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The needs analysis of learning higher order thinking skills for generating ideas

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Abstract

Generating of idea is thinking skills activity which require high level of creative thinking and actions. Hence, the purpose of this research was to analyse the needs of learning higher order thinking skills for generating ideas among technical students based on the opinions of academic staffs. The findings indicated that deadlock of ideas is the most important factor in the difficulty in generating ideas among these students. The difficulty of generating ideas is a key factor in affecting the achievements of the students' assignments. Thus, students need to learn higher order thinking skills to address the difficulty in generating ideas.

Keywords: Generating idea; higher order thinking skills; needs analysis; technical students

1. Introduction

In the 21st century, thinking skills especially creativity is crucial in order to support economic prosperity. Human creativity has become a major economic resource (Florida, 2002). Industries of the 21st century will increasingly depend on the generation of knowledge through creativity and innovation (The Third Outline Perspective Plan, 2001). Employers often suggest the importance of students to be equipped with skills to make decisions and think critically and creatively before entering the working world.

In addition, the increase in labor productivity also depends on the quality of each individual's talent, namely creativity (Ario, 2006). Creativity and innovation are important keys to success in any field in this era of rapid development (Wheelihan, 2011). This is so because business management activities such as processes to increase productivity, solve problems, motivate employees, make decisions and rapid technological change are in dire need of creative ideas. Idea generation thus, is a crucial part in resolving a problem (Sharp, 2008).

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Jonson (2005) defines idea as a basic element of thought which can be visual, concrete, or abstract. Idea is all stages of the cycle of abstract thinking (Graham & Bachmann, 2004) and it also can be visualized in our mind. Abdul Hamid (2001) and Beyer (1992) categorized the generation of ideas as a higher order thinking skills (HOTS) activities that require high level creative thinking and action.

However, not everyone is able to generate good ideas because ideas cannot be generated easily. Idea generation occurs in our brain through the cognitive, metacognitive, chemical and biological process (Abd Hamid, 2001). Hence, complex thinking skills such as problems solving, creating, analyzing, evaluating and others are needed to process the collected information (Abd. Rashid, 2003, Meyer, 2002) for generating an idea.

Furthermore, high level thinking challenges us to interpret, analyze or manipulate information (Mohamed, 2006, Ea et al., 2005, Newmann, 1990). With high level thinking, an individual will be able to use the new information or prior knowledge and manipulate information to obtain a reasonable response to new situations (Rajandran, 2008, Lewis & Smith, 1993). Consequently, creative ideas can only be generated through high level thinking, instead of the low level thinking through the application of knowledge learned in daily lives.

2. Problem background

Currently, the generation of new ideas is often emphasized at Institute of Higher Education (IHE) as students' assignments become more complex and challenging (Kuh, 2001). Students are given a variety of academic and non-academic projects that require them to solve problems creatively. For example, university students need to generate ideas to complete their coursework either in the form of written assignments or producing a project (Jailani et al., 2010).

Generating abstract or concrete ideas for solving problem is a Problem-Based Learning approach (PBL) where students are exposed to the actual solving process (Mohamad, Esa & Junoh, 2008). PBL involves learning the process of acquiring knowledge in technical areas; and consequently in the mastery of the knowledge itself. Acquisition and mastery of knowledge especially those related to a real situation or problem will lead to the collection of facts needed to find the solution (Whittington, 2003). Hence, the need to generate various ideas has become a necessity for every technical students in order to complete all assignments.

However, many students have difficulty generating ideas whether it is used to produce concrete or abstract product. This was proven by a survey conducted on 246 students at the Faculty of Technical Education, Universiti Tun Hussein Onn Malaysia. The findings showed students have a high level difficulty in producing projects (concrete idea), and a moderate level of the difficulty in completing a written assignment (abstract idea) for engineering education subjects (Yee et al., 2010). Research findings also showed that among the most difficult assignment to generate ideas for concrete products is PBL assignment in Engineering Drawing II (AutoCAD). Students also perceived that the highest level of difficulty in the process of producing a concrete product is idea generation.

Students feel it is difficult to generate creative ideas as they do not realize everyone possess the capacity to generate ideas. However, ideas do not simply materialise on their own. Ideas must be generated through the stimulation of senses and sensory. Thus, it is the purpose of this study to analyze the needs of learning higher order thinking skills for generating ideas among technical students based on the opinions of academic staffs.

The specific objectives of this study are to:

i) identify the existence of difficulties in generating ideas for individual assignments among technical students.
ii) identify the needs of learning higher order thinking skills among technical students.

3. Research Methodology

This is a survey research using quantitative method for data collection on the needs of learning HOTS for generating ideas among technical students. According to Wiersma (2005), a survey involved attitude, thinking and individual style. Common in most survey research, the characteristics of the population can be described through the distribution of frequencies and percentages.

