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The effects of industrial training on students' generic skills development

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Abstract

This conceptual paper reviews the underpinning theories and past literatures on generic skills in relation to industrial training attended by students in higher learning institutions. Subsequently, a number of hypotheses and a framework of generic skills development are proposed. Four generic skills discussed are communication skill, teamwork skill, critical thinking and problem solving and moral and professional ethics. The paper proposes that the development of these generic skills is influenced by or have some relationships with students' demographic and motivation, as well as organizational characteristics and culture. The methodology of conducting this study is also illustrated.

Keywords: Engineering students, generic skills, industrial training, communication skill, teamwork skill, critical thinking and problem solving, moral and professional ethics.

1. Introduction

In recruiting new employees, the job market is ever emphasizing on working experience in addition to the paper qualification; thus the requirement makes working experience or industrial training becomes fundamental in the higher learning institutions (Saat and Ahmad, 2009). Higher learning institutions are now providing students with the opportunity to translate the knowledge gained into practice through industrial training, also known as practical training or internship. The training period which lasts to about six months aims to develop the skills required by the industry and this seems to become an important role to provide quality and professional workforce in the future (Omar, et al., 2008).

Rapid changes in the information technology, work life and society (Lam & Ching, 2007) lead to the advancement in work context as well as affect to the economic growth. In addressing these changes, crucial profession like engineering will definitely hire highly skilled future engineers to cope with the competitive market. Hence, to be employed, students should develop not only their technical skill but also generic skills from day one in university. There are no specific list of skills in the generic skills but typically, it relates to dominate in skills such as communication, teamwork, critical thinking and problem solving, leadership, entrepreneurship, lifelong learning and ethics (Ministry Of Higher Education, 2006). According to Robinson, employability skills or generic skills refer to "those basic skills necessary for getting, keeping, and doing well on a job" (2000, p. 1) . These skills are also known

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as a transferable skill (Kelly, 2001; Yorke, 2006) as well as teachable skill (Lorraine Dacre & Peter, 2007). Generic skills are important to students in higher education particularly to engineering students as recently being studied by many scholars (Yuzainee, Zaharim, & Omar, 2011; Zaharim, et al., 2010).

There is an issue in generic skills deficiency (Cable, Dale, & Day, 2007; Jackling & Watty, 2010) among engineering students and this may become an obstacle for them to be employed and worse if this leads to unemployment. In order to overcome these problems, industrial training in the academic program should serve as the best medium to develop generic skills for students. In the context of engineering students focused in this paper, industrial training provides a lot of benefits by providing early preparation in engineering professions and enhances engineering skills during the training (Omar, et al., 2008). Besides, students have the opportunity to integrate the theoretical learning in university with the practical work in the engineering environment. The benefits of industrial training for students are undeniable since numerous studies conducted in various field produced positive outcomes (Callanan & Benzing, 2004; Cook, Parker, & Pettijohn, 2004; Mihail, 2006). Nevertheless, past studies shows that the experience during industrial training can be influenced by the type of individual (Cook, et al., 2004; Leonard & Kenneth, 1999; Martin, Myers, & Mottet, 1999; Nill & Schibrowsky, 2005; Rolf van, Patrick, & Guido, 2009) and organizational characteristics (Baker & Comer, 2012; Coralie, Ron, & Rod, 2007; Jehn, 1997; Jose Luis, 2010; Katajavuori, Lindblom-Ylänne, & Hirvonen, 2006; Kupritz & Hillsman, 2011; Mortenson, 2002; Smith & Hume, 2005).

Hence, this paper proposes two types of independent variables which are individual and organization characteristics that may influence the development of generic skills. Individual characteristics include student's demographic and motivation factor while organizational characteristics consist of the demographic of supervisor and organization, and job scope and work environment. Motivation can be defined as "the process whereby goal-directed activity is instigated and sustained" (Pintrich & Schunk, 2008, p. 4). Meanwhile, Robbins and Judge (2009) defined demographics as individual's characteristics like age, gender, races and academic background. Besides that, organizational culture seems to influence the generic skills development because organization with strong cultures are having the right direction to achieve goal (Deal & Kennedy, 1982). Thus, this paper will discuss on how organizational culture influence generic skills development of engineering students. In addition job scope and work environment may also influence to students' generic skills development with industrial training intervention. Industry should assign and supervise multiple tasks that can enhance the student's interest to attend industrial training (Busby, Brunt, & Baber, 1997).

