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Cognitive-Learning Styles Conceptual Framework in Vocational Education

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Abstract: This study was conducted to analyze how learning styles influence the students' academic achievement based on cognitive mastery and vocational elements. Descriptive case study was applied with quantitative and semi-structured interview as supporting components in this study. The quantitative data were gathered based on Felder and Silverman Learning Styles Model (FSLSM), Felder-Soloman Index of Learning Styles (ILS) and vocational cognitive elements which consist of the aspects of knowledge, skills and problem solving were taken into account in constructing the question items. Respondents from Vocational Colleges were involved in this study. Purposive sampling was used to select the schools and stratified sampling procedure was applied in the selection of 128 students as research respondents. Purposive sampling was also chosen to select teachers as respondents for interview. The study discovered that students tend to be visual learners. Visual learners represent the input dimension of FSLSM and the result showed there are significant differences between input dimension with skills and problem solving but not with knowledge. The discussions with teachers revealed that most teachers accommodate students learning styles with cognitive mastery by using visual approach to increase students' academic achievement.

Key words: Cognitive, learning style, visual learner, knowledge, skills, problem solving

INTRODUCTION

The cognitive processes that contribute to student learning require that the student have the ability to manipulate information and ideas to solve problems and produce new knowledge. In Vocational Education (VE) the importance of the cognitive process is based on a few factors, namely, the cognitive abilities needed in the current work environment, the ability to adapt to changing VE requirements in a global context and the demands of cognitive development. A student's learning is influenced by a few factors. The basic issues of student learning as explored by Muhammad *et al.* (2014) include home background, learning environment and government policies. Martins *et al.* (2007) stated that family background factors determined academic performance and learning styles influenced a student's academic performance. Adesoji and Olatunbosun (2008) concluded that the school environment and teacher related factors were the dominant factors influencing achievements, especially if the student was highly self-motivated. Learning in VE is defined as the transition from using basic problem-solving strategies towards using expert problem-solving strategies (Thomas, 1992). Learners in VE must observe and experience the required cognitive processes to learn them and know how, where and when to use them. One of the factors debated over the last few decades was the relationship between student achievement and learning styles. Proponents of Learning Styles (LS) maintain that adapting classroom teaching methods to suit student's preferred styles of learning improves the educative process (Felder, 1993). However, opponents of learning style theories maintain that little empirical evidence is available to support LS involved strategies that students tend to apply to a given teaching situation. Each individual can fit into different styles that can result in students adopting attitudes and behaviors that are repeated in different situations.

Cognitive and learning styles in vocational education: The cognitive of curriculum and instruction is the basic requirement to measure student's achievement and teacher's teaching strategies. Many of cognitive theories reflected the curriculum structure in educational system. Cognitive and learning styles are one of the criteria to develop teaching strategies. Research was focused on

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Felder-Silverman Learning Styles Model (FSLSM) and the basic needs of cognitive dimension in vocational education. Cognitive process and activities such as information processing, mental representations, predictions and expectations are central to the cognitive interpretation of learning. Cognitive psychologist do not completely discount the findings of the operant and behaviorally oriented scientist they merely believe that cognitive events are also involved in how organisms learn. For cognitive scientists these events include internal processes which translate into a modern interpretation of a rather ancient concept the mind. It can be said that cognitive events are mental events.

Cognitive development: Jean Piaget proposed the concept of modern cognitive development. He explained how knowledge grows in human mind in progressive pattern of increasing the mental process. The challenging to promote student's cognitive development need teachers plan the structure lesson so everyone is challenged. The connection cognitive development and student's activities in the classroom (http://teachingasleadership.org/sites/default/files/Related-Readings/LT_Ch2_2011).

The connection of cognitive development and classroom activity

Cognitive development:

- Use concrete examples
- Provide ample practice, use a lot of models, plan lesson that are sensitive to activity levels and attention spans
- Opportunity for students interactions and encourage of student initiatives

Classroom activities:

- Limitation of students activities based on physical size and strength
- Play area with suitable equipment and involve all students in activities
- Helping students in activities and ask them focus on instruction given

Teacher should carefully in design instructional method in classroom. Cognitive development will give teachers consider in planning the lesson instruction. It is relate with identifying student's learning styles because the cognitive development have basic criteria in different ages student will have different thinking, students will actively in construct learning, cognitive development also builds on prior knowledge and with active interaction it will help the cognitive growth.

Learning styles: Felder-Silverman Learning Styles Model (FSLSM) proposed by Richard Felder and Linda Silverman focused on learning style in engineering education. The model based on concept information processing in cognitive based. The FSLSM was developed from information processing learning theory perspective whereby the authors viewed learning in a structured educational system as two-step process that involved receiving and processing information. Felder and Silverman (1988) described, the reception step is where external and internal information becomes available to students and students select the information process and ignore the rest. The processing step is where students process information and move towards understanding.

