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Development of Internship & Capstone Design Integrated Program for University-Industry Collaboration

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Abstract

Internship is a good program for the students to experience the real industry environment in advance before graduation and it is also good to excite them to study harder. But, during the period of internship, it is not easy to check the progress and status of each student by the supervising professor periodically. In addition, relatively short period of internship is another problem for the students to experience real design problems in the industry field. Capstone design is another good program for the students to experience the entire process of engineering design but to find the proper real field problems annually is not easy for the university. To solve these problems and enhance the university-industry collaboration, a novel program named as Internship & Capstone Design Integrated program (ICIP) is developed by Dongguk University in Korea. In this paper, the detailed information of ICIP including the management process is introduced and the effect of ICIP is analyzed using the case studies.

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1. Introduction

Today's Information-Technology industry has the expectation that university graduates should be productive without immediate additional training. In order to provide industry with graduates who can meet this expectation, universities have to provide sufficient experiential learning to students.

Even though university education in Korea seems to have massive supplement of highly educated manpower and ability to compete, it feels quite not satisfied to meet various specific needs from industry these days.

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As it has been issues that the human resources produced by the university education are below the level of the requirement from the industry, university has tried to make various educational courses reflecting the industrial opinions. But there are no industrial-educational cooperation models that are satisfied by university and industry at the same time yet. And furthermore as the representative industrial-educational cooperation program, mentoring or internship system doesn't consider the requirements from industries and students but are busy attaining actual results. So university educational systems are trying to reflect the requirements from industry gradually, to have strengthened in practical ways, and to have focused on the following requirements in these days:

- 1) Training human resources who have professionalism, creativity and active thinking
- 2) Training human resources who have various knowledge and management skills besides expertise
- 3) Training human resources who have the ability to adapt organizational culture, leadership and communicational skill

Despite these efforts of universities, the industrial world comments that newly joined resources still lack practical qualifications.

Contrary to the requirement from industry, university has some stances that university education basically aims at increasing the general ability in a major field, it is too risky to educate for some specific companies in university and industry has to contribute to training human resources required in practical area.

Fulbright [1] described the genesis of Informatics Professional Corporation (IPC), lessons learned, and the experiences of the inaugural class of interns at IPC. IPC has become a great source of pride among the students and students have shown an unexpected level of maturity. Many students are remaining associated with the company even though the internship is complete and intend to make it their permanent job after graduation. Goold, [2] and Reichlmay, [3] discussed examples of capstone project based experiential learning activities. Goold, [2] introduced a project management focus into the course that allows for a more structured process of product development. This restructure was possible because the curriculum prior to the project course emphasized teamwork and project management. Reichlmay, [3] discussed how the department has positioned itself to meet the challenges of collaborating with industry by incorporating cooperative education, commercially sponsored senior capstone projects and the development of research partnerships.

Gorka, [4] addressed the benefits of developing capstone projects in conjunction with industry and the authors developed such projects. In order to provide graduates who can meet the expectation that graduates of IT programs should be productive from day one with little or no additional training, experiential learning activities are essential for today's undergraduate student. Experiential learning activities are beneficial at all course levels; however, experiences that occur early in a program are limited by the students' lack of broad-based knowledge in the field and do not provide a capstone experience. While internships and cooperative experiences are perhaps the easiest way to provide such learning activities, they may not be practical for all students.

Johari, [5] discussed the Project-based learning in an internship program. The roles of task, learner, and mentor in a successful project-based instructional technology internship program were studied in light of contemporary motivation theories. Interns in four different locations were asked to apply their academic experiences in constructing real projects at work under the supervision of their site mentors and academic advisor. Data included tape-recorded intern interviews, status-review notes, e-portfolios, mentor interviews, and mentor evaluations. Data were collected over 6 semesters, from 18 different cases, 4 of which are highlighted here. The study considered the roles of task, learner, and mentors as they are needed to make the most of project-based internship programs. Implications for the design and development of internship and capstone programs, and specifically successful student performance in internship programs, are considered.

These references clearly show that a work-based or industry experience is the best experiential learning opportunities for students graduating. But, it may be difficult for all students to obtain a cooperative learning experience or internship. So, it is necessary to provide classroom based sufficient experiential learning activities

to prepare graduates for the demands of industry. Such experiences have the benefit of providing a capstone learning that has its basis in real industry situations.