The purpose of this paper is to review the theories and past literatures on generic skills in relation to industrial training. Subsequently, this paper proposes a number of hypotheses and a framework of generic skills development among engineering students with intervention of industrial training. In this paper, only four generic skills will be discussed, namely, communication skill, teamwork skill, critical thinking and problem solving and lastly, moral and professional ethics. These generic skills act as dependent variable of the proposed framework. The next sub-section will review on four generic skills theories.

2. Theoretical framework, literature review and hypotheses development

As mentioned earlier, this paper proposes a framework of generic skills development with the intervention of industrial training. The framework is developed based on previous studies in the generic skills and unemployment issues among engineering graduates. Four generic skills will be discussed in this paper; communication skill, teamworking skill, critical thinking and problem solving skill and finally moral and professional ethics. These criteria are justified by reviewing past literature. This section provides a review on the theoretical framework and continues with the past studies related to generic skills development and cover with the hypotheses. The next sub-section will discuss on transactional model of communication (Adler & Towne, 1996; Wood, 2006) related to the context of this paper.

2.1. Communication theory: Transactional Model of Communication

In a transactional model (refer to Figure 1), the communication process is depicted as a two way communication whereby both communicators act as *sender* and *receiver* (Wood, 2006). Two circles represent the communication

process occurred between two persons and the information sent and received simultaneously. Both persons, in the communication process have their own field of experience. When the communication takes place, both of them will share the field of experience due to the information is interchangeable. This is depicted in the overlap of the circles. Meanwhile, time element in this model shows that the communication pattern of these persons will change over time. In simple words, at the first time two persons communicate, the communication is in formal way, but it will slowly change to informal way, since the relationship have built and both are keeping trust to each other.

