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Fostering Creativity through Innovation Engagement in Science and Technology Education: Case Study of Universiti Teknologi MARA Students

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Abstract

Students tend to learn faster through hands on participations. Guided problems solving outside the classroom environment has been regarded as better and a motivating learning method for these young generation. Innovation engagement among students from higher institution are very much encourage as their participation in the activities belief to result in a group of creative and innovative intellectual who will be future leaders and entrepreneurs. A survey was done on students from this institution to obtain their perception on the subject matter through a set of questionnaires adopted from similar study done elsewhere. A comparison of the responses from those that have directly engagement with innovation, invention and design project (IID group) and those without any direction engagement with innovation, invention and design project (non-IID group) was carried out. Students who participated in the innovation convention related themselves to be more confident and motivated in their study as compared to students who have not participated in any innovation, invention and design project. Their engagement in the project helps them in the teamwork and their communication skills. Their thinking is more influenced by their lecturers than by their friends. This finding is opposite to that of the students who did not participate in the project. Hence, the effort, time and money spent on engaging students with activities related to IID are worthwhile endeavour that steered towards producing competent graduates.

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Keywords: creativity; innovation; critical thinking; problem solving

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1. Introduction

"In the Renaissance, creativity might have been a luxury for a few, but by now it is a necessity for all"
(Jackson et al., 2006)

Science and Technology Education have been perceived as the vehicle for economic development and technological modernization. Thus the national vision statement of Malaysia to be a fully development nation, aims for 60 per cent of the school children and young people to take up Science, Technology, Engineering and Mathematics education to ensure a new generation of career for a better future of the country. In 2000, the ratio was 25: 75 and since then ratio has improved to 42:58. Among the initiatives undertaken by Universiti Teknologi Malaysia is to foster creativity through innovation engagement to create passion in science, technology, engineering and mathematics (STEM) education.

1.1. Creativity in the educational setting

Ever since the late 90s, enhancing creativity has become a global-wide interest reflecting social and economic changes and the need to raise competitiveness in globalization activities (Shaheen, 2010). Being creative is said to be an important factor gearing up towards productivity in any organization. Creativity is the production of novel and useful ideas in any domain whereas innovation is the successful implementation of creative ideas within an organization (Amabile, 1996). Thus, creativity of any individuals is the beginning for innovation to evolve. Today creativity and innovation particularly creativity is very crucial especially in entrepreneurship and to remain competitive in business competition.

Realizing the importance of creativity and innovation these days, much research has been done to find strategies in fostering creativity in an educational setting (Lin, 2010). The attempt to foster creativity through education started in the mid twentieth century whereby many psychometric researchers put efforts in extending and measuring individual's creativity. There has been curriculum reform carried out to include creativity in education policy in western countries such as the United Kingdom, United States, France, Sweden and Australia (Shaheen, 2010). Hence, many Asian countries including South Korea, Taiwan and Singapore also responded to this trend whereby they put emphasis on creativity development in a top down mode (Cheng, 2010). At this point, the relationship between creativity and education is to encourage personal development and self-actualization and to equip the younger generation with the survival skills needed in the realm of globalization and technological changes.

1.1.2. Significance of creativity and innovation

In general, any person who engaged in innovation activities would develop a host of skills that are increasingly important in the professional world (Caruso & Woolley, 2008) such as stronger communication skills, time management, challenge assumptions and problem solving skills. In addition, people who are creative or engaged in creative activities are more likely to have better physical health and often lead to academic success (Stuckey & Nobel, 2010). Therefore, through innovation engagement among the students, the creativity of the students are being channelled in an appropriate way for students' development in many aspects such as learning environment, soft skills and survival skills (Kaufman & Beghetto, 2009). Hence, this helps the students to be more confident and motivated in their study.

1.1.3. Engaging with Invention, Innovation and Design (IID) Convention : Case study

With a belief that creativity and innovation engagement among students will develop skills that may not have been highlighted in the normal classroom set up, Universiti Teknologi MARA motivates students to participate in the annual Invention, Innovation and Design convention. They are expected to work in group of three to five students, same or different discipline, outside the classroom time and apply the knowledge they have studied to come up with a solution to a problem close and known to them. These students will be guided by their lecturers to suggest and produce creative and innovative way of overcoming the problem(s) or coming up with an invention or design. The

groups that have won at the campus level will then participate at the university level, national level and international level.

In consequence, a case study involving students from this university with the objective of investigating whether students' engagement in the IID convention have different perspectives and motivation towards learning science and technology than those who did not engage in such activity.

2. Methodology

A survey was carried out during the Invention, Innovation and Design (IID) Convention 2014 held at the university level in Shah Alam, Kuala Lumpur. A set of structured questionnaires adapted from Anon (2012) was developed distributed randomly to students who participated with their products, known as the IID group or just as observers at the convention known as non-IID group. The data were keyed in using Statistical Package for Social Sciences (SPSS) software and the analysis was carried out to elicit possible difference between the two groups of participations, those that were actively involve and those who were observers.

3. Key Findings

Key findings are discussed below.

3.1 Profile of the respondents

A total of 100 students, 70.0% female and 30.0% male were surveyed. 89.0% of the students were in the age group of 21 to 24 years old. A higher percentage, 52.0% were from diploma programs, 46.0% from degree program while only 2.0% from the master program. Out of these 100 students surveyed, only 30 or 30.0% are from the IID group while the rest are the non-IID group.

