developed through STP analysis and 4P analysis, they make their product. As shown in Figure 5, their products are well built and are applicable in real life. Finally, students are told to create design and PR materials for their products

based on marketing factors.

Conclusion

As the n-PBL class is given to students based on the MPM, students produced well-built products. With a lecture on patent search through WIPS, students understand the problem of existing patents. They select their product themes by searching patents and find solutions to the problems of their products. SWOT and 4P mix analyses are used for students to take marketing factors into account. In conclusion, students learn how to solve engineering problems by searching patents and create products with marketing factors highly reflected.

References

01. Suh N.P., The Principles of Design, New York: Oxford University Press, 1990.
02. Suh N.P., Axiomatic Design : Advances and Applications, New York: Oxford University Press, 2001.
03. Cha S.W., Creative Design Method, Yonsei University, 2001.
04. Cha S.W., Kim D.E., Lee S.H., Creative Design Project 3 : Course Materials and Report, Yonsei University, 2003.
05. Cha S.W., Axiomatic Design : Course Materials, Yonsei University, 2003.
06. Cha S.W., Kim D.E., Lee S.H., “Engineering Education Course and Application for Training Creative Engineers”, Conference on Engineering Education & Technology Transfer, 2003.
07. Cho P., “Engineering Education : ABET EC2000 ”, Journal of Engineering Education & Technology Transfer, Vol. 10, No. 02, pp. 72-84, 2003.
08. Cho H.E., “Change of Engineering Education ”, Journal of Engineering Education & Technology Transfer, Vol. 11, No. 01, pp. 19-23, 2004.
09. Robert Boostrom, Developing Creative & Critical Thinking, NTC Publishing, 1992.
10. Shinmory Yasnory, Creative Thinking with a Difference, Kukje Publishing, 1996.
11. Edward Lumsdaine, Creative Problem solving and Engineering Design, McGraw Hill, 2000.