An Experimental Learning Model for Rfid

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Abstract
Radio Frequency Identification (RFID) has been widely applied in various industries in recent years. The logistics and supply chain is the most common industry applying RFID. While the RFID market is now growing rapidly, the demand on RFID professionals is increasing sharply. However, there are quite a few RFID courses or trainings provided during the study of logistics and supply chain students, this leads to a problem of succession between schools and companies. In order to support this vigorous growth and relieve the succession problem, RFID education becomes important to cultivate future RFID professionals from the students who can apply the knowledge into daily operations immediately. Hence, a comprehensive plan of RFID education at the tertiary level should be well developed. This paper investigates current problems of RFID education, and hence a RFID educational model will be proposed.

Keywords: RFID education, tertiary education, teaching and learning methods

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Introduction

RFID is a wireless communication technology using radio frequency signal as the medium to identify objects automatically from a distance (Huang, Yeung, Kong, & Gao, 2011). A set of RFID system contains various parts, including RFID tags, antennas, readers and a middleware. As a matter of fact, the adoption of RFID technology involves difficult concepts, setting and cooperation between involved system, equipment and objects. However, the efficiency and effectiveness of task accomplishment by using the technology are guaranteed. Unfortunately, the supply and demand of RFID professionals is unbalanced, which the supply cannot meet the demand. The root reason is that there are limited courses or trainings in the society. In Hong Kong, there are only four universities and one company providing RFID courses or trainings. The lack of courses leads to a succession problem between schools and companies. Therefore, a RFID educational model should be developed to cultivate more well-equipped graduates.

Background Research

Logistics and supply chain industry has been becoming more and more essential due to globalization. This industry has implemented RFID technology for at least a decade already, including automatic check-in and check-out, warehouse management, inventory tracking, transportation, on-shelf monitoring, quality control and theft control, which all are the most common areas applying RFID (Beheshti & Beheshti, 2010). RFID then becomes a key piece of the technology in the process of supply chain and logistics over the world (Kumar, Kadow, & Lamkin, 2011).

The implementation of RFID technology requires learnt knowledge and trained skills, for example, collecting data, changing business process, integrating enterprise systems and infrastructure, and making proactive decisions. Specific types of tags, frequency and antennas should be used to suit the properties of the goods and the external environment. Also, Das and Harrop (2015) reported that the market of RFID system, including RFID tags, antennas, readers and middleware, was worth over US$10 billion in 2015, and it was predicted that the value would be increased to over US$13 billion in 2020. With these figures, the demand of RFID experts and practitioners, who familiarize themselves with RFID technology and applications to different industries, keeps boosting in the society. Companies applying RFID in their business can achieve competitive advantages, which RFID brings higher efficiency and effectiveness to the company. Hence, a person who is not equipped with pre-requisite RFID concepts and knowledge may find hard to understand and apply RFID in practice. If a company can acknowledge the significance of RFID education and skill training, the operation will have better performance than that of without RFID acknowledgement. Therefore, there is a need of a comprehensive plan for cultivating RFID experts.

Lecturing is the most common teaching and learning method in education circle (Clynes, 2009), and tertiary education has been dominating by the traditional lectures (Schwerdt & Wuppermannb, 2011; Weiss, 1997). Sangestani and Khatiban (2013) and McIntosch (1996) defined lecturing is a traditional one-way communication without any discussion or immediate practice; students are the passive participants who can only jot notes and may have time for them to ask questions afterwards.

Middendorf and Kalish (1996) and Ghani (2009) defined lecturing is that lecturers are talking and writing on board while the students are listening and taking notes of text written on board. Some criticisms of lecturing are summarised by DiPiro (2009). Lecturing is a passive method and knowledge intention is likely to fail, and it is a kind of information presentation while it is not account for different learning styles. The information and facts delivered in the lesson become outdated rapidly, and lectures do not deliver skills. All these cannot equip students to be professionals. However, a well-presented lecture may succeed in gaining students' attention, and can improve their quality in learning (Curzon, 2004). Penson (2012) also pointed out that lecturing is the backbone of tertiary courses. It is considered to give students a whole picture of courses and overall strategies, and students can understand learning objectives and reasons of the objectives. Further, Bligh (2000) stated lecturing is as effective as other teaching methods on transmitting knowledge, and it is an appropriate tool for teaching science and engineering programs, which is significant to digest a large amount of knowledge. Besides, Penson (2012) suggested lectures could contain some "enhancement activities", for example, short discussions between students, in-class exercises, animations, question-and-answer (Q&A) sessions, workshops, group work etc. These kinds of "enhancement activities" are important to make passive lesson to be active and can encourage students to have deep learning. In addition, lecturing involves deeper cognitive processing and active listening, including interpreting, paraphrasing and questioning, and putting new materials into students' space of prior knowledge (Nilson, 1998).