3.2 Pre-university education on creative thinking skills

The IID Group perceived that their pre-university education had an impact between positive and substantial positive with an average score of 4.26 while the Non-IID Group scored close to positive impact of 3.90. However, there was no significant difference based on t-test (p=0.145). Both groups indicated parents had a great impact on their thinking habits and the percentage among the IID group was found to be higher that the non IID group. It is interesting to note that the percentage (26.7%) of lecturers influencing the thinking of the IID group was higher than that of the non IID group (20%). On the other hand, the percentage of non IID group with friends influencing their thinking (30.0%) was found to be higher than the percentage (20.0%) of the IID group.

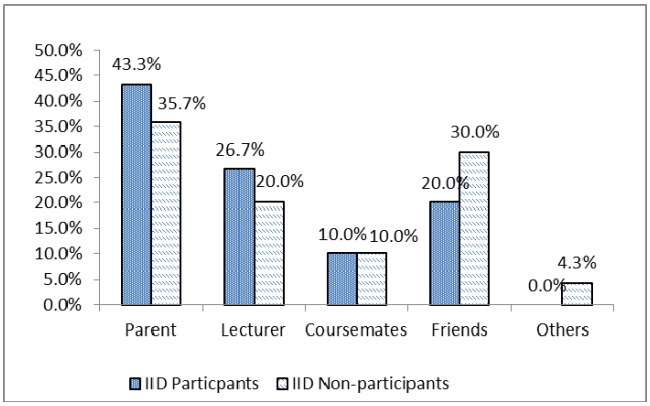

Fig. 1. Impact on thinking of the two groups

3.3 Reasons for pursuing tertiary qualification

Based on chi-squared test with a p-value of 0.001, there is a significant difference on the motivation level to study among the IID and non-IID groups. It was found that more than half, 56.7% of the IID groups indicated that they were studying subjects that were of interest to them, while 13.3% claimed to enjoy their study, another 13.3% indicated that they were trained for a specific type of job, 6.7% wanted to obtain a degree or diploma, 6.7% indicated that they study because of family encouragement and only 3.3% wanted to pursue in order to improve their job prospect. On the other hand, only 18.6% of the non-IID group admitted studying subjects that were of interest to them and 8.6% enjoyed what they were studying. This group tended to focus on getting their tertiary qualification (37.1%) and 22.9% expressed of studying to improve their job prospective. Only 7.1% of this non-IID said that they were trained for a specific job and 4.3% were studying because of their family encouragement.

3.4 Interest on the course attended

There was inter-item consistency among three items that consisted of self-interest, lecturers' stimulation and keenness to learn about new aspects exploring new ideas as measured by the Cronbach's α coefficient of 0.77. The inter-items consistency was higher among the IID group as compared to the non-IID group with the Cronbach's α coefficient of 0.88 and 0.71 for the two groups respectively. The average scores of these three items of the IID and non-IID groups were 2.1 and 2.32 respectively where scale of 1 (strongly agreed), 2 (agreed) and 3 (neither agree nor disagree).

3.5 Perception of most important element of success

Knowing what ones wanted and aspiration of achieving dream was noted as the most important element of success by both the IID and non-IID groups. The percentages of the IID and non-IID groups who agreed with this element were 63.3% and 74.3% respectively. A chi-squared test at α level of 5% for the different response for the two groups was found to be insignificance. Mental reward was found to be the second most important element of success for both the groups. One factor that they considered as less important was material rewards.

3.6 Communication skills

The students were required to provide their response on seven inter-item questions with a scale of 1 (strongly agree) and 5 (strongly disagree) to describe their communication skills. A higher consistency for the items was obtained among the IID group as compared to the non IID group with a Cronbach's α of 0.51 and 0.26 respectively. However there was no significant difference between the two groups based on t-test ($p > 0.05$). IID Group had a higher average score of 3.26 which was between neither agree nor disagree and most agree as compared to the Non-IID Group's average score of 2.70 which was between neither agree nor disagree and most disagree.

3.7 Teamwork

There was a good consistency response for the IID group for twelve inter-items used to assess students' perception on teamwork. The same is not true for responses given by the non IID group. This is reflected by the Cronbach's alpha of 0.87 for the IID group and 0.62 for non IID group.

3.8 Impact of their engagement in IID project

The IID group asked to give feedback on inter-item measure classified as problem-solving skills, personal development and intellectual motivation. The analysis is summarized in Table 1.

Table 1. Impact summary of engagement in IID project

Inter-item response on	Cronbach's α	Mean response (variance value)	Range of inter-item correlation matrix
Problem-solving skills	0.92	3.9 (0.01)	0.75 to 0.91
Personal development	0.88	4.0 (0.21)	0.67 to 0.78
Intellectual motivation	0.92	4.1 (0.005)	0.79 to 0.81

Note: Response scale of 1 (strongly disagree) to 5 (strongly agree)

Consistency on the three classified impacts were found to be high, Cronbach's α of at least 0.88 with mean response of 4.0, indicating a scale of agree and with a very small variance value. The inter-item correlation matrix indicates a good correlation between for the three impacts measured. Students who were involved in the IID project or the IID group agreed that their involvement has benefited them in the problem-solving skills, personal development and intellectual motivation.

4. Conclusion

In general the IID group often scored higher positive score in their perception to any items evaluating the creative and innovative skills. While majority of both groups had similar perception of important elements of success, IID group had a wider range related to both tangible and non-tangible reward gain. The IID group also perceived that their problem solving skills had been enhanced and there were differences in their perspective in value toward their learning process when compared to the non-IID group. The IID group displayed learning with creative and innovative process and they also valued their work. To encourage students to be creative and innovative, it involved the lecturers and students engagement in learning together. This is supported by Torrance (1963) who stated that creativity can be taught to students of all ages. Therefore, being involved in activities outside the normal classroom set up will definite develop students who will be more motivated with positive outlook, more confident and skilful as they are challenged to come up with solution to problem faced by them or people around them.

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