From these reasons Dongguk University made a decision that first of all it is essential to educate competent persons to comply with the requirement from industry and change the recruitment trend that prefers employing the experienced persons, has developed internship program and advanced concept of the industrial-education cooperation that is associated with Capstone design curriculum, and has been making every effort to accommodate the requirement from industry.

This paper discusses the benefits of developing capstone projects and internship in combination with industry and provides a discussion of how such projects can be run.

2. Internship & Capstone Design

Internship is a good program for the students to experience the real industry environment in advance before graduation and it is also good to excite them to study harder. Students learn about corporate structure, processes, and behavior and obtain opportunities for authentic learning and practice. Students acquire knowledge that is performed in an actual workplace producing real products. Internships are intended to offer the breadth, depth, and scope of real IT experiences. But, during the period of internship, it is not easy to check the progress and status of each student by the supervising professor periodically. In addition, relatively short period of internship is another problem for the students to experience real design problems in the industry field. Capstone design is another good program for the students to experience the entire process of engineering design but to find the proper real field problems annually is not easy for the university. To solve these problems and enhance the university-industry collaboration, a novel program named as Internship & Capstone Design Integrated (ICIP) program is developed by Dongguk University in Korea. In this paper, the detailed information of ICIP program including the management process is introduced and the effect of ICIP program is analyzed using the case studies.

The representative internship program of Dongguk Univ. is ICIP or Internship & Capstone design Integrated Program. Capstone Design deals with the engineering design which is defined as the process of devising a system, component, or process to meet desired needs. Among the fundamental elements that are taught in the capstone design class are the establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. Students form a team and work on a project throughout the semester. Senior students must take one capstone design class for graduation. By participating in summer internship and one-year Capstone Design work, practical problems given by businesses are solved. A group of four to five students will work, under the supervision of a professor in charge and a mentor from business, on a project given by a business for a year. A student who completed ICIP 1 during the first semester must take the summer internship and should take ICIP 2 during the second semester in order to get nine credit hours under this program.

Students on summer vacation, do an internship at the company proposed project themes. The internship course requires students to work in teams under mentors who work in the partner company. Students apply their academic experiences in constructing real projects at work under the supervision of their site mentors and academic advisor.

For the themes proposed by industry, related professors can guide each team's research works. Students can catch on the understanding of the practical job in real workplace, can acquire the problem-solving ability required in the actual work, build up the system, element, and the process design capability and also can develop efficient communicative skills to cooperate closely with other students who have different majors or with mentors in industry.

ICIP is a Project and Internship-based course. Therefore, the bulk of the class time is meeting with student groups to provide hands-on instruction related to the team's specific project.

3. Internship & Capstone Design Integrated program (ICIP)

Internship & Capstone Design Integrated Program(ICIP) is a two-quarter sequence (Spring and fall) where students work with partner companies like LG Electronics Inc., choongwae Information Technology, and GABIA INC.. Corporate partners provide rough project description for the open ended problems from their R & D site for which they are seeking new solutions and ideas. Student teams have freedom as to how they approach the project challenges and are encouraged to think with open mind. The goals of this course include providing students with exposure to the following: current practices in software engineering and the design space; significant development experience with creative freedoms; working in groups; real-world software engineering challenges; public presentation and writing of technical work. The two-quarter sequence affords time to experiment, benchmark and try out different ideas before starting their project. The two-quarter time frame also means provides enough time to build something of lasting impact. This is program is also a great opportunity to develop relationships with a company, and increase the ability to do the roles as a member of the team.

4. 2012 ICIP Process

Dongguk University and LG Electronics opened again a course for ICIP in 2012. However, LG greatly reduced the scale of project participation due to LG's internal matters, and picked only eight students for the projects. But the dept. of Computer Science and Engineering of Dongguk University could reopen the ICIP course with the cooperation of the six midsize companies like GABIA Inc., choongwae Information Technology, Fasoo.com, Inc., Storyhenge Inc., Saltware. Co.Ltd, SimLab Co.Ltd. in the first semester of 2012. In the second semester, JIRANSOFT Co.Ltd joined ICIP with three topics of project.

