THE EFFECTIVENESS OF INDUSTRIAL FIELD TRIP IN ENHANCING CIVIL ENGINEERING UNDERGRADUATES' LEARNING AND ATTAINMENT OF PROFESSIONALISM

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ABSTRACT: *This paper presents the outcomes of the innovative methods applied in industrial field trip, and the evaluation of students' experience on pavement engineering subject. The 1-day industrial field trip was collaborated between university and two consulting firms that were specialised in pavement engineering, particularly on pavement maintenance and rehabilitation. The industrial field trip was comprised of pavement lab visit and field instruments demonstration, followed by pavement rehabilitation design workshops. Course contents was designed by university module convenor however it was delivered by consulting engineers. Upon field trip, questionnaire and consent forms were distributed for the compilation of feedbacks. The study revealed that industrial field trip with workshop has significantly improved the students' experience and able to retain their study interest in civil engineering, principally in pavement engineering. This activity was also able to inspire students to work towards professional membership registration. Workshop or hand-on activity handled by professional engineers during industrial field trip is the key of success on this learning activity.*

Keywords: Engineering education, Industrial field trip, pavement engineering, student experience, professional membership.

1. INTRODUCTION

Pavement evaluation and rehabilitation course is rarely to be offered in civil engineering undergraduate programme. It is a specialisation subject, under the field of highway and transportation engineering. This course requires fundamental knowledge of pavement materials and pavement design, and practical knowledge on pavement deterioration, before proper evaluation to be carried out and mitigation measures to be proposed for pavement maintenance. In order to enhance students' learning, normally they are required to acquire knowledge and understanding on field inspection methods, using an advance and sophisticated devices, such as falling weight deflectometer (FWD), high-speed road monitor, ground penetrating radar (GPR), etc. These devices are costly and rarely used for teaching and research, and therefore not all instruments are fully equipped and available in university. This has become one of the obstacles for teaching effectively and as a result, students will be learning based on the concept and theory of each instruments, without any hand-on practical to operate the device and analysing the output.

To teach the flexible pavement system innovatively and effectively, Mehta and Najafi [1, 2] have recommended the use of backcalculation analysis and field visit for observing the falling weight deflectometer tests, in order to explain and understanding the behaviour of the pavement system. Mehta and McCarthy [3] also recognises the importance of the laboratory session. While teaching civil engineering material course, they have modified their teaching style and the structure of the course so that the students are actively engaged in the laboratory during the class time. Student are required to plan the laboratory ahead of time and understand the appropriate implications in the civil engineering industry.

Furthermore, it is a challenging task to attain the civil engineering undergraduates' interest on construction industry, starting from the freshman year until graduating year. Students might be diverted their interest on this field due to lack of exposure to the real industry and practical works, or influence by other engineering disciplines. Hence, it is becoming more difficult to encourage graduates to pursue and working towards for their professional membership on civil engineering. The efforts to promote the professional membership should be initiated during the undergraduate study, not only from the compulsory taught course, but it should be integrated with a series of relevant activities that enable to attain students' ambition to become a professional or chartered engineer. Knox et. al. [4] have initiated the joint supervision project with practitioner to assist on their capstone course in civil engineering and environmental science programme, and the found that it is benefit not only for students, but also for civil engineer and city officials. According to Chakrabarti [5], it is imperative that undergraduate civil engineering education needs its integration with civil engineering industry, and therefore, attempts should be made to expose the civil engineering students as far as possible, to the real life situations of civil engineering profession in a holistic sense, through a systematic implementable scheme of industry-interface in place as a compulsory component of the undergraduate civil engineering curriculum. Industrial field trip has been recognised as the most common teaching approach that directly engaging students to the industry and practical exercises, subject to the design on the field trip activities.

The aim of this study is to identify the effectiveness of field trip in enhancing students' learning on pavement engineering and attaining their interest on professional membership.

