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Research paper

An Industry Involvement to Enhance the HCI Small-Scale Project Learning Experience

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Abstract

Human-computer interaction (HCI) is one of the courses that require in-depth involvement with the end-user to build usable and useful software. The course consists of both theory and practical aspects. One element in this course is doing project work. Throughout the semester, the project has been about a lecturer assigning groups of students with project topics for them to complete by the end of the semester. It is a common practice and has led the students to stagnant learning experience throughout the semester. In order to make students' learning experience more challenging and engaging, the project has included the industry as part of its 14 weeks duration. The industry was involved in giving the project title, persona, and conducted formative and summative assessments. Finally, an interview session was conducted with the students to obtain information about their learning experiences with the industry involvement while doing their project. The study received both positive and negative feedback from students about this approach.

Keywords: *Human-computer interaction course; HCI small-scale project; Learning experience; Industry involvement.*

1. Introduction

The emerging of Industry 4.0 affects higher education. The most important element of the industry 4.0' includes machines, devices, sensors and people [1]. The current education approach has been shifted from memorizing facts to being able to work in a team, becoming creative, building skills and taking responsibility which benefits students in many ways. Meanwhile, the teaching approach in higher institution has also been altered from instruction paradigm to learning paradigm. The latter is focusing more about the learner's needs to empower knowledge discovery, knowledge construction, self-confidence, creativity, self-control and communication as requested by the industry [1 ,2]. As regard to this, the higher education must provide a curriculum and content that can fulfil the industry's needs. In addition, there are more research focusing on innovative teaching from various disciplines that have emerged extensively, as reported in the conference book [2].

Human-computer interaction (HCI) course is one of the core subjects taught in Software Engineering Degree Programs [13]. This course is about designing the interactive systems focusing on the user interface design and development. The former deals with the User-Centered Design (UCD) approach. The latter deals with software development libraries from various languages used to build the user interface. This work was constructed in the former approach. The course contains both theoretical and technical aspects to balance the student's needs as well as the degree program objectives [14]. The course assessments consisted of assignments, exercises, short presentations and a small-scale project. Since the HCI course was introduced in the software engineering curricula, lecturers assigned small-scale projects with specific themes to students. The work by [4] was about the investigation of the effect of realistic projects on students' motivation, based on case study methodology. The authors have not found many related works regarding students' learning experience when the industry was involved in the small-scale projects for HCI course. Some works [10] reported about teaching user experience subjects. Other works [3,4] studied different learning and teaching approaches for HCI course.

The industry involvement in university has been a debating issue in [5,6,7]. The Malaysian higher education system, especially in universities, also faces this issue between the academia and the industry. One of the debating issues is the graduate skills from the university and the required skills by the employer [8]. So, by involving the industry in the small-scale projects, input and feedback can be gathered from the industry about what is needed for students when they graduate.

The objective of this paper is to describe the role of industry involvement in small-scale projects and to report the students' learning experience when the industry is involved with their small-scale projects. Section 2 describes a literature review about teaching approaches conducted by other researchers to enhance students' learning experience and a brief history about the HCI course in one of the public universities in Malaysia. Section 3 describes the methodology employed. Then, section 4 provides the students' learning experience results. Finally, section 5 concludes the research.

2. Literature review

2.1. HCI Teaching Approaches

The ultimate aim of teaching is for students to gain knowledge and would be able to apply it when they are in the working

environment. In any universities or colleges, the lecturers' task is to prepare the students to gain soft-skills, life-long learning and creativity as well as main knowledge.
Many teaching approaches such as the usage of flipped classroom encourage active learning environment for computer science bachelor students [6]. Meanwhile, a team-approach allows a large number of HCI bachelor course students to apply learner-centered principles in their learning practice [9].
[10] reported her experience from designing and teaching user experience (UX) related subjects. She identified many teaching strategies such as lectures, giving assignments and small scale group projects which were in line with the practice in UPM since the year 2000. Besides, [11] conducted a study to observe a group of international Chinese students who studied in Australia. They concluded that student-centered approach facilitating a "shift power from the expert teacher to the student learner" has effective outcomes in teaching HCI to international students from China [11]. Furthermore, project-based assignments and inquiry-based learning are among the popular approaches selected by instructors in teaching HCI [12].
[4] conducted a study in HCI course to show the relationship between students' motivation and real-life projects. The non-computer science (non-CS) students were involved in real life projects using the UCD approach. As a result, the students enjoyed doing the real-life projects compared to previous learning methods such as doing short and concrete exercises. Hence, the real-life project increased their intrinsic motivation and considered this project to be important and beneficial for them.