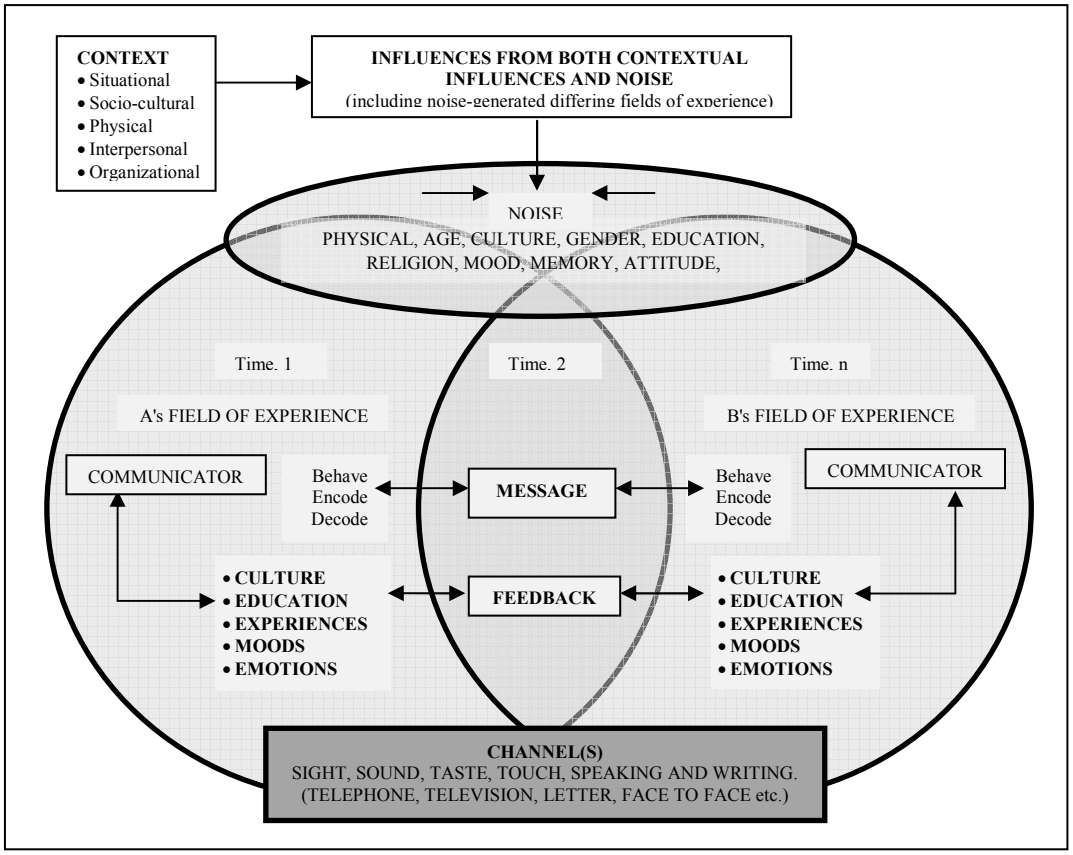

Figure 1: A Transactional Model of Communication

Source: Adapted and modified from Wood (2006) *Communication in Our Lives* (5th ed.). Belmon, CA: Holly Allen and Adler and Towne (1996) *Looking Out/Looking In: Interpersonal Communication* (7th ed.) Florida: Harcourt Brace & Company.

The other element in the model is noise which refers to the "distortion or barriers which prevent the message reaching the target recipient in the ways it was intended" (Scott, 2009, p. 25). Physical noise and semantic noise are including in the type of noises. Physical noise is the barriers that distract the exchange of information, due to the surrounding, such sound of drilling the wall. Culture, attitude, and external socio cultural are interferences from semantic noise. One of the prominent advantage of this model is the dynamism of communication regarding to both communicators can give their own feedback (depicted in double arrows) and the communication occurs in social systems of both communicators.

The Transactional Model of Communication is a relevant model within the context of this paper. This is because the two way communication processes between two communicators (students and supervisor) is important in exchanging the messages and feedback. Furthermore, this model describes how students can develop their communication skill by having regular interaction with their supervisors as well as with staffs. In doing so, students

not only develop communication skills but enhance their proficiency in communicating with the professional groups, particularly in engineering field. Moreover, the exchange of information and knowledge, especially from supervisor to students is only effective when students participated actively in giving feedback either in the form of opinions or inquiries. Thus, this paper hypothesizes that:

$H_{1:}$ Students will experience significant improvement in communication skill after their industrial training.

As mentioned in the introduction section, student's motivation will be studied with industrial training intervention. Prior studies on motivation show there are five reasons that motivate the students to communicate with their instructors, which refers to relational, functional, participatory, and excuse-making and sycophancy (Martin, et al., 1999). In relational reason, students try to build a relationship with their supervisor, while students will learn on the task given for functional reason of their communication with the supervisor. The third reason is participatory; refer to the students that willing to participate in giving ideas and thoughts to their supervisor. This action portrays that they are understand on the topic being discussed. Meanwhile, students will motivate to communicate when they need to give an excuse for unfinished work to their supervisor. The last reason is sycophancy, related to those students who only communicate to their supervisors in order to get some compliances and attention. On the other hand, supervisor with good communication skill can influence the students to communicate effectively (Guerrero & Floyd, 2006). This is supported with the study by Mark van, Menno and Erwin (2007). In their study, they found that the supervisor's communication have affected the employees commitment to the organization. Based on the argument made by the past studies, this paper hypothesizes that:

H_{1A}: There is a relationship between motivation and student's communication skill development.

Other than motivation, students may also be influenced by organizational culture in organization where they attend industrial training. The culture, either individualism or collectivism type can only be observe during the period of industrial training. In a collective culture, people tend to respect others' feelings whereas it is otherwise for individualism culture which emphasized towards the subject matter of the message that is being communicated (Mortenson, 2002). Therefore, this paper proposes that:

H_{1B}: There is a relationship between organizational culture and student's communication skill development

In addition, job scope and work environment may affect the communication skill development of engineering students. For example, when a student's job deals a lot with customers (for being the sales engineer) the communication skill development may be significant as compared to a student who deals with machines in his working environment. Regarding to this matter, Kuptriz (2002) found that work environment has affected the communication process between employees and supervisors. He asserts that the work environment such as working space, ergonomic design, lighting and ventilation of the organization should be in good circumstances to ensure effective communication process. Hence, this paper hypothesizes that:

H_{1C}: There is a relationship between job scope and work environment in organization with the student's communication skill development during industrial training.

Effective communication is essential especially when working in a team. Good communication skill may assist in working with other people. In other words, communication is important in teamworking nature as this is a way to exchange the ideas and thoughts of the team members. The subsequent sub-section will discuss the importance of teamworking skill.

