International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:8, No:1, 2014

Learning Styles Difference in Difficulties of Generating Idea

M. H. Yee, J. Md Yunos, W. Othman, R. Hassan, T. K. Tee, M. M. Mohamad

***Abstract*—**The generation of an idea that goes through several phases is affected by individual factors, interests, preferences and motivation. The purpose of this research was to analyze the difference in difficulties of generating ideas according to individual learning styles. A total of 375 technical students from four technical universities in Malaysia were randomly selected as samples. The Kolb Learning Styles Inventory and a set of developed questionnaires were used in this research. The results showed that the most dominant learning style among technical students is Doer. A total of 319 (85.1%) technical students faced difficulties in solving individual assignments. Most of the problem faced by technical students is the difficulty of generating ideas for solving individual assignments. There was no significant difference in difficulties of generating ideas according to students' learning styles. Therefore, students need to learn higher order thinking skills enabling students to generate ideas and consequently complete assignments.

***Keywords*—**Difference, difficulties, generating idea, learning styles.

I. Introduction

GENERATING idea is a process of creating, developing and communicating ideas. Idea is a basic element of thought which can be visual, concrete or abstract [1]. Reference [2] defines the idea as all stages of the cycle of abstract thinking and it can be visualized in our mind. Idea can be any conception which existing in the mind as a result of mental understanding, awareness or activity. Reference [3] states idea as something such as a thought or conception that potentially or actually exists in the mind as a product of mental activity.

Reference [4] highlights that new ideas as a combination of well-establish pattern of thought by a process of cross fertilization. Ideas are core part of the innovation process [5]. Each innovation begins with an idea [6]. Accordingly, the generation of ideas is categorized as a higher order thinking skills (HOTS) activities that require high level creative thinking and action [7], [8].

M. H. Yee is with the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400 Batu Pahat, Johor, Malaysia (corresponding author to provide phone: +60109-2630840; fax: +607-4536585; e-mail: yeemeiheong@gmail.com).

J. Md Yunos, R. Hassan, and M. M. Mohamad are with the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400 Batu Pahat, Johor, Malaysia (e-mail: jailani@uthm.edu.my, razalih@uthm.edu.my, mimi@uthm.edu.my).

W.Othman is with the Faculty of Education and Language, Open University Malaysia, Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia (e-mail: widad@oum.edu.my).

T. K. Tee is with the Faculty of Technical and Vocational Education, Sultan Idris education University, 35900 Tanjong Malim, Perak, Malaysia (e-mail: tktee@fptv.upsi.edu.my).

Idea generation occurs in our brain through cognitive, meta cognitive, chemical, and biological process [7]. Based on aspects of cognitive psychology, the generation of an idea that goes through several phases is affected by internal and external factors [9]. Internal factors include individual factors, interests, preferences, goals and motivation. With the availability of internal attributes, one would be driven to try to generate ideas more easily.

Also, an idea can generate by external factors such as environment, employers, friends, problems faced, and rewards and so on. Therefore, [7] defines idea as a mental process or personal opinion that is available exclusively through information and stimuli from the environment, experience, observation, informal learning and discussion with others. In conclusion, ideas in the human mind which is generated from the cognitive and meta cognitive processes due to internal and external stimuli.

Reference [4] discusses a variety of ideas which are to solve problem, help people, save, fix and create things, make things better and cheaper and so on. Idea generation is a crucial part in decision making and problem solving [10], [11]. Additionally, creativity which is essential element in generating idea could find unknown in every field, being original and developing different solutions to every problem and encounters [12].

Hence, in the context of this research, we define idea as being conceived as a result of mental activity where previous knowledge, information or facts were combined and associated in some way to form the new idea to solve the problem in completing students assignments.

II. Problem Background

World continuous change thrives on creative individual. Creativity and innovation are important keys to success in today's intensely competitive and dynamic environment [13]. Creativity has always played a central role in generating idea. At Institute of Higher Education (IHE), generating new ideas is often emphasized as students' assignments become more complex and challenging [14].

