Fine-Tuning Paradigm in Design Studies: The Case Study of Interdisciplinary Teaching and Learning for Product Design & Development

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Abstract: This paper aims to interpret analysis and propose a paradigm to achieve pedagogical objectives of collaborative-interdisciplinary approach in product design studies for all stakeholders by looking at an interdisciplinary course co-organized by Industrial Design Program – KMUTT, Department of Control System and Instrumentation Engineering – KMUTT, and Thai Toshiba Electric Industries Co., Ltd. (TTEI). The insights obtained through participation among instructors, students, in both engineering and design programs and businesses have raised awareness and understanding of the differences among creative people, engineers and businesses. Consequently, a suggestive paradigm in product design & development studies can be adopted not only as an efficient approach to apprentice students for their future career, but also as a way for businesses to gain more understanding of the research-and-design-driven innovations.

1. Introduction

Interdisciplinary efforts over the last century can best be understood as a desire to facilitate unity and synthesis in terms of knowledge, according to Holley (2009) [1]. Rationale of both design and engineering programs to merge rather course, project, or curriculum is less likely to be resisted. Especially in product design and development process, various disciplines such as designer, engineer, marketing, and more or less related experts have been considered to be appropriate for interdisciplinary relations [2]. Not just in higher-education pedagogies, in real businesses, the approach is now widely realized as the most effective way to innovate products or systems in order to maintain competitiveness in their territories. However, academic collaboration in interdisciplinary still requires manipulated inputs from its institute consisted of seeding, supporting, and sustaining as stated in the University of Washington's internal report [3].

2. Research Objectives and Methods

The study proposed to define the problems and constraints of the interdisciplinary pedagogy in product design education. In comparison of two concept designs, product development concept and emerging concept [4], these two characteristic concepts as the comparative paradigms were deployed to identify constraints occurring with all participants. Accordingly, suggestive development as a single paradigm to enhance teaching and learning performance is expected for continuous improvement of related programs and all stakeholders.

Case studies were assigned into a project-based-learning course by TTEI, the local electronic-appliances manufacturer. Design and engineering programs (KMUTT) bundled their courses to fulfill several learning outcomes of learners. In which, separately they rarely experience such a complete product-design-and-development-process situation. In these semester-long projects, the researcher, as one of the design-program instructors, in the mean while teaching and mentoring, observed and collected data with interested issues. Undergraduate students, divided to be multidisciplinary groups, actively participated their learning in design-studio-type classroom, working on each group research-oriented-design project. Occasionally along semester, TTEI team also participated with their advisory group, comprised of engineers, marketing staffs, and executives. Accumulated data through participation and discussion can be concluded at the end of the semester.

3. Paradigms in Product Concept Design

In this case study, three characteristics of product design concepts, according to Keinonen [4], were cited as a set of paradigms to investigate similarities and differences in the aspect of discipline's viewpoints. Three kinds consist of product development concept, emerging concept, and vision concept. This research assumption is that the problems or constraints occurring in the previous academic years came from the different viewpoints of different disciplines. As a result, several confusions were posed to the students in form of fragment opinions and guidance without the unity from both program's instructors and TTEI team. It was somewhat ambiguous for learners whether the chaos of design directions was acceptable professionally within design process. Instead, the clear and unified paradigm from instructors and real-business team would efficiently stimulate learners to perform and apprentice their disciplinary and interdisciplinary skills.

According to the assigned projects, there were just two out of three paradigms based on either product development concept or emerging concept. But in fact, these were assigned by two different natures of the cases; one is existing-product-based assignment, and another is user-oriented assignment. In existing-product-based projects represent as the product-development-concept paradigm, the design outcomes from students were still restricted with more existing-product conditions. Their specifications and functions were quite confined within the current product circumstance (refer with: Fig. 1).

Fig. 1. Samples of Students' Design Outcomes in Product-Development-Concept Paradigm; (Left to Right) Electric Pan, Air Purifier, Rice Cooker, Water heater, Electric Fan, and Electric Boiler.

On the other hand, in the user-oriented project represent as the emerging-concept paradigm, the design outcomes were less constraint. The more open-ended product specifications were to search for innovation opportunities through user-behavior research and analysis. Likewise in product-development concept in term of research-based design process, this distinctive assigned

paradigm was efficient enough to lead several interesting design outcomes from students (refer with: Fig. 2).

Fig. 2. Samples of Students' Design Outcomes in Emerging-Concept Paradigm; (Left to Right) Hot & Cold Water Purifier, Electric Food Preservation, and Electric Pillow for Pregnancy Mom.

4. Discussion

4.1 Disciplinary-Paradigm Tendency

The paradigm's difference among stakeholder disciplinary can be illustrated through observation and discussion with all participants, focusing on the teaching-side not the students. Five groups of teaching side consist of (1) Engineering Instructor (2) Design Instructor (3) Marketing Staff (4) Engineer (5) Company's Executive. In academic side, engineering instructors were familiar with product-development-concept paradigm. To prove the ideas of embedded systems or control systems was their major concern in project consulting. While design instructors always try to encourage students creating new ideas, thinking-out-of-the-box was the key to generate new design after gathering user behavior and analysis within research phrase. Implying by the evidence, the design instructors were into the vision-concept paradigm totally in contrast with engineering.