2.2. Teamwork theory: Interprofessional Teamwork

This sub-section will discuss on the teamwork model, past studies and hypothesis development of teamworking skill. Teamworking leads to enhance organizational performance while it is also beneficial for employees in term of knowledge sharing and close relationship between team members (Betty & Brian, 1997). Due to the benefits of teamworking skill, this paper will examine a teamwork model proposed by Reeves, Lewin et al. (2010) to extend the understanding of this skill (refer Figure to 2). The model was adapted and slightly modified to suit with the area of this paper. In this model, there are four major domains referring to relational, processual, organizational and contextual that interrelated to each other.

The first relational domain consists of professional power, hierarchy, socialization, team composition, team roles and team processes factors that affect the relationship among team members. As inexperience employees, students should build trust and respect in relationship with supervisor and former staffs because they have an authority and most importantly their valuable experiences. The second processual domain related to the time and space that influence in a teamwork. This domain includes factors such as time and space, routines and rituals, information technology, unpredictability, urgency, complexity and lastly, task shifting. Usually, when a task nearly to dateline, team members will give more effort and endeavour.

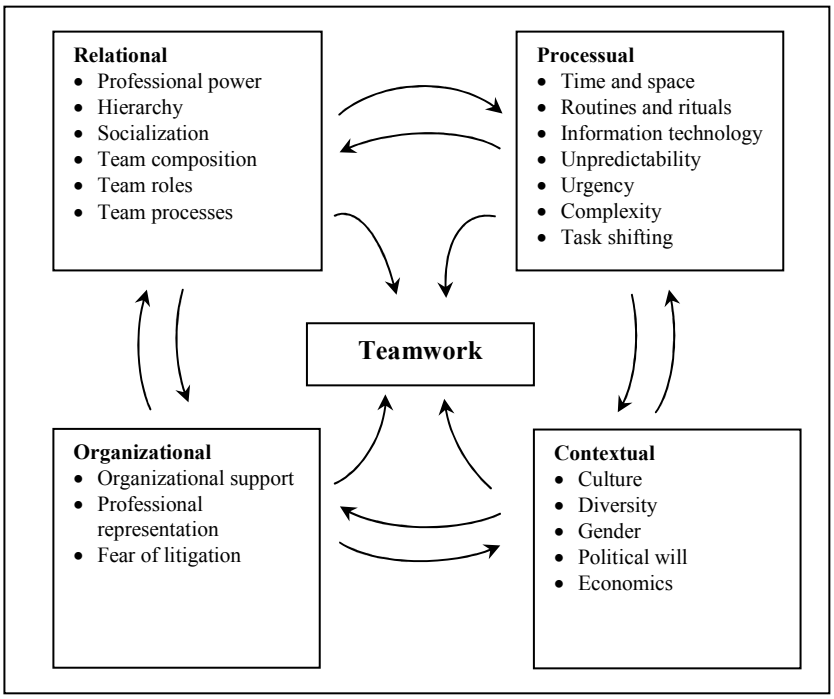

Figure 2: A model for understanding teamwork
Source: Adapted and modified from Reeves, Lewin, Espin, & Zwarenstein (2010). A Conceptual Framework for Interprofessional Teamwork *Interprofessional Teamwork for Health and Social Care* (pp. 57-76): Wiley-Blackwell.

The third domain is contextual, consists with factors of culture, diversity, gender, political will and economics. Teamwork is similar to collectivistic culture due to team member's shared same feelings and behaviors. Thus, this paper will identify how corporate culture can influence in teamworking skill among engineering students during their six months training. The fourth organizational domain may influence on teamwork operation in regard to work environment in organization. Organizational support, professional representation and fear of litigation are factors in this domain. Example, lower level employees tend to conduct task in unethical manner because of fear of litigation to the authorities. In the context of industrial training, organization play important roles to provide effective training by giving full support to the students. From the organizational support, perhaps students can develop their teamworking skill as a preparation before entering work field. From this review, this paper hypothesizes that:

H_2: Students will experience significant improvement in teamworking skill after their industrial training.

As mentioned earlier, this paper focuses on the motivation factors that affect on the student's generic skills development. According to Rolf van, Patrick and Guido (2009), individual's motivation can be enhanced by working in a team because they have sources of reference. A student has less motivation when working in a team due to the opportunity to rely and refer to others when given a task. In other words, free rider among team members might avoid the employees to become motivated. In addressing these issues, Rolf van, Patrick et al. (2009) suggest that team members should realize what is the exact meaning of the team for themselves are. In other words, the team

members need to perceive the importance of the team in enhancing the organization performance. In other study, Erez and Somech (1996) asserted that teamwork is one of the ways in reducing free rider practice among employees. Based on the past literatures on motivation, this paper hypothesizes that:

H_{2A}: There is a relationship between motivation and student's teamworking skill development.