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 completing a project [15]. Thus, the need to generate multiple ideas has become a necessity for every student in order to complete their course assignments.

Despite growing recognition of creativity's importance for young people, the research of students' creativity, especially

in generating idea still is neglected [16]. Many students have difficulty generating ideas whether it is to be used to produce concrete or abstract product [17], [18]. A total of 246 students from Faculty of Technical Education, Universiti Tun Hussein Onn Malaysia responded that they have a high level of difficulty in producing projects (concrete idea), and a moderate level of the difficulty in completing a written assignment (abstract idea) for engineering education courses [18].

Not everybody is able to generate good ideas because ideas cannot be generated easily. Interesting ideas take time to develop and are not instant successes. A number of obstacles in understanding and application of idea generation techniques also exist among students [19]. This is because individual creativity is influenced by personality factors [20], cognitive styles and capability [21], skills of disciplines related to the task, motivation and impacts from social contexts [22].

Learning styles is one of the individual factors that may influence an individual in generating ideas. Learning styles is the uniqueness of individual's learning habits in perceiving and processing information. Reference [23] stated that learning styles are shaped by genetic characteristics, past experiences of the individual and expectations of the social environment.

We hypothesized that different students' learning styles affect the difficulties of generating idea. It may lead to the problem in completing students' course assignments. Consequently, to test this hypothesis, the following research objectives were arisen. The specific objectives of this study are to identify:

i. The pattern of Kolb Learning Styles among technical students.
ii. The major difficulties faced by technical students in generating ideas for completing individual assignments.
iii. The difficulties faced by technical students in completing higher order thinking skills (HOTS) based assignments.
iv. The difference in the difficulties faced by technical students in generating ideas for completing individual assignments according to learning styles.
v. The difference in the difficulties faced by technical students for completing HOTS based assignments according to learning styles.

III. Research Methodology

This is a survey research which uses quantitative method for data collection on the difference of difficulty in generating ideas according students' learning styles. Survey involved attitude, thinking and someone's style [24]. Common in most survey research, the characteristics of the population can be described through the distribution of frequencies, percentages and mean score.

A. 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 [25]. In this study, the target population was the year 1, 2, 3 and 4 technical students in Bachelor of Civil Engineering, Electrical and Electronic Engineering and Mechanical Engineering from Malaysia Technical University Network (MTUN) institutions. MTUN comprises four universities, namely University Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTEM), Universiti Malaysia Pahang (UMP) and Universiti Malaysia Perlis (UNIMAP).

A total of 375 technical students were selected as samples. The minimum number of samples selected was based on the reference number, as [26]. The sampling procedure used for this study was stratified random sampling. The stratification was based on university. The samples were randomly selected in a specified layer to reduce sampling error such as the size of a large variance of sample estimates [27]. Table I shows the population and sample of technical students by university.

TABLE I
THE POPULATION AND SAMPLE OF TECHNICAL STUDENTS IN FOUR UNIVERSITIES

University	Population	Sample
Universiti Tun Hussein Onn Malaysia (UTHM)	5373	148
Universiti Teknikal Malaysia Melaka (UTEM)	3425	95
Universiti Malaysia Pahang (UMP)	2194	60
Universiti Malaysia Perlis (UNIMAP)	2626	72
Total	13, 618	375

Source: Student Academic Management Division, MTUN

B. Research Instrument

The Kolb Learning Styles Inventory and a set of developed questionnaires were 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 [28]. In addition, more data can be obtained from the respondents in a short period of time [24]. Furthermore responses are found to be more consistent when compared with data collected through observation.

The questionnaire is divided into three parts. Part A comprises five items related to demographic factors including gender, year of study, intake qualification, academic result and parents' monthly salary. Part B comprises 18 items which consists of two choice answers. Meanwhile, Part C comprises 19 multiple choice items which consists of two choice answers, 'Yes' and 'No' 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 to ensure the desired objectives of this study can be achieved. The reliability of Kolb Learning Styles Inventory was tested using the test-retest method and the value of the reliability was obtained through Cramer V correlation test. The value of the reliability was .90 above in all cases. The 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 of Kolb Learning Styles Inventory are suitable and reliable for obtaining stable scores.