3.1 Population and sample

Population is a group of people who have similar characteristics. Population should be identified appropriately based on the research to be conducted (Ary, Jacobs & Razaviech, 2002). In this study, the target population was the academic staffs with experience and expertise in the field of Civil Engineering, Electrical and Electronic Engineering and Mechanical Engineering in the four faculties of University Tun Hussein Onn Malaysia (UTHM). These four faculties including the Faculty of Civil and Environmental Engineering (FKAAS), Faculty of Electrical Engineering and Electronics (FKEE), Faculty of Mechanical and Manufacturing Engineering (FKMP) and Faculty of Technical and Vocational Education (FPTV).

A total of 242 academic staffs were selected as samples. The sampling procedure used for this study was stratified random sampling. The stratification was based on faculty. The samples were randomly selected in a specified layer to reduce sampling error such as the size of a large variance of sample estimates (Idris, 2010). Table 1 shows the population and sample of academic staff by faculty.

Table 1. The population and sample of academic staffs in four faculties

Faculty	Population	Sample
FKAAS	163	61
FKEE	195	73
FKMP	195	73
FPTV	91	35
Total	644	242

Source: Recruitment & Service Unit (Academic), Human Resource Division, UTHM Registrar Office

3.2 Research instrument

The choice of instruments is important to ensure data collected will answer the research questions. A set of questionnaires was developed and used as research instrument. Questionnaires allow respondents more time to think and make responses. They will be able to decide on the response or provide a more accurate data because they do not need to hurry with their responses (Chua, 2006). In addition, more data can be obtained from the respondents in a short period of time (Wiersma, 2005). Furthermore responses are found to be more consistent when compared with data collected through observation.

The questionnaire is divided into two parts. Part A comprises six items related to demographic factors including age, gender, faculty, field, post and teaching experience. Meanwhile, Part B comprises 43 multiple choice items which consists of three choice answers, 'Yes', 'No' and 'Not Sure' and four rank-ordering items.

Prior to the actual research, a pilot test was conducted to determine the reliability of the instrument as well as well ensure the desired objectives of this study can be achieved. The reliability of both types of items was tested using the test re-test method. Multiple choice items are of nominal scale while rank-ordering items are of ordinal scale. The value of the reliability of the multiple choice items and rank-ordering items were obtained through Cramer V correlation test and Spearman Rho correlation test respectively. Both correlation tests showed that there was a significant positive relationship between the questionnaire scores for the first time and the questionnaire scores for the second time. This means that all items are suitable and reliable for obtaining stable scores.

4. Data analysis and results

Descriptive statistics such as frequencies and percentages have been used to explain the distribution of data and also for answering the research questions. The collected data were analyzed using *Statistical Package for Social Sciences* (SPSS) software. The findings are presented in the table format.

4.1 The existence of difficulties in generating ideas for individual assignments among technical students

The findings depict a total of 201 (83.1%) academic staffs found technical students having trouble in solving individual assignments (Table 2). In addition, a total of 194 (80.2%) academic staffs agreed that technical students having difficulty generating ideas to solve individual assignments.

Table 2. Distribution of the existence of problems when technical students complete individual assignment

Statement	Response						Total	
	Yes		No		Not Sure			
	f	%	*f*	%	*f*	%	*f*	%
Students having trouble in completing individual assignment.	201	83.1	38	15.7	3	1.2	242	100
Students having difficulty generating ideas to solve individual assignment.	194	80.2	45	18.6	3	1.2	242	100

Table 3 showed that a large number of academic staffs agreed the biggest problem faced by technical students while solving individual assignments is difficulty of generating ideas. This is followed by problems in the vagueness of assignment questions; understanding the requirements of the assignment and competition among peers.

Table 3. Descending order of problems faced by technical students while solving individual

Problems	*f*	%
Difficulty of generating ideas	131	54.1
Vagueness of assignment questions	51	21.1
Understanding the requirements of the assignment	42	17.4
Competition among peers	18	7.4

Table 4 indicated a total of 117 (48.3%) academic staffs felt the most difficult individual assignment for technical students is critical review or summary of articles. This was followed by the model production, written assignments, reports, engineering drawings, folios and presentation.

Table 4. Descending order of individual assignment that students have problems in generating ideas

Assignment	*f*	%
Reviews or critical articles	117	48.3
Model production	107	44.2
Written assignments	91	37.6
Reports	88	36.4
Engineering drawings	23	9.5
Folios	21	8.7
Presentation	17	7.0

Deadlock of ideas is the most contributing factor in the difficulty of generating ideas among technical students as illustrated in Table 5. This was followed by the lack of information, specialized skills, exercises to generate ideas, time and emotional disorders such as depression.

Table 5. Descending order of factors in the difficulty in generating ideas for solving individual assignment among technical students

Factors of Difficulty in Generating Ideas	*f*	%
Deadlock of ideas	121	50.0
Lack of information	99	40.9

Lack of specialized skills	96	39.7
Lack of exercises to generate ideas	81	33.5
Lack of time	45	18.6
Emotional disorders such as depression	41	16.9

Research findings in Table 6 depict a total of 189 (78.1%) academic staffs agreed that idea generation is important for the completion of individual assignment. A total of 190 (78.5%) academic staff concurs that difficulty in generating ideas will lead to technical students having problems in completing their assignments. They believed that the difficulty of generating ideas is a key factor affecting the achievement of the students' assignments.