2. METHODOLOGY

2.1 Industrial Field Trip Activities

The 1-day industrial field trip was additional activity to accomplish the course syllabus of CIVE4071 (H24HEM) Highway and Infrastructure Evaluation and Maintenance. The theme and topic of the industrial field trip was Pavement Evaluation and Rehabilitation. A total of 21 students registered for this field trip and agreed to participate in the questionnaire study. Activities of the day were planned and designed by the university module convenor and civil engineers from IKRAM Paves and IKRAM Premier Consulting, both from Kumpulan IKRAM Sendirian Berhad. This field trip specifically designed to be led by professional engineers (PEng) and all activities were practical and hand-on based. In the morning session, the activity was hosted by engineers from IKRAM Paves, they demonstrated the field instruments and pavement laboratory for road and pavement evaluation (Fig. 1). While in the afternoon session, the activity was taken over by IKRAM Premier Consulting, they conducted hand-on workshop on pavement rehabilitation design (Fig. 2).

Fig. 1. Field Instruments Demonstration

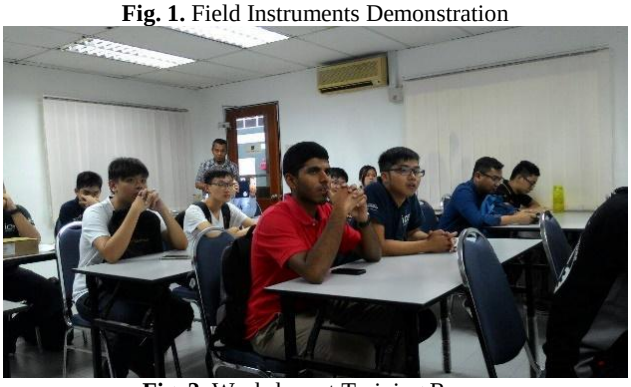

Fig. 2. Workshop at Training Room

2.2 Questionnaire Design and Data Collection

Upon completion of the field trip, participants were required to complete the questionnaire and provide their feedback on this event. The evaluation form comprises of 14 Likert-type questions (poor; fair; good; excellent) and six open ended questions. The questionnaire survey is aim to understand the students' perception on pavement engineering industry and their intention to apply for professional membership. A total of 21 questionnaires were collected (100% of response rate from students with different nationality); 19 participants were undergraduate students (MEng programme) and the rest were postgraduate students (MSc programme).

3. RESULTS AND DISCUSSION

The key findings of this questionnaire study is been selected to be presented in this session. In overall, students were satisfied with this field trip (95% combined rating of excellent and good), especially on value of time spent (95% combined rating of excellent and good). All students would recommend others to join this field trip.

Question (1): How would you rate your level of knowledge of, and experience with, "Pavement Evaluation and Maintenance" before this field trip? The aim is to determine students' background and understanding on pavement engineering. The results (Fig. 3) indicate that 76% (combination of fair and poor ratings) of students have less experience and knowledge on pavement evaluation and maintenance before joining the field trip. Highway and Transportation sub-disciplines are always the optional modules and not compulsory for civil engineering students, and hence it is expected to have less exposure on this area.

Question (2): How would you rate the extent of improvement to your knowledge of "Pavement Evaluation and Maintenance" in this field trip? The aim is to identify the level of improvement after attending the field trip. Fig. 4 indicates that 95% (combination of excellent and good ratings) of students have gained improvements on their knowledge on pavement evaluation and maintenance. The changed of learning style such as field trip (lab visit) and workshop have significantly improved and enhanced their understanding. Furthermore, the analysis in Table 1 showed that the field visit had successfully improved 93% of respondents in the experience and knowledge level from fair to good and excellent.