For part C, 19 multiple choice items are dichotomy items. The value of the reliability of the dichotomy items were

obtained through Kuder-Richardson *21* (KR-21), which is .9062. However, rank-ordering items are of ordinal scale. The reliability of rank-ordering items was tested using the test re-test method and the value of the reliability was obtained through Spearman Rho correlation test. The 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 four of rank-ordering items are suitable and reliable for obtaining stable scores.

C. Data Analysis

The collected data were analyzed using SPSS software. The statistics selected for data analysis was based on the research questions as illustrated in Table II. Descriptive statistics such as frequencies and percentages have been used to explain the distribution of data and also for answering the research questions 1, 2 and 3. Inferential test analysis is used to answer the research questions 4 and 5. The findings are presented in the table format with calculation of mean score.

TABLE II
SUMMARY OF RESEARCH QUESTIONS AND STATISTICAL TECHNIQUES USED IN THE STUDY

No	Research Questions (RQ)	Statistical Techniques
RQ1	What is the pattern of Kolb Learning Styles among technical students?	Percentages and frequencies
RQ2	What are the factors that contribute to the difficulty in generating ideas for completing individual assignment among technical students?	Percentages and frequencies
RQ3	Are technical students facing difficulties in completing HOTS based assignments?	Percentages and frequencies
RQ4	Are there any significant differences in the difficulties of generating ideas for completing individual assignments according to learning styles?	Chi Square Kruskal Wallis
RQ5	Are there any significant differences in the difficulties of completing HOTS based assignments according to learning styles?	Chi Square

IV. RESULTS AND DISCUSSION

Both descriptive and inferential statistics were used as analytical tools. Non parametric statistical techniques were used with the inferential statistics.

A. The Pattern of Kolb Learning Styles

The pattern of the technical students' learning styles were determined through descriptive analysis and the results are presented in Table III. The findings depict a total of 107 (28.5%) technical students have dominant learning styles in Doer. This was followed by Watcher (25.6%), Feeler (24.0%) and Thinker (21.9%).

This pattern seems very appropriate to technical courses which emphasize applying knowledge or skills to a practical problem. Group work or group projects that apply theory to real-world setting are the major learning activities in technical courses. By way of learning something abstractly and process it actively, these students can be a good engineer understand the theory they have learned and apply it in workplace.

TABLE III
THE PATTERN OF KOLB LEARNING STYLES ACCORDING TO GENDER, YEAR OF STUDY AND EDUCATION BACKGROUND

Characteristics		Kolb Learning Styles				Total
		Feeler	Doer	Thinker	Watcher	
Gender	Male, *f* (%)	51, 13.6	54, 14.4	40, 10.7	43, 11.5	188, (50.1)
	Female, *f* (%)	39, 10.4	53, 14.1	42, 11.2	53, 14.1	187, (49.9)
	Total, *f* (%)	90, (24.0)	107, (28.5)	82, (21.9)	96, (25.5)	375, (100)
Year of Study	Year 1, *f* (%)	22, 5.9	23, 6.1	24, 6.4	25, 6.7	94 (25.1)
	Year 2, *f* (%)	22, 5.9	29, 7.7	20, 5.3	23, 6.1	94 (25.1)
	Year 3, *f* (%)	20, 5.3	25, 6.7	22, 5.9	27, 7.2	94 (25.1)
	Year 4, *f* (%)	26, 6.9	30, 8.0	16, 4.3	21, 5.6	93 (24.8)
	Total, *f* (%)	90, (24.0)	107, (28.5)	82, (21.9)	96, (25.5)	375 100
Education Back- ground	Matriculation, *f* (%)	31, 8.3	35, 9.3	31, 8.3	37, 9.9	134, (35.7)
	STPM, *f* (%)	107, 4.5	27, 7.2	12, 3.2	25, 6.7	81, (21.6)
	Diploma of Community College, *f* (%)	1, 0.3	2, 0.5	2, 0.5	2, 0.5	7, (1.9)
	Diploma of Polytechnic, *f* (%)	30, 8.0	34, 9.1	25, 6.7	28, 7.5	117, (31.2)
	Diploma of University, *f* (%)	11, 2.9	9, 2.4	12, 3.2	4, 1.1	36, (9.6)
	Total	90, (24.0)	107, (28.5)	82, (21.9)	96, (25.5)	375, (100)