Table 6. Distribution of the importance of generating ideas for solving individual assignments among technical students

Statement	Response					
	Yes		No		Not Sure	
	f	%	*f*	%	*f*	%
The difficulty of generating ideas is a key factor affecting the achievement of the student's assignment.	190	78.5	52	21.5	0	0.0
The difficulty in generating ideas will lead to technical students having problems in completing their assignment.	188	77.7	54	22.3	0	0.0
Average	189	78.1	53	43.8	0	0.0

4.2 The needs of learning higher order thinking skills among technical students

Research findings in Table 7 demonstrated that a total of 227 (93.7%) academic staffs felt it is crucial that technical students learn HOTS. It is most important in assisting students to generate ideas; followed by solving student's assignments, teaching and learning in lectures as well as learning about a subject. However, in practice, the majority of technical students use higher order thinking skills to solve problems in learning, followed by generating ideas to solve individual assignments and to learn a subject. Therefore, it is evident that technical students need to learn HOTS for generating ideas in solving their assignments.

Table 7. Distribution of the needs of learning HOTS among technical students HOTS

Statement		Response					
		Yes		No		Not Sure	
		f	%	*f*	%	*f*	%
HOTS important in	teaching and learning in lecture.	234	96.7	8	3.3	0	0.0
	learning about a subject.	228	94.2	14	5.8	0	0.0
	solving student's assignments.	236	97.5	6	2.5	0	0.0
	helping students generate ideas.	237	97.9	5	2.1	0	0.0
HOTS will be used to	generating ideas to solve individual assignments.	215	88.8	26	10.7	1	0.4
	solving problems in learning.	222	91.7	19	7.9	1	0.4
	learning about a subject.	205	84.7	36	14.9	1	0.4
The needs for learning HOTS among technical students.		237	97.9	5	2.1	0	0.0
Average		227	93.7	15	6.3	0	0.0

5. Recommendations

Ideas generation has become a necessity for every student to solve all assignments. However, deadlock of ideas will cause the difficulty in generating ideas. Deadlock of idea is a reflection of the weakness of one's thinking skills (Abd. Rashid, 1999). In fact, weakness in HOTS is the main factor causing deadlock of ideas. Thus, students who are weak in thinking skills cannot perform cognitive and metacognitive based tasks effectively (Pillips, 1997).

According to Abdul Hamid (2001), one must go through a process of experience, observation, informal learning and discussion with others for generating an idea.

The process of ideas generation occurs through restructuring and relating knowledge and experience in new ways. Information form the basis for generating ideas and without information, idea generation will not begin. Therefore, information must be collected, restructured and assessed in the right brain to generate new ideas. This is a clear indication that ideas will be generated through a process of thinking. However, thinking is not an easy task because it requires an effective method and skills particularly to generate ideas. But with experience, knowledge and thinking skills, an idea can be generated more easily.

Furthermore, in this age of information overload; with limited time for information processing (Phillips, 2004); students will be able to face such challenges by using HOTS. Thinking skills will enable students to solve problems in specific situations from different perspectives (Rajendran, 2008, Mohd & Hassan, 2005), especially solving the high level critical problems. Learning HOTS will also enhance an individual's mind; leading to the production of a variety of alternatives, ideas, actions, solutions and design. Therefore, students should learn and use HOTS to generate ideas so they can complete their assignments more effectively.

Models, strategies, techniques, and activities are model lesson plans showing how thinking skills could be taught together with subject matter using the integrated approach that have been implemented in the school system in Malaysia since 1993(Rajendran, 2008). Nevertheless, a self-instructional manual can be an alternative approach. The manual is self-paced and can cater to the more extendable individual differences of learner's abilities, interest and degrees of application. Besides, the manual is self-instructional requiring a specific basic study programme which can be conducted either as a pre-requisite or as part of a total programme structure of the technical and vocational education (Jailani, Tee & Yee, 2010). Based on these arguments, we proposed the use of self instructional manual to develop HOTS among students. These manuals for individualized learning will be able to support the current learning system since students can study at their own pace (Meyer, 1988).

6. Conclusion

This study indicated that technical students do face problem in solving individual assignments. One of the most significant problems faced by these students is difficulty in generating ideas; followed by the vagueness of assignment questions; understanding the requirements of the assignment and competition among peers. The most difficult individual assignment is critical review and summary of articles. Others include the model production, written assignments, reports, engineering drawings, folios and presentation. The academic staffs believed deadlock of ideas is the most important factor in causing difficulty in generating ideas among these technical students. Other factors include the lack of information, specialized skills, exercises to generate ideas, time and emotional disorders such as depression.

The findings also showed that idea generation is important for the completion of individual assignments. The difficulty in generating ideas will lead to technical students having problems in completing their assignment. It is a key factor affecting their achievements in the assignments. Hence, students need to learn HOTS to address the difficulty in generating ideas. HOTS become essential as it can assist them to complete their assignments and learn the subject. Consequently, students should be assisted to acquire HOTS; either through the conventional teaching and learning environment or a self- instructional, individualized manual.

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