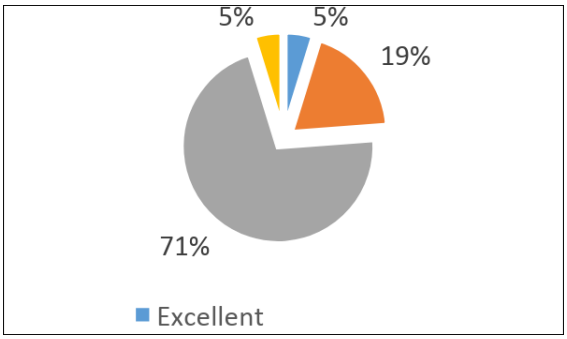

Fig. 3. Students' Background and Knowledge on Pavement Evaluation and Maintenance

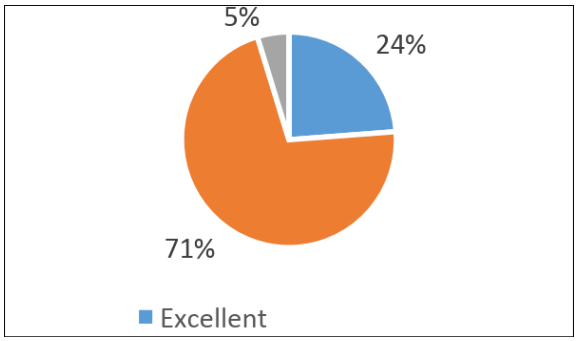

Fig. 4. Improvement of Understanding on Pavement Evaluation and Maintenance

Table 1. Level of Knowledge, Experience before the Field Trip versus Improvement of Knowledge in the Field Trip Analysis

			Improvement of knowledge in the field trip			Total
			Excellent	Good	Fair	
Level of knowledge, experience before the field trip	Excellent	Count	1	0	0	1
		Percent	100.0%	0.0%	0.0%	100.0%
	Good	Count	2	2	0	4
		Percent	50.0%	50.0%	0.0%	100.0%
	Fair	Count	1	13	1	15
		Percent	6.7%	86.7%	6.7%	100.0%
	Poor	Count	1	0	0	1
		Percent	100.0%	0.0%	0.0%	100.0%
Total		Count	5	15	1	21
		Percent	23.8%	71.4%	4.8%	100.0%

Question (3): How would you rate your perspective and interest on Pavement Engineering after this field trip? The aim is to determine whether the field trip able to promote and retain the students' interest on pavement engineering. Fig. 5 indicates that 95% (combination of excellent and good ratings) of students have positive perspective on this area. The field trip and workshop were hosted by experienced certified engineers and students were able to gain closely experience on this industry and consultation works.

Question (4): How well this field trip has attained your interest in Civil Engineering discipline? The aim is to determine whether this field trip can retain students' interest in civil engineering discipline. Results indicate that 100% (combination of excellent and good ratings) of students agreed that this field trip have attained their interest in civil engineering discipline and it is good teaching approach to promote student experience.

Further analysis based on Q3 and Q4 (as in Table 2) shows that students who attained good interest in Civil Engineering discipline, 30% of them actually expressed highly interest (excellent rating) on Pavement Engineering after the field visit. In the other words, more students wanted to join to the Pavement Engineering after they had explored and learned more about this field after the visit.

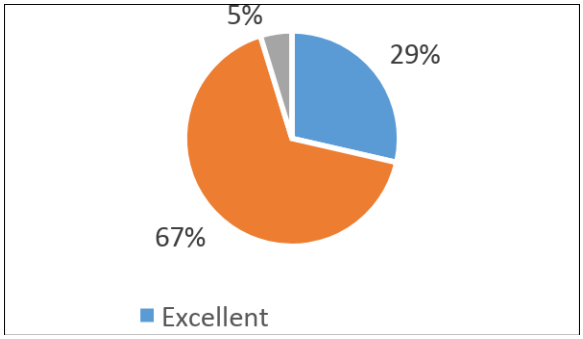

Fig. 5. Students' Perspective and Interest on Pavement Engineering

Table 2. Attained interest in Civil Engineering Discipline versus Perspective and Interest in Pavement Engineering after the Field Trip Analysis