B. The Factors that Contribute to the Difficulty in Generating Ideas for Completing Individual Assignment

Students answered the question "Do you face difficulties in completing individual assignments?" by giving a yes or no respond. The data analysis result indicate that a total of 319 (85.1%) technical students experience difficulties in completing individual assignments (Table IV).

TABLE IV
PERCENTAGE OF STUDENTS FACING DIFFICULTIES IN COMPLETING INDIVIDUAL ASSIGNMENT ACCORDING TO GENDER, YEAR OF STUDY AND EDUCATION BACKGROUND

Characteristics		Responde				Total	
		Yes		No			
		f	%	*f*	%	*f*	%
Gender	Male (M)	160	42.7	28	7.5	188	50.1
	Female (F)	159	42.4	28	7.5	187	49.9
	Total	319	85.1	56	14.9	375	100
Year of Study	Year 1 (Y1)	81	21.6	13	3.5	94	25.1
	Year 2 (Y2)	80	21.3	14	3.7	94	25.1
	Year 3 (Y3)	84	22.4	10	2.7	94	25.1
	Year 4 (Y4)	74	19.7	19	5.1	93	24.8
	Total	319	85.1	56	14.9	375	100
Education Back-ground	Matriculation (M)	117	31.2	17	4.5	134	35.7
	STPM (S)	69	18.4	12	3.2	81	21.6
	Diploma of Community College (DCC)	6	1.6	1	0.3	7	1.9
	Diploma of Polytechnic (DP)	95	25.3	22	5.9	117	31.2
	Diploma of University (DU)	32	8.5	4	1.1	36	9.6
	Total	319	85.1	56	14.9	375	100

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

TABLE V
TYPES OF DIFFICULTIES FACED BY TECHNICAL STUDENTS IN COMPLETING INDIVIDUAL ASSIGNMENT

Problems	*f*	%
Difficulty of generating ideas (P1)	193	51.5
Vagueness of assignment questions (P3)	85	22.7
Understanding the requirements of the assignment (P4)	75	20.0
Competition among peers (P2)	22	5.9

Table VI indicates a total of 171 (45.6%) technical students felt the most difficult individual assignment for them is critical review or summary of articles. This was followed by model production, written assignments, reports, folios, engineering drawings and presentation.

TABLE VI
TYPES OF INDIVIDUAL ASSIGNMENTS THAT STUDENTS HAVE PROBLEMS IN GENERATING IDEAS

Individual Assignments	*f*	%
Reviews or critical articles (A2)	171	45.6
Model production (A7)	164	43.7
Written assignments (A1)	147	39.2
Reports (A3)	137	36.5
Folios (A4)	64	17.1
Engineering drawings (A6)	38	10.1
Presentation (A5)	29	7.7

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

TABLE VII
FACTORS CONTRIBUTING TO DIFFICULTIES IN GENERATING IDEAS

Factors of Difficulty in Generating Ideas	*f*	%
Deadlock of ideas (F3)	121	50.0
Lack of information (F2)	99	40.9
Lack of specialized skills (F5)	96	39.7
Lack of exercises to generate ideas (F6)	81	33.5
Lack of time (F1)	45	18.6
Emotional disorders such as depression (F4)	41	16.9

C. Difficulties in Completing HOTS Based Assignments

The findings depict a total of 272 (72.5%) technical students having trouble in completing HOTS based assignments (Table VIII). It can be concluded that a majority of technical students regardless of gender, year of study and education background face difficulties in completing HOTS based assignments.