Other than motivation, organizational cultures also seem to influence the team effectiveness. According to Jose Luis (2010) workplace spirituality, element of organizational culture has the effect on the team effectiveness based on three attributes; trust, creativity and respect. As the nature of collectivism dimension is related to work in a team, it is expected that this dimension will influence the development of teamworking skill among students during their industrial training. Hence, this paper hypothesizes that:

H_{2B}: There is a relationship between organizational culture and student's teamworking skill development.

Some jobs are person-centered in nature; an employee work on his/her own, for example an engineer who designs on the safety or doing cost evaluation. On the other hand a student exposed in a working environment involving quality aspect in process improvement or product improvement will need input from others and thus work in a team. Therefore, the job experience students had in a certain working environment may influence the development of teamworking skill. Students working in a team will experience three types of conflicts, refer to task conflict, relationship conflict and process conflict (Jehn, 1997) as compared to students who are working individually. In the former, students will encounter with the differences with ideas and thoughts during accomplishing the task (task conflict). Relationship conflict occurs in early stage of teamworking, where there are incompatibilities among team members while disagreements in tasks assignment lead to process conflict. The exposure in handling or observing these conflicts will prepare students to address problems relating to team work and this is important for their future. Thus, it is hypothesized that:

H_{2C}: There is a relationship between job scope and work environment in organization with the student's teamworking skill development

In the process of completing the tasks, team members need to come out with ideas and thoughts which involve critical thinking and problem solving skills. Thus, the next sub-section will discuss on the theoretical framework and past studies relating to these skills.

2.3. Critical Thinking and Problem Solving Theory

It is said that a person with critical thinking skill will come out with extraordinary result based on their mental ability and past experiences of that knowledge. In higher educational setting, university students particularly need to develop this skill to distinguish them from others as well as to cope with the rapid changes in today environment (Young, 1992). In addition, they can solve a problem effectively, due to the interrelation between critical thinking and problem solving skills (Alan & Mohamed, 1997). Coralie, Ron et al. (2007) developed a model on thinking based on the culture and teaching method of Confucian Heritage students as shown in Figure 3.

In this model, they proposed four important stages for students to think critically; learning, repetitive activities or memorizing, understanding and reflecting (refer to the inner circles of Figure 3). In every stage, there are factors that influence the critical thinking process. For example, in between learning and repetitive activities or memorizing stages, the factor of teacher-student relationship influences the process. Other factors are collective or collaborative studying, deep approach and transformational learning (refer to the outer circles in figure 3). The salient factor that relates to Hofstede cultural dimension is collectivism (collective and collaborative studying). According to Coralie et al. (2007), students from Asia countries are more incline to study in a group and thus reflects that they are in the collectivism culture. This is because they can share and exchange various ideas and thoughts. The vigorous exchange of ideas and knowledge may improve their critical thinking. Similar situation can be explained in an organization with collectivism culture. Here supervisors and students actively interact, share knowledge and ideas in performing a task, and this can improve students' critical thinking as the whole process involve learning, repetitive activities or memorizing, understanding and reflecting. Based on the above review, this paper proposes the following hypotheses:

H_3: Students will experience significant improvement in critical thinking and problem solving skill after their industrial training.

H_{3A}: There is a relationship between organizational culture and student's critical thinking and problem solving skill development.

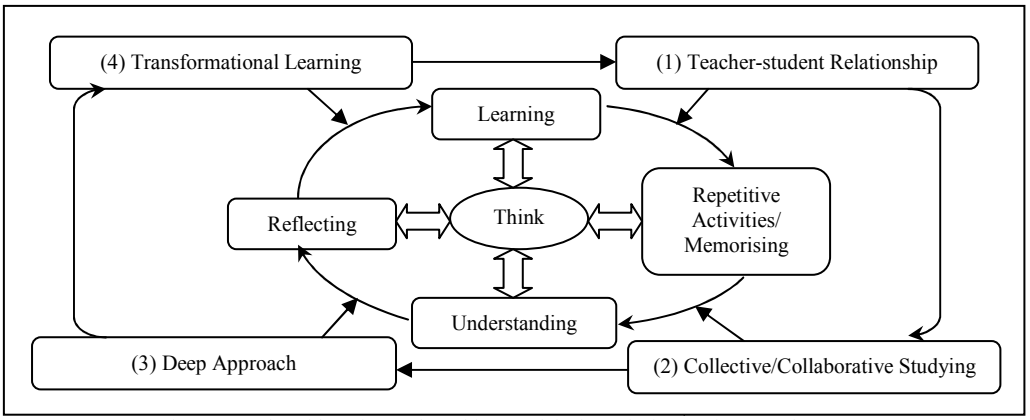

Figure 3: Cultural learning and teaching model of Confucian Heritage students
Source: (Coralie, et al., 2007)