The upper grade students who are in between jobs didn't cares deeply about the recruiting projects different from the major companies. Through the managing Capstone design curriculum subjects which are required for graduation, we could encourage much participation then 2011. The ICIP managing processes with mid-size companies are summarized as following:

The ICIP project of the Capstone design curriculum for the computer science engineering is provided for the developing software programs to resolve actual problems in the second semester.

To maintain the program by the year, it is needed to contact famous IT leading companies at first, and contract about the management of the industrial-educational cooperation project in partnership with Dongguk Univ. In sequence, the cooperating companies provide some practical project themes that need to development or improvement at each company or need to find new ideas. The professors who are responsible for the program review and provide feedbacks on the proposed project themes to make suitable for students, and set final themes. Confirmed themes are announced for students and fully described through information sessions. Students make teams of 4 or 5 students and each team selects a project among proposed themes. In this stage, the professors who are responsible for the capstone design estimate and refine the proposed ideas from each team. Each team defines the design from the proposed idea, performs technical survey about it, submits the specific design proposal and finally implements its own output at the end of 1st semester.

During summer vacation, the industrial internship course requires students to work in teams under mentors who work in the partner company. This vacation session is important to perform projects.

At the start of fall semester, it may be possible to have a chance to re-configure team members or present modified proposal if possible. During the second semester, each team has to make up, complete its program works as a result of project, and report final result after testing and verifying processes.

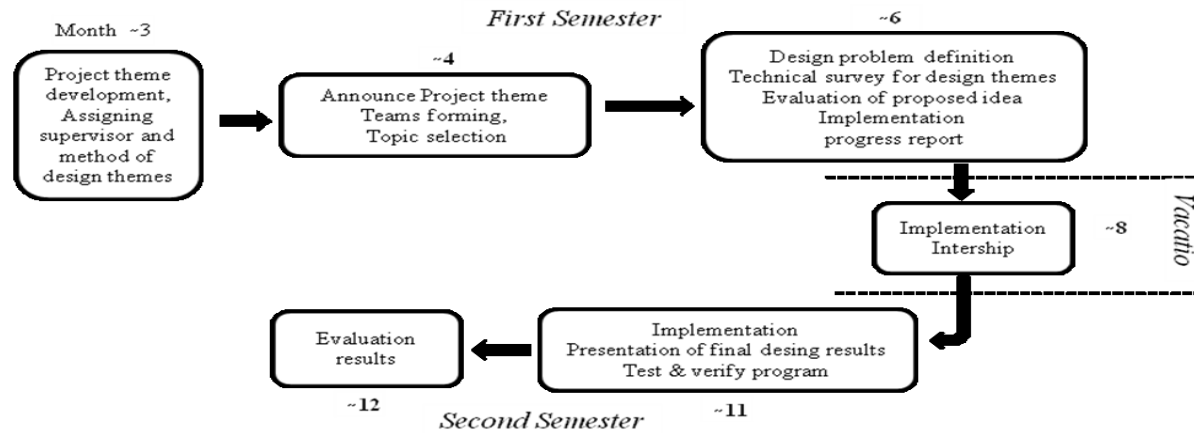


Fig. 1. 2010 ICIP Process

5. Ideal ICIP Process

If a project progresses favorably in ideal management period, it can make acquire maximized performance. But due to human resource, budget or other factors it often happens that starting and ending time are not meet with the ideal managing time. At this paragraph the ideal time to manage ICIP is summarized as following:

We have to rearranges project proposal timing to operate ICIP more systematically. In 2012, ICIP has been started late due to the internal problems, but project partner companies for ICIP must be determined until January. In order to give enough time for project, it's requested that companies confirm participation in ICIP course as soon as possible. Once a company has signed up the industrial-educational cooperation, the teaching team(university and companies) develop possible project themes together. After we have received a letter of participation intent, partners have to submit a 1-4 page project abstract as soon as possible. And there are exchanges of opinions between university and partner companies for determining the level of projects. As soon as the new semester begins, we have to start the projects.

Students have to begin their summer internship once the first semester ends. The internship program is good chance to learn real work at the field.

We have to advance the entire ICIP schedule for the job prospects of the graduating class. In November, we celebrate the accomplishments of our students at the "Capstone Design Exhibition". This is a celebration of the creative work of our students. Student teams will give final result presentations and exhibit their project result at the booths.