According to the works and theory of Dewey (1938), Lewin (1951), Piaget (1951) and Kolb (1984), experiential learning is a continuous process of a person transforming the created knowledge through experience, and learners have a chance to reflect their learning through experience (Frontczak & Craig, 2000). Kolb (1984) also defined this learning method with six assumptions, experience learning: (1) is a process, not an outcome; (2) is derived from the experience; (3) requires ones to solve dialectically which may oppose some theories; (4) is comprehensive and integrative; (5) requires interacting with ones and surrounding environment; and (6) results that ones learn the knowledge (Kayes, 2002). Experiential learning was proposed to have a four-stage cyclical model for learners as shown in Figure 1, starting from: (1) Concrete Experience (CE); (2) Reflective Observation (RO); (3) Abstract Conceptualisation (AC); and (4) Active Experimentation (AE). This model addressed that immediate experience of ones is the base of observation and reflection (Matsuo, 2011). Learners can gain new perception on the "experience", then knowledge is developed. This learning method can enhance ones' learning and engagement level, and problem-solving and judgement ability. Learners can also understand the concepts in a better way, and have a greater knowledge retention (Feinstein, 2001; Gross & Rutland, 2017; Gujarathi & McQuade, 2002; McKeachie, 1980; Udovic et al. 2002; Zoller 1987). However, a researcher stated students involved in experiential learning may have a change to create their own actions with unique interpretations from the experience, and hence the knowledge may not be created properly (Dixon, 1999). Because of the advantages, experiential learning is widely spread over the world's medical colleges and health-science-related programs, and is even extended to engineering programs.
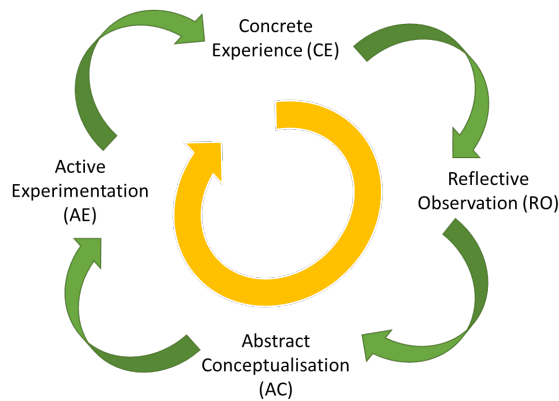
Figure 1 The 4-stage Experiential Learning Cycle

However, when education comes to RFID, there are limited RFID teaching and learning models available for the institutes and companies for reference. Hence, it is necessary to find the problems and propose a RFID teaching and learning model to improve the existing RFID education and training systematically in response to the vigorous expansion of RFID market and complexity of its applications. In this paper, a brief review on two different teaching and learning methods will be first performed, the current situation and problems of RFID education will be then studied, and more importantly, a RFID education model, which target tertiary students, will be proposed at last.

Design of The Proposed RFID Education Model

A comprehensive RFID education course is rare in the society, wherever in universities and companies. However, society have been depending heavily on the technology, and thus it is necessary to equip students for their future career before graduation. Although some universities provide RFID courses, the courses are not well developed, which are mainly dominated by the lectures. Also, it is discovered that students seldom prepare for the class. Students do not have many chances to experience and practise the use of the RFID equipment and tools during lectures. This learning system leads to a situation that students may only understand the theories and concepts, but lack of practical experience on the situation of actual applications in different industries, including its strengths, opportunities, difficulties, hindrance, effectiveness before and after the applications etc.

Based on previous sections, the proposed model mainly consists of two parts, lecturing and experiencing, as shown in Figure 2.
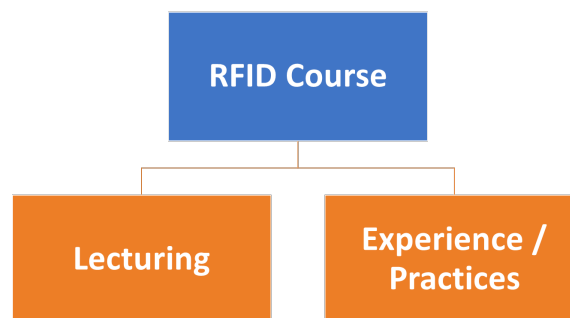

Figure 2 Proposed RFID Education Model

This proposed RFID course aims at enabling students to understand the concepts and general operation of RFID. Thus, students will be able to apply corresponding techniques to tackle the issues on the traditional logistics process and have a working knowledge with one of the latest information and communication technologies. Students can also learn and develop their skills related to RFID.