TABLE VIII
PERCENTAGE OF STUDENTS FACING DIFFICULTIES IN COMPLETING HOTS BASED ASSIGNMENT

Characteristics		Response				Total	
		Yes		No			
		f	%	*f*	%	*f*	%
Gender	Male (M)	135	36.0	53	14.1	188	50.1
	Female (F)	137	36.5	50	13.3	187	49.9
	Total	272	72.5	103	27.5	375	100
Year of Study	Year 1 (Y1)	68	18.1	26	6.9	94	25.1
	Year 2 (Y2)	75	20.0	19	5.1	94	25.1
	Year 3 (Y3)	60	16.0	34	9.1	94	25.1
	Year 4 (Y4)	69	18.4	24	6.4	93	24.8
	Total	272	72.5	103	27.5	375	100
Educati on Back-ground	Matriculation (M)	90	24.0	44	11.7	134	35.7
	STPM (S)	48	12.8	33	8.8	81	21.6
	Diploma of Community College (DCC)	6	1.6	1	0.3	7	1.9
	Diploma of Polytechnic (DP)	95	25.3	22	5.9	117	31.2
	Diploma of University (DU)	33	8.8	3	0.8	36	9.6
	Total	272	72.5	103	27.5	375	100

D.Difference in the Difficulties of Generating Ideas for Completing Individual Assignments According to Learning Styles

Result of Chi Square test in Table IX shows that there was no significant difference in students' learning styles on the difficulties of generating ideas for completing individual assignments. It means that learning styles do not influence an individual in generating ideas. However, this is contra with researches by reference number, as [20] to claim that individual idea generation is influenced by personality factors.

TABLE IX
DIFFERENCE IN THE DIFFICULTIES OF GENERATING IDEAS ACCORDING TO LEARNING STYLES

Learning Styles	Respond				X^2	p
	Yes		No			
	f	Std. Residual	f	Std. Residual		
Feeler	77	.1	13	-.1	1.67	.64
Doer	92	.1	15	-.2		
Thinker	72	.3	10	-.6		
Watcher	78	-.4	18	1.0		

*Difference is significant at the .05 level.

Result of Kruskal-Wallis H test in Table X indicates that there was no significant difference between students' preferred learning styles in Feeler, Doer, Thinker and Watcher on problems faced, individual assignments and the factors of difficulty in generating ideas. The findings indicated that types of difficulties faced by students in completing individual assignments, types of individual assignments that students have problems in generating ideas and the factors contributing to difficulties in generating ideas are not influenced by students' learning styles.

TABLE X
PERCENTAGE OF STUDENTS FACING DIFFICULTIES IN COMPLETING HIGHER ORDER THINKING SKILLS BASED ASSIGNMENT

Items		Mean Rank				X^2	p
		Feeler	Doer	Thinker	Watcher		
Problems (P)	P1	203.8	179.2	195.8	176.4	4.90	.18
	P2	176.6	187.2	181.1	203.7	3.84	.28
	P3	179.8	185.8	186.0	199.8	1.91	.59
	P4	186.7	196.9	193.7	174.5	2.65	.45
Individual Assignments (A)	A1	185.9	195.7	173.6	193.6	2.36	.50
	A2	183.8	170.9	197.5	202.8	5.40	.15
	A3	177.3	192.4	187.6	193.5	1.35	.72
	A4	179.1	182.4	189.6	201.3	2.44	.49
	A5	193.3	188.4	171.5	196.7	2.93	.40
	A6	182.1	207.7	188.6	171.1	6.47	.09
	A7	205.6	182.4	197.1	170.0	6.06	.11
Factors of Difficulty in Generating Ideas (F)	F1	188.7	184.5	183.9	194.7	0.63	.89
	F2	179.3	193.8	197.7	181.4	1.98	.58
	F3	193.2	176.8	199.5	185.8	2.48	.48
	F4	177.9	191.4	182.9	198.2	2.03	.57
	F5	195.2	184.4	185.3	187.6	0.59	.90
	F6	194.8	197.5	186.8	172.0	3.39	.34

*Difference is significant at the .05 level.