Critical thinking and problem solving skills are also dependable on the individual characteristic as posited by Leonard and Kenneth (1999). In their studies, they delineate on the psychology influences on the adult learning in achieving the higher level of thinking. The psychological effect is related to students' motivation, whether they are enthusiastic in the learning process during industrial training. Meanwhile, organizations that encourage their staff (including training students) to participate actively in critical thinking and problem solving will lead to the team performance improvement (Sam & Frederick, 2006) and increase their work motivation. With this in mind, this paper hypothesizes that:

H_{3B}: There is a relationship between motivation and student's critical thinking and problem solving skill development.

In the context of this paper, the model can be implemented by the engineering students to think critically during the industrial training. For example, the supervisor will act as a teacher to train the students in accomplishing jobs in organization. Then, students will retrieve the previous knowledge learned from their supervisor and lecturers in order to understand how the jobs being done (Katajavuori, et al., 2006). Then, the task or problem can be solved after reflecting the previous learning process by thinking critically. In addition, the multiple tasks or jobs should be given to the students during their training because they can develop more on the critical thinking skill (Eraut, 2000). Based on past literatures, this paper hypothesizes that:

H_{3C}: There is a relationship between job scope and work environment in organization with the student's critical thinking and problem solving skill.

Critical thinking and problem solving skills are important skills that relates to decision making. Right or wrong decision making will affect the organization in term of performance and reputation. Basically, right decision is determined by individual's thinking whether it is ethical or unethical. Regarding to this matter, next sub-section will discuss on ethical decision making in organization.

2.4. Moral and professional ethics theory: Model of ethical decision making in organizations.

There are a number of theories on moral and ethics but this paper adopts Trevino's theory. Trevino (1986) has extended the work of cognitive moral development by Kohlberg and emphasize it in the first stage in her propose model (refer to Figure 4). She claims that the cognitive element is insufficient to decide whether the individuals make a decision in ethical or unethical manner (1986). Thus, she proposed two variables, namely; individual and

situational that affect in the individuals decision making. These variables are in the context within the organizational culture and job perspective.

The individual variables include ego strength, field dependence and locus of control. Individuals that have their own principles seem to have consistency in their moral development because of their high ego strength. Besides, individuals that inclined to obtain others assistant in making decision are depicting as high field dependence. Locus of control refers to the ability of individuals in controlling the circumstances of ethical dilemma. Individuals with internal locus of control are having more responsibility in their decision, either right or wrong and it reverse to the external locus of control.