Lectures will be the backbone of the RFID course. They will be found in the whole course, and will be a guide for teachers and let students to follow and learn RFID. Both teachers and students can have a whole picture of the course. RFID is an engineering subject, substantial teaching materials will be provided to students to read and digest, and finally transform to their own knowledge learnt. Traditional lectures will be presented to strengthen the basic concepts and knowledge of RFID technology, techniques and operation of logistics and supply chain processes, in meanwhile, different kinds of materials, including books, papers, videos, animation, can also be presented in the course to broaden the view of RFID technology. In order to consolidate the learnt knowledge, some enhancement activities in the lectures are suggested, such as providing some exercises to students. Consultation session will also be set during non-lesson time. If students have any questions on the subject, they can visit and ask lecturers, in order to clear up their wrong concepts and move on to the experiencing step.

For the experiencing part, students will have some experience and practices of using RFID technology. Several laboratory exercises and a project will be assigned to students for gaining hand-on experience. They can touch, try, and develop the know-how of using RFID technology. Applying the learnt concepts and theories from the lectures in the laboratory and conducting project can enhance the engagement level of students, they may then understand and remember the concepts more clearly, and this will be much better than only attending lectures. The laboratories will be interjected between the lectures, so students can revise and consolidate the knowledge. A problem-based project will be designed. Students can make use of the knowledge and know-how gained to solve the situation provided and also make suggestions to the case to improve logistics processes.

In order to let students to learn RFID practically, the following laboratory is an example which is designed for students to understand the best position and orientation of tags. By varying the height, vertical angle and orientation of antennas, and location of the tags on a carton, students are allowed to experience the adjustment of vertical-angle, horizontal-angle, orientation and height of antennas, the position of tags and the orientation of the target object, as well as the speed of the moving path (Figure 3). A RFID software, a set of RFID equipment and an environment setting guide will be provided to students to learn, obtain, visualise and analyse the collected tag performance (Figure 4), and then evaluate the current location of the tags on the carton. The equipment and environment setting will be similar to companies which are depending on RFID technology for operation. Therefore, students can have a chance to experience the real situation which they may face in future career. Students are also required to write a report to explain the antenna setting and tag locations.
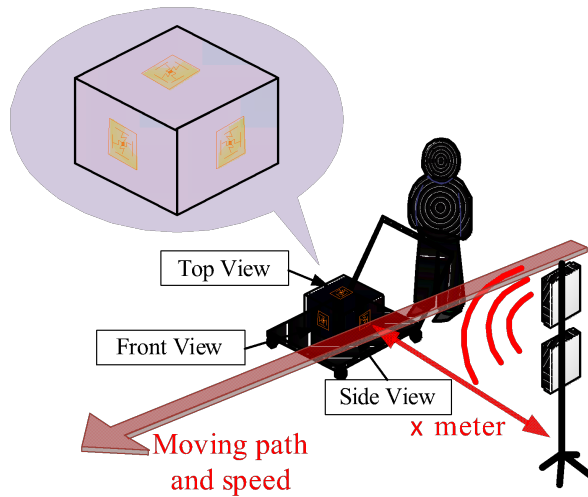
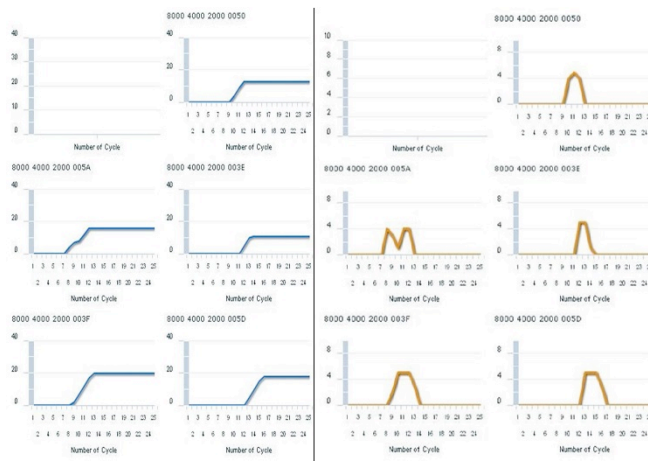Figure 3 Illustration of the Laboratory

Figure 4 Analysed Results of Tag Performance

Conclusion

Due to the rapid growth of RFID applications in various kinds of industries and the succession problem between schools and companies, the demand of RFID professionals has been increasing vigorously. Though there are limited RFID courses provided in the market, the courses are less well-organised and students may not be well-equipped to face the challenges in the industries. Thus, a RFID education model is proposed. The model consists of two main teaching and learning methods, which are lecturing and experiencing. Lecturing with two enhancement activities can equip students with concrete RFID concepts and knowledge, and it also encourage students to have deep learning. Experiencing allows students to gain hand-on experiences which students can understand and remember the knowledge they have learnt. With the courses designed by following the proposed model, students would have a better way to get familiar with RFID technology as well as its substantial knowledge and practical experience.

Acknowledgements

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