2.2 Teaching Strategy in the HCI

Normally, the HCI course's teaching duration ranges from ten to fourteen weeks [4]. The course includes theoretical lectures, practical demonstrations and laboratory sessions that are distributed a few sections per week from one to two hours long [13,14]. Theory and technical practices are considered essential in HCI teaching [15]. The usual HCI pedagogical strategies include understanding the user, design, development and evaluation [16]. The students have practical assignments which also includes a small-scale project. The small-scale project involves between three to six students per group [17,18]. These small-scale projects are usually based on case study. The case study technique allows the students to design and build real-world artefacts, which is an important aspect in HCI learning [19].
Student's play several roles in the small-scale projects: designers, developers, users and clients [17]. However, this approach lacks the real relationship and communication between the students, real end-users and real client. [14] points out that the students should work with real end-users and [8] recommends that the industry should be more involved in the students' project. These two important points highlight the appropriate experience needed to understand end-users' and clients' needs. The involvement of the industry also requires the student to understand how they feel and act during the development of a system [13].
In other studies [13,14], industry involvement has been practiced in Western and European countries of HCI pedagogy. The industry acts as a mentor for the students. The mentors come from industrial backgrounds regarding software development and consulting. Their main responsibility is to lead and give suggestions to students and sometimes they also act as the end-user [13,20]. Therefore, the Malaysian university teaching pedagogy needs to involve the industry in their small-scale projects. In addition, it is important to explore the learning experience acquired by the Malaysian HCI students.

3. Methodology

The brief description about the HCI course conducted in one public university is described in section 3.1. Section 3.2 demonstrates the industry involvement in the student's small-scale project from the initiation, during the progress of the small-scale projects until the aftermath of the showcase.

3.1. HCI Course in UPM: an Overview

HCI is an interdisciplinary discipline that studies the human-(context, environment and activities) computer (the design, usability and user interface) interaction (user experience) aspects. It is important to understand these three elements in order to build a usable interactive system. In curriculum guidelines for undergraduate degrees program in software engineering [21], HCI is one of the courses suggested to encourage innovation in students. Hence, the course allows students to create usable software and teaches students that software engineering discipline is not just about the technology. In our previous curriculum, HCI was one of the core subjects (three credit hours, 3+0) for all majors except for networking students and served as an elective course for students in other faculties such as the Faculty of Ecology [22].

3.1.1 HCI Course History

HCI course was first offered in the year 1999 at the Faculty of Computer Science and Information Technology (CSIT), Universiti Putra Malaysia (UPM). The learning goals and outcomes are as the following [22]:

- Students can analyse the needs/requirements to develop the usable system.
- Students can design creatively and build interactive systems.
- Students can assess the usability of interactive systems.

At this point in time, a lecturer had to conduct a class that consisted of more than 50 students. The lecture-based or instructional approach was one of the main approaches used in teaching. It was a challenge for the lecturer to teach HCI course because of the big class size.
In 2007, UPM was appointed as a Research University (RU) in Malaysia [23], where the number of students' intake were reduced to become more manageable. Each lecturer normally conducted a class with the maximum number of not more than 25 students. As a result of this appointment, the lecturer could design better teaching approaches and styles, quality assignments and assessments.

3.1.2 HCI Assignments and Assessments

Students were informed about the course content during the first week when the new semester began. They were given the big picture about the expectations of the course. The 14th week classes were about theoretical aspects and practical aspects. The course assessments consisted of examinations, small-scale assignments and a group project. Every semester since 2011, the project-based work was conducted in various course themes. For example, Human Meets Machine in 2011, and Students Design Challenge in 2013 and 2014, and Agriculture in 2015. The project-based assessment marks were only assessed by two panels: lecturer and internal assessor. The marks were also based on few criteria such as poster presentation, demo prototype and project's write up report. The project-based work would contribute 30% to the overall course assessment marks.
The first HCI showcase in 2011 was a successful event. The event was conducted at the foyer of the CSIT, UPM faculty and was attended by students and lecturers (see Fig 1). Participating students were enthusiastic with their designs and hence managed to pitch their work to the audience..
After so many project-based themes were introduced and assigned by the HCI lecturers, the HCI course committee agreed to change and enhance the old practice of the group project approach by inviting an industry as part of the project and also as the main client in the group project work. The reasons of doing this would

spur many benefits not only to students but also to the lecturers. Therefore, students and lecturers could obtain knowledge and technical exchange throughout the process of collaboration with the industry.