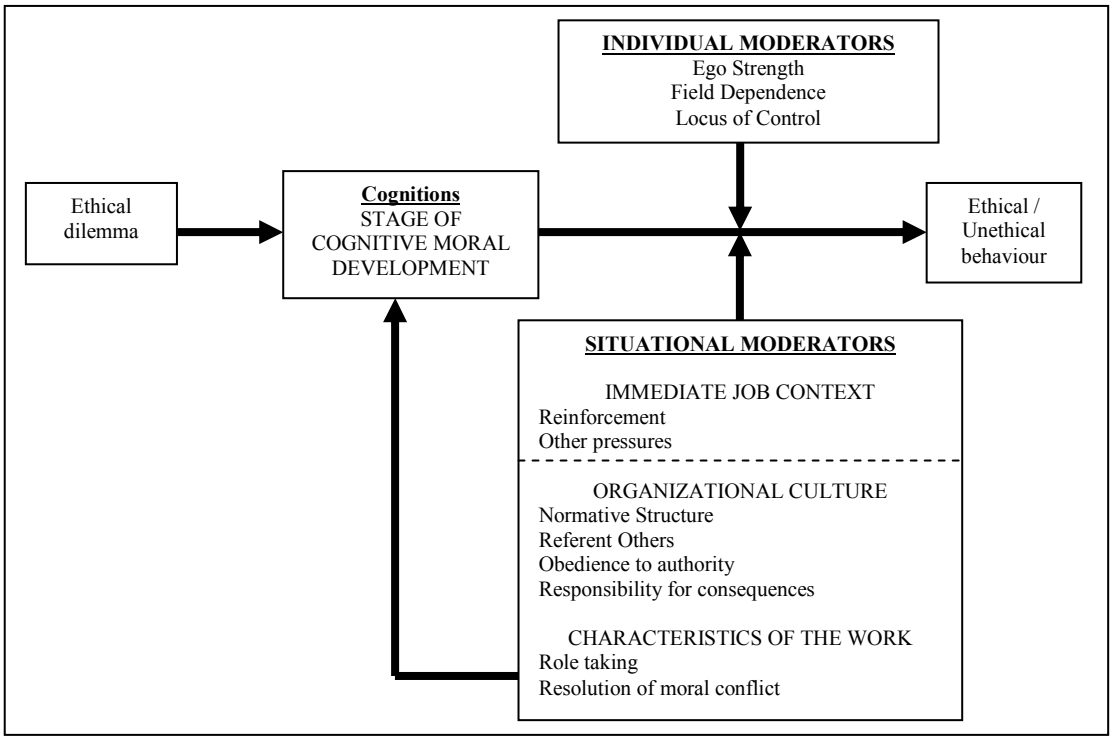

Figure 4: Model of ethical decision making in organizations
Source: Trevino (1986, p. 603)

In situational variables, the moderators that influence on the decision making are immediate job context, organizational culture and characteristics of the work. Reinforcement and other pressures include in immediate job context moderator. The reinforcement possesses rewards and punishment for ethical or unethical behaviour while personal cost, pressures of scares resources or competitions are including in other external pressures. Normative structure, referent others, obedience to authority and responsibility to consequences fall under organizational culture moderator. Trevino (1986) asserts that strong normative structure serve as a guide for individuals to behave ethically. The good role model in organization become as a referent to others in making right decision. In obedience to authority, individuals will follow the rule because they have trust to the organization, meanwhile, individuals may act in ethically if they are assign to responsible with the consequence of the decision. On other side, characteristics of work include role taking and resolution of moral conflict which individuals with these moderators are advanced in their moral development. Based on this theory, this paper hypothesizes that:

H_4: Students will experience significant improvement in moral and professional ethics skill after their industrial training.

The model of ethical decision making in organizations is relevant to the context of this paper because industrial training mostly being conducted in organizations. The decision making is expected being done by expert in

organizations, such as managers or supervisors rather than students. It is because the students are new learners whereby they are usually relying on their supervisor in making decision. Although they are not involved directly in making decision, they still can observe the values and attitudes that being implemented in the organization. Example, student A makes observation on the dress code and punctuality of the staff in order to identify the level of ethical awareness in organization. Besides, the organizational cultures also play important roles in affecting individual's decision making either ethical or unethical, as this proposed by Trevino (1986) in her model. This notion also in line with studies by Nill and Schibrowsky (2005) where they found organizational culture, reward system and perceive moral intensity are significantly affected ethical decision making of marketing students. At the same time, the reward system serves as a symbol of motivation in ethical decision making which relates to this paper. Therefore, this paper hypothesizes that:

H_{4A}: There is a relationship between motivation and student's moral and professional ethics skill development.

Smith and Hume (2005) also studied on the culture and ethics as this topic getting concern in organization. They narrow their study in the context of individualism versus collectivism and power distance to perceive ethical beliefs in accounting field. They identified that accountants in collective culture tend to protect their subordinates values and beliefs due to benefit the organizations even though they need to act unethically. After reviewing the past literatures on organizational culture, this paper hypothesizes that:

H_{4B}: There is a relationship between organizational culture and student's moral and professional ethics skill development.

Job scope and work environment seem to influence on the student's moral and professional ethics development. In the context of this paper, the students are more incline to act in ethical manner as they are new learners and supervise by their supervisor in the industry. On the other hand, industry that implement work ethics, such as elimination of corruption, having trust and respect to each other will influence on students' moral and professional ethics skill development. All these matters are related to the industry and university role in order to assist the students to develop this skill. The students need to expose on ethics course (Baker & Comer, 2012) before they attending the industrial training by respective universities. Then, during the training, they will be able to segregate between right or wrong action in accomplishing the tasks. It is anticipated that industrial training will lead the students to become future engineers with high level of moral and professional ethics skill (Varma, 2000). Thus, this paper hypothesizes that:

H_{4C}: There is a relationship between job scope and work environment in organization with the student's moral and professional ethics skill.