E. Difference in the Difficulties of Completing HOTS based Assignments according to Learning Styles

Result of Chi Square test in Table XI shows that there was no significant difference in students' learning styles on the difficulties in completing HOTS based assignments. Although learning styles significantly affect on the level of individual HOTS [29], [30], but it does not affect an individual in completing HOTS based assignments.

TABLE XI
DIFFERENCE IN THE DIFFICULTIES OF COMPLETING HIGHER ORDER THINKING SKILLS BASED ASSIGNMENTS ACCORDING TO LEARNING STYLES

Learning Styles	Respond				X^2	p
	Yes		No			
	f	Std. Residual	f	Std. Residual		
Feeler	67	.2	23	-.3	1.74	.63
Doer	76	-.2	31	.3		
Thinker	63	.5	19	-.7		
Watcher	66	-.4	30	.7		

*Difference is significant at the .05 level.

V. CONCLUSION AND RECOMMENDATIONS

In conclusion, this study illustrated that different students' learning styles did not significantly affect the difficulties of generating idea for completing individual assignments and HOTS based assignment. The factor contributing most to the difficulty in generating ideas among technical students is deadlock of ideas. 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, especially generating ideas. Consequently, students should be assisted to acquire HOTS; either through the conventional teaching and learning environment or a self- instructional, individualized manual by depending on students' learning style.

ACKNOWLEDGMENT

The authors would like to thank the Ministry of Higher Education, Malaysia for supporting this research under the Fundamental Research Grant Scheme (FRGS). In addition, the authors also wish to thank the four universities of Malaysia Technical University Network (MTUN), namely University Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTEM), Universiti Malaysia Pahang (UMP) and Universiti Malaysia Perlis (UNIMAP) who have given their full cooperation to ensure the success of this study.

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M. H. Yee was born in Sarawak, Malaysia on 5 March 1979. She obtained her first degree was Bachelor of Techology with Education (Civil Engineering) at Faculty of Education, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia in 2002. In 2003 she completed her Master's degree in Technical and Vocational Education at the same university Teknologi Malaysia, Skudai, Johor, Malaysia in. Now, she is persuing her PhD studies in Technical and Vocational Education at Universiti Tun Hussein Onn Malaysia, Batu Pahat, Johor, Malaysia. Her PhD research focuses on learning styles and higher order thinking skills.

Her working experience include; secondary school teacher, Proctor Assistant for final examination at Open University Malaysia, Open University Malaysia Part-Time Tutor, Industrial Practicum Supervisor, Undergraduate Project Superevisor, Undergraduate and Master's Projects' Examiner, Subject Matter Expect, Subject Examiner, and Professional Consultant for Multiple Intelligent Tests and Learning Styles Inventory Instrument Construction Workshop. Now, she is a lecturer with the Department of Engineering Education, Faculty of Technical Education, at Universiti Tun Hussein Onn Malaysia. (Email: mhyee@uthm.edu.my). Her previous publicatios include The Factors of Difficulty in Generating Idea among Malaysia Technical University Network Students (Batu Pahat, Johor: Universiti Tun Hussein Onn Malaysia, 2013), The Needs Analysis of Learning Higher Order Thinking Skills for Generating Ideas (Elsevier Ltd, 2012), The Level of Marzano Higher Order Thinking Skills among Technical Education Students (Singapore: International Association of Computer Science and Information Technology (IACSIT), 2011). Current and previous research intertests are learning styles, teaching styles, thinking styles and thinking skills.

Miss Yee is a member of Universiti Teknologi Malaysia Alumni and Malaysia Technical and Vocational Education Association.