Fig. 1: HCI first showcase in 2011

3.2 The Process

3.2.1 Initiation

The initiation of the idea started before the semester began by contacting a local software development industry., The industry was owned by one of the CSIT, UPM alumni. Since the CEO of the industry was a CSIT alumni, communication between the students and the industry were quite smooth and easy. The industry listed out their expectations and requirements as their involvement such as: (a) the user requirement/the persona; (b) their time to become involved with students via email if students and lecturers have questions; (c) formative and summative evaluation during the project; and (d) the final showcase. Most of the communication between students and the industry was conducted via email (see Fig 2). Students were required to solve issues related to restaurant/cafe owners in Malaysia. As part of the process of the project, they were required to conduct their research and interview the restaurant owners. However, during the period of the data gathering, they had three major problems which were: (a) the restaurants/cafes could not find the right channel to market their products (food) and services; (b) the competition had consumed their customer base over time; and (c) they had no expertise in customer relationship management.

The requirement or the persona given by the industry was quite comprehensive. The persona was distributed to students in their third week of their study week. There were five groups from the Software Engineering (SE) and Information System (IS) majors, six groups from the Computer Science (CS specialized in multimedia) major and one group from the previous semester (Software Engineering and Information System major).

The students followed the (UCD) approach in order to provide the solution for the industry. The focus was on understanding the specific target end-user, the conceptual model, the prototype (low and high fidelity process) and the final prototype of the problem. Finally, all groups produced the project report, product demo and the poster during the showcase as their final output of the project.

Fig. 2: The email communication between the industry and the lecturers

3.2.2. During the Project

Each group was assigned different target end-users, including millennial group, professionals, elderly and others in order to encourage each group to undergo the requirement process and emphases on understanding user. Different set of target users have different needs or requirements which encouraged the students to challenge their creativity in providing the solution for specific target users. Once the group had a clear understanding of the problem given by the industry, they started their project following the UCD approach. The formative evaluation was actively applied when they have drafted their initial draft of low-fidelity prototyping until their high-fidelity prototype. There were groups that requested the industry to evaluate their prototype and acquired constructive comments and suggestions for their reference. However, before they contacted the industry, they presented their prototype to their lecturers. Then, any comments from the lecturer were taken into account for any required changes to the prototype design. Later, they contacted the industry for prototype evaluation process. This process was iteratively conducted until they reached the final stage of the design. Figure 3 shows one of the group's low-fidelity prototype.

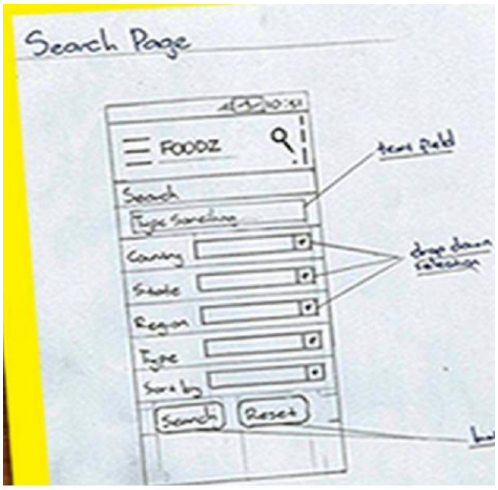

Fig. 3: Group low-fidelity prototype

3.2.3 Showcase

All groups presented their project outcome during the showcase which was conducted in week 14. The event was conducted at the faculty foyer. Each group was requested to prepare an A0 poster and exhibit their high-fidelity prototype. The students' projects were judged based on the whole UCD process that they went through, their creativity and innovative aspects of the prototype. The industry was invited as one of the judges in the showcase alongside the lecturers from the faculty. The average marks were calculated to determine the winners. The learning outcomes targeted from this showcase concentrated on communication and presentation skills. Figure 4 shows the HCI showcase event's crowd at the faculty foyer.

Fig. 4: The HCI showcase crowd

3.2.4 The Aftermath

After the showcase, a small-scale study was conducted to gather the new learning experience from students. Previously, there were none project-based work from this course or any other courses that involve the industry. Ten students were invited to participate in the study (six female and four male). The interview session was between conducted 15 minutes to 30 minutes at the faculty. A set of questions were distributed as the following:

- Students' learning experience with the industry's involvement in their project-based work.
- What are the advantages and the disadvantages by involving industry in this project?
- Since the industry were involved in their project, how would this change their current perspective as a student?