The next subsection will discuss on the methodology of this paper.

3. Methodology

In identifying students' generic skills development during industrial training, both quantitative and qualitative methods will be used as the research methodology. The main research instrument is questionnaire (quantitative), whereas interview (qualitative) will be conducted to gain some insight and in-depth information. The population of this study is undergraduate engineering students from all public and private universities in Malaysia. Students who undergo a minimum of six months training will be selected. Based on the statistics of students' enrolment in the engineering program (retrieved from the website of Ministry of Higher Education Malaysia), a total of 381 respondents from public universities and 379 respondents' private universities will be selected as the sample in this study. The number of respondents determined are based on Krejcie and Morgan (1970) table.

In regards to data collection process, the study will be conducted in two phases, pre (Phase 1) where students are about to attend and post (Phase 2) when students have undertaken the industrial training. The significance in conducting the pre and post study is to examine the differences between the development of student's generic skills before and after attending the industrial training. In order to ensure the validity of the study, similar students will be used in both phases. As the objective is to determine the development in pre and post phase, two similar sets of questionnaires will be designed, with additional questions in Phase 2. Basically, there are three parts in the questionnaires; Part A for students' demographic, Part B for organization demographic (includes supervisor background, organizational culture and others) and Part C for generic skills (communication skill, teamworking

skill, critical thinking and problem solving skill and lastly moral and professional ethics skill). Additional questions will be included in the Phase 2 set which ask students regarding their experience during industrial training and organizational culture that the students being exposed to.

In the qualitative part, interview session will be conducted with thirty engineering employers which host the industrial training. Convenience sampling will be used where employers who are willing to participate and cooperate are selected. In the interview session, the employers will be asked about their expectations of industrial training in engineering field, and to discuss on the importance and achievement of the generic skills. Overall, this study expects that engineering students will develop their generic skills due to industrial training intervention. The next section will conclude this paper and propose the framework on generic skills development.

4. Conclusion

In regards to the above discussion on the development of generic skills with industrial training as an intervention, it is expected that a certain degree of development among student will be achieved. When the study is implemented, the findings will contribute to the stakeholders (engineering students, universities, industries) and the body of knowledge. Stakeholders can identify the loop holes where they can improve the industrial training with better planning and implementation. It is important to provide better planning because students must clearly understand the objectives of training in order to integrate theory and practical in a real setting workplace. Furthermore, feedback regarding these issues is really useful to improve the content in research proposal for doctorate degree. As mentioned earlier, this paper will propose a framework for generic skills development that can be depicted in Figure 5.

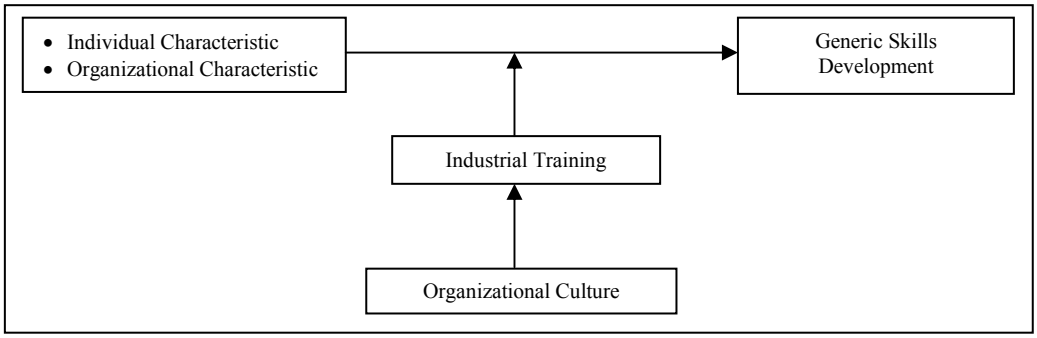

Figure 5: A Framework for Generic Skills Development

This framework anticipates that individual and organizational characteristics influence the generic skills development among engineering students. Meanwhile, industrial training intervention is expected to be a platform in developing students' generic skills. This paper also suggests the culture of the organization affects the experience during industrial training and subsequently influence the development of generic skills. In other words, generic skills development between different cultures may affect the extent of generic skills development among the students.

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