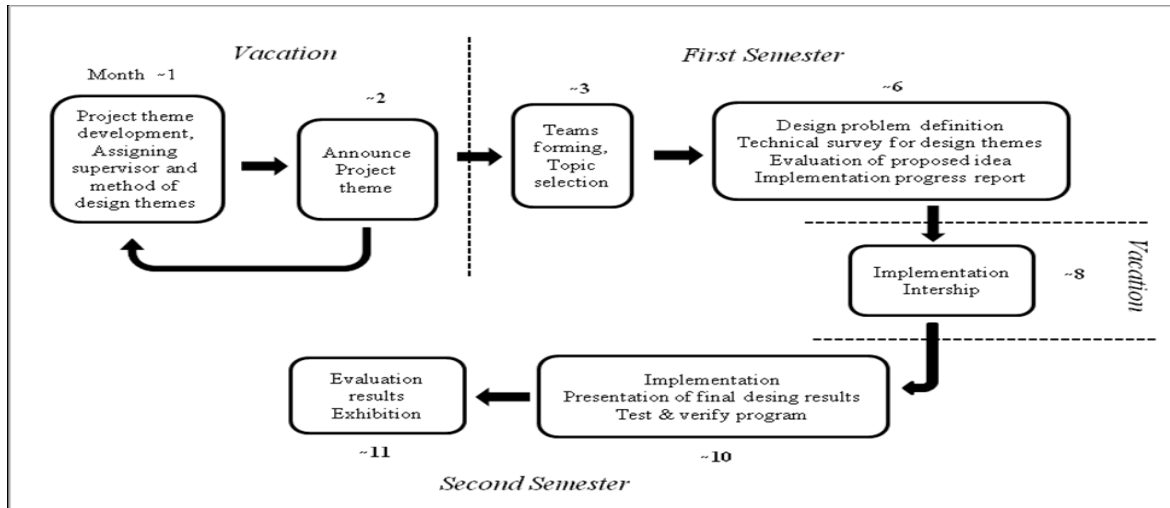


Fig. 2. Ideal ICIP Process

6. Conclusion

ICIP can apply to senior class in an undergraduate curriculum and ICIP is crucial that students have the opportunity to deal with real world problems to prepare their future career. Capstone experiential learning projects should strive to integrate a student's knowledge and skills and allow students to practice their communication skills via written reports and presentations. ICIP provide students with the opportunity to complete research in diverse field and the opportunity to learn how to build a business case to fund their project.

Developing projects with industry also provides benefits to industry and the educational institution. Industry can obtain solutions to their problems, gain insight from the research and solutions provided by the students and can better understand the educational institutions and student expectations.

Educational institutions can foster a positive relationship with industry and obtain feedback from industry on their educational systems. Ideas for developing capstone projects in conjunction with industry can come in many different fields. Faculty can find potential projects when participating in conferences, trainings and any event where you meet new people. The "ICIP model" applies not only to developing capstone projects, but also to developing projects at any and all levels of the IT curriculum. Students tend to be better motivated when confronted "real world" problems.

References

- [1] Fulbright, R. and Routh, R. L. IPC incorporated: a student-run IT services company for experiential learning. In Proceedings of the 6th Conference on information Technology Education (Newark, NJ, USA, October 20 - 22, 2005). SIGITE '05. ACM Press, New York, NY, 2005,211-216.
- [2] Goold, A. Providing process for projects in capstone courses. In Proceedings of the 8th Annual Conference on innovation and Technology in Computer Science Education (Thessaloniki, Greece, June 30 - July 02, 2003). D. Finkel, Ed. ITICSE '03. ACM Press, New York, NY, 2003, 26-29. DOI
- [3] Reichlmay, T. J. Collaborating with industry: strategies for an undergraduate software engineering program. In Proceedings of the 2006 international Workshop on Summit on Software Engineering Education (Shanghai, China, May 20 - 20, 2006). SSEE '06. ACM Press, New York, NY, 2006, 13-16.
- [4] Gorka, S., Miller, J.R., and Howe, B.J. Developing Realistic Capstone Projects in Conjunction with Industry. In Proceedings of the SIGITE Conference on Information Technology Education (Destin, FL, USA) 2007.
- [5] Johari, A.; Bradshaw, AC. Project-based learning in an internship program: A qualitative study of related roles and heir motivational attributes. Educational Technology Research and Development, 2008, 56, 329-359.