4. Results

Thematic analysis was used to determine the students' learning experience. Positive and negative learning experiences were discovered from the study. The positive experience consisted of: (a) challenging; (b) engaging; and (c) feeling acknowledged. Whilst, negative experience consisted of: (a) Thorough and meticulous; and (b) time consuming. Six students obtained positive learning experience. On the other hand, four students obtained negative learning experience.

1 4.1 Positive Learning Experience

Positive feedback acquired from the interview reported that the students' learning experience was challenging, feeling acknowledge, engaging and exciting. Students reported that they had a challenging learning experience as they felt that they had to do their best in their project. Since they were the first batch who ventured with the industry, it was very important that they portray a good image of themselves specifically and the faculty in general.
Student 1 reported: "*My group and I feel that this project requires us to be well-prepared since we are working with the industry. This project will definitely be different from other project-based work that we did this semester and the previous semester. We cannot mess with this project. It is okay if we do not win, but we must show the best from our solution."*
Engaging was another positive learning experience that was identified during the feedback gathering. From the analysis, it could be concluded that the students' engagement came from the theory aspects taught in class and their goal to provide the best solution for the industry.
Student 2 explained: "*They realized the importance of involving humans in the design and development. It is a bit difficult not to think about system functions but we are learning. When we listen carefully to our users (people), we will find that each of them require a different solution or an easier solution which sometimes differ from what we have in our minds."*
Student 3 extended the course engagement: "*This course was fun and it also gave me another perspective about how to develop a usable and functional system. The usage of persona, design principles and usability evaluation proved to be a good way to achieve a highly usable system for the user*".
Acknowledgement by the industry can boost their self-confidence. It was said that the industry felt satisfied with the designs and prototypes showed to them. Moreover, the industry will use some of the presented designs in their project. The students felt overwhelmed and never thought that the industry would use their designs. This information makes the students realize that their ideas hold some value to other people and can be useful to the industry.
Student 4 said, "*We never thought that the industry would use our design. We thought that our design would not achieve the industry standard. We know that the industry will benefit from our design, but it is okay. They have given us opportunity to experience how it feels like working with somebody*".

4.2 Negative Learning Experience

On the other hand, the students also provided some negative feedback from their experience doing projects with the industry. The negative feedback from the students described their learning experience as thorough and time consuming. The negative learning experience was classified based on what students felt about this collaboration when doing their project.
Thorough and meticulous learning experience means some students who were a bit laid-back felt that they had to work harder to produce the prototype. They could not use their laid-back working attitude because there was another party (industry) monitoring and assessing their project. Another negative learning experience identified whereby more time was needed to complete the project. Students said that they had few projects from other different courses, but because of the industry's involvement they felt that they must spend more time to complete this HCI project.
Student 7 reported: "*We have extra work to do. It feels as if we are working with somebody when we are waiting for the industry's feedback about our design. We are usually not like this, but because of the industry we somehow have to work extra hard. Hurm…we are kind of feeling over the moon about this project. However, we have to work extra hard and we feel it is not good because we tend to spent most of our time working on our project."*

5. Conclusion

Industry involvement in small-scale projects for HCI course is a challenge for both students and lecturers. It is an advantage for us to explore the industry's involvement during the small-scale projects in HCI course. It requires a lot of effort and time to monitor and engage with the industry. However, the industry's involvement allows students to learn what to expect from the working environment. In addition, the lecturers can check if the teaching content is what is needed by the industry. Even though a lot of effort is needed from the university to collaborate with the industry only for a semester, it is a good experience to explore between the industry and the university. The lecturer can update the knowledge content and skills required for their next semester. Thus, the collaboration could provide some information whether the contents and the current syllabus is still valid or needs improvement.
Several positive and negative learning experiences were captured during this collaboration. The positive learning experience was explained as challenging, engaging and gaining acknowledgement. Whereas, the negative learning experience was referred to as time consuming, thorough and meticulous to complete the project. In conclusion, the industry's involvement brings positive aspects in both teaching and learning. The lecturers have the opportunity to get involved with the industry and create a good networking with them. Meanwhile, the students have an early exposure with the requirements and expectations from the industry. These assist students to equip themselves with proper skills, creative thinking and problem solving aspects.

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