Fig. 3. Disciplinary-Paradigm Tendency

Meanwhile in the business side (refer with: Fig. 3), TTEI's consultant team reflected the organization based on their experience and technical expertise. Fundamentally, TTEI is the company that originally manufactured the products (OEM). The engineer is capable of driving down the cost of production and solves the technical issues in product development as minor change. Incidentally, their open-mindedness allowed student's creativities up to the level of emerging-concept paradigm. For example, when the student's ideas challenged of existing technology but not ready in market, due to its cost-competitiveness concern, engineer team still allowed them to develop their designs with helpful guidance. In marketing, their advices for students were always based on current marketing scenario. Occasionally, the marketing staffs seem to be willing to accept the new ideas, but without

confidence, they suggested not to cross the existing-market-segmentation familiarity. It is in between of product-development-concept paradigm and emerging concept. For the most manageable representative from the company, in more holistic viewpoint, the executive understandably accepted the wide ideas in student's projects. They knew that these ideas were for skill practicing. Simultaneously, they implied somewhat willingness to educate their own staffs to gain more understanding of the research-and-design-driven innovations.

4.2 Problematic Constraint and Paradigm Suggestion

As stated previously, several confusions were posed to the students with different kinds of reasons. Although all supervisors in the project spent lots of time and effort, the chaos between student's team working frequently happened, and irresistibly, one of the major problematic causes was too many paradigms within the consultancy. In fact, students in both programs needed to learn how another discipline think and work in the same project as ours. It is the intentional objective as a learning outcome. But among the course's coordinators, if fine-tuned to just single paradigm before kickoff, the collaborative-disciplinary approach will certainly stimulate learner's knowledge and skill whereas single-disciplinary approach will not be capable to synthesize likewise.

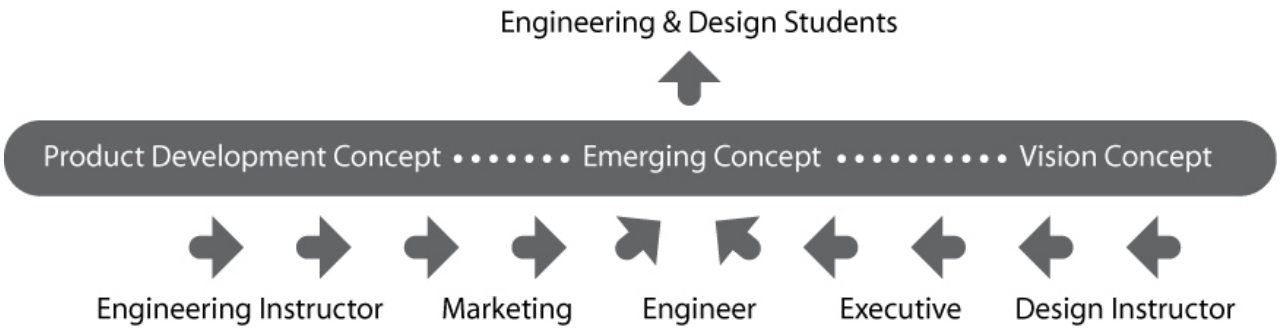

Fig. 4. Fine-Tuning Product-Concept-Design Paradigms of Stakeholders to be Unified and Appropriate for Student's Learning

The paradigm suggested from recapitulating analysis to be deployed in this type of pedagogy in design studies shall be *emerging-concept paradigm* (refer with: Fig. 4). In which appropriate as well as functional approach, the teaching and learning determination will predictably succeed for all stakeholders. Students can practice to gain their skills in essence of creative and design thinking, problem solving, and interdisciplinary team working. And for all facilitators will be likely to just fine-tune their understanding the project's objective that at the end of the course the win-win situation will drive the activity itself to be continue in future academic years.

5. Conclusion

The result of this research has validated that the collaborative-interdisciplinary approach is one of the forefronts of teaching-and-learning innovation in KMUTT. In the institute's strategic plan, the less-passive-and-more-active-learning approaches will be promoted and launched in various ways such as the work-integrated learning, the outside-classroom learning, and the active learning. In order to strive for KMUTT's vision - "lifelong learning", the industrial design program and department of control system and instrumentation engineering shall continue to improve this collaborative interdisciplinary study not only in the courses but also the curriculums. Further study would be

interested to focus on how the businesses in Thailand adopt the collaborative-interdisciplinary approach in their product-design-and-development processes.

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References

[1] K. A. Holley, Understanding interdisciplinary challenges and opportunities in higher education, *ASHE Higher Education Report*, vol. 35 no. 2, pp. 1-9, 2009.

[2] C. R. Hausman, Introduction disciplinarity or interdisciplinarity?, *The Pennsylvania State University Press*, pp. 1-10, 2010.

[3] J. T. Klein, Creating interdisciplinary campus cultures: A model for strength and sustainability, *Jossey-Bass*, 1st ed., pp. 67-97, 2010.

[4] T. Keinonen, Product concept design: A review of the conceptual design of products in industry, *Springer Science Business Media*, pp. 2-30, 2006.