			Perspective and interest after the field trip			Total
			Excellent	Good	Fair	
Attained interest in Civil Engineering discipline	Excellent	Count	3	0	0	3
		Percent	100.0%	0.0%	0.0%	100.0%
	Good	Count	3	14	1	18
		Percent	16.7%	77.8%	5.6%	100.0%
Total		Count	6	14	1	21
		Percent	28.6%	66.7%	4.8%	100.0%

Question (5): How would you rate your ability to think critically after this field trip? The aim is to identify whether this field trip will change the students' way of thinking, especially on technical issue. Fig. 6 shows that 90% (combination of excellent and good ratings) of students have been motivated to think critically as engineers. Face-to-face direct communication on field with certified engineers has fostered students to seek for answer and clarification confidently.

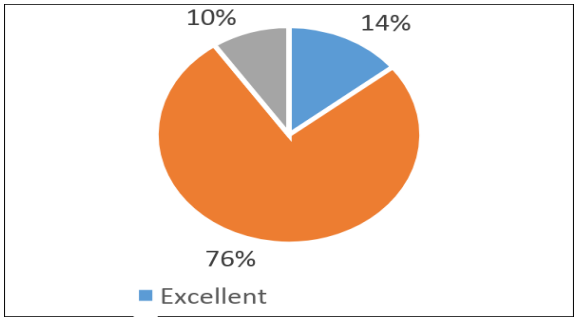

Fig. 6. Ability to Think Critically after Field Trip

Question (6): How would this field trip inspires you in working towards professional membership (CEng/PEng)? The aim is to identify how effective of this field trip to inspire students to work towards professional membership. Fig. 7 indicates that 86% (combination of excellent and good ratings) of students were inspired to gain professional membership in future. Besides, the analysis (Table 3) also showed that the visit had inspired 40% of respondent who rate good interest in Civil Engineering discipline, to aim for professional engineering membership in the future when they join the industry. This field trip have created a good environment to promote professionalism and inspired students to apply for professional engineer status, via continuously professional development.

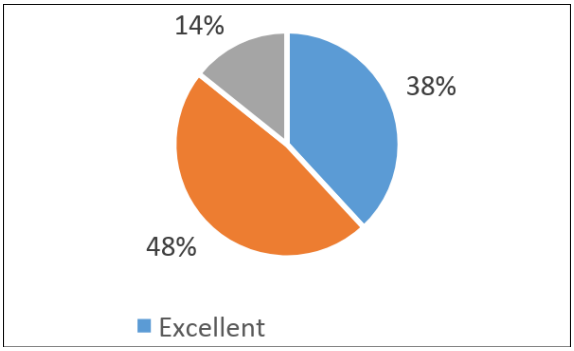

Fig. 7. Inspiration of Professional Membership (CEng/PEng)

Table 3. Attained interest in Civil Engineering Discipline versus Inspiration Working towards Professional Membership Analysis

			Inspiration working towards professional membership			Total
			Excellent	Good	Fair	
Attained interest in Civil Engineering discipline	Excellent	Count	1	1	1	3
		Percent	33.3%	33.3%	33.3%	100.0%
	Good	Count	6	9	3	18
		Percent	33.3%	50.0%	16.7%	100.0%
Total		Count	7	10	4	21
		Percent	33.3%	47.6%	19.0%	100.0%

4. CONCLUSION

The study confirmed that industrial field trip with workshop has significantly improved the students' experience. The changing of learning style from classroom to field leaning has proven that this teaching approach is able to retain students' interest on civil engineering and pavement engineering. Apart from enhancing students understanding on the learning subject, it is also found to be effective in promoting professionalism and improving critical thinking, which leads to the inspiration of professional membership registration. Workshop or hand-on activity handled by certified engineers (CEng/PEng) during industrial field trip is the key of success on this learning activity.

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