The earlier version of FSLSM incorporated five dichotomous dimensions intended to capture student's learning preferences with regards to perception (sensing or intuitive) input of information (visual or auditory) organizing information (deductive and inductive) processing information (active or reflective) and understanding information (sequential or global). Felder and Silverman made two modifications to the original model in relation to the organization and input dimension whereas the organization dimension was dropped from the model because of pedagogical reasons associated with teaching engineering education. The input (visual or auditory) dimension was changed to input (visual or verbal) as the term "auditory" was considered to be much more inclined to sound and spoken words to the exclusion of written texts (Felder *et al*., 2000; Felder and Soloman, 1997; Felder, 1993).

The learning styles used in FSLSM were not original to the model by Felder and Silverman (1998) but they are the result of combining and blending other learning models. However this combination of learning models is unique. In several studies Felder and others are explicit in acknowledging the original learning theories on which FSLSM dimension are based (Felder and Spurlin, 2005; Felder *et al*., 2000; Felder and Soloman, 1997; Felder 1993; Tsvigu, 2007). The sensing or intuitive dimension is similar to the sensing or intuitive Myers Briggs Type Indicator (MBTI) which were influenced by Carl Jung's theory of psychological types. This dimension is equivalent the concrete/abstract dimension of Kolb's learning style model. The processing dimension represent by active or reflective is a component of Kolb's active experimentation/reflective observation dimensions. The dimension is similar to Myers-Brigg's extrovert/introvert dimensions. The input (visual or verbal) and the understanding (sequential/global) dimensions are rooted in cognitive studies of information processing and learning styles. A study of FSLSM shows that the dimensions of the model have perceptive characteristics. As in any LS model, some characteristics of FSLSM are more representative of their dimension on others (Tsvigu, 2007).

In summary, this study elaborated on the theories, models and research regarding the study variables. The details explanation in Felder-Silverman learning styles model showed that why research chose the model and what are the advantages than other model. The comparison between learning styles models and theories showed that FSLSM is suitable with the characteristics and concept in vocational education in Malaysia especially in school system. The index of learning styles proposed by Felder-Soloman contained 44 items questions also match with the criteria of learning in vocational. The items very clear and direct to measure what type of learners. The student's achievement through cognitive learning is one important variables investigated in this research. Based on the Bloom's taxonomy and Anderson Krathwohl's toxonomy the factors on student's perception and the abilities mastery learning were developed. Integrating learning styles and student's achievement through cognitive learning provided the meaningful suggestions and support the research findings and the discussion whereas these points will be applied in last chapter of this thesis to support the findings of this study.

MATERIALS AND METHODS

The description of learning styles and Vocational Education (focused on Building Construction) developed throughout the research process in teaching and learning. This study consisted of three stages. Stage 1 included conducting research, reviewing the literature and finding the variables and purpose of the research. Pilot studies were carried out in this stage to measure the reliability and validity of the chosen research instruments. In Stage 2, quantitative data was collected. Three instruments were used to examine the research questions and analyze the data. In Stage 3 is qualitative method which involving teachers in semi-structured interview.Kuchi *et al*. (2003) points out that case study inquiry is only successful when built on the collection and analysis data from other multiple sources. Furthermore Yin maintains that case study could based on any mix of quantitative and qualitative evidence. In order fully answered research questions, data collected from students and teachers administrated by questionnaires and interviews. The study started by distributing the Index of Learning Styles (ILS) and one set of questionnaires to students in Building Construction Courses (BCC) from three Vocational Colleges (VC). The test given to the students used the achievement test questions developed by researcher with help from building construction experts. During the last stage, BCC teachers were subjected to a semi-structured interview before the research report was completed. The feedback from the interview was supported the quantitative finding from the ILS and questionnaires.

A research conceptual framework was designed as a guideline to merge the theory, model and factors to overcome research problems. This study is focused on the two factors investigated, namely, the learning styles and cognitive learning related to student's academic achievement for Vocational Schools. The variables investigated include the dependent and independent variables concerned on the characteristics of each type of learner according to Felder and Silverman as well as the level of cognitive learning measuring student's perception and mastery through their academic achievement. The cognitive learning focused on Bloom *et al.* (1956) and Anderson *et al.* (2001). This study used Building Construction modules which focused more on the three major vocational elements, namely, knowledge, skills and problem solving to measure the cognitive mastery.

Figure 1 shows the framework used in this study and FSLSM (Felder, 1993) was applied classified learning styles into four dimensions: processing, perception, input and understanding. Using the Index of ILS proposed by Felder and Soloman (1997), Felder and Bent (2005) the dimensions were further divided into eight types of learners. These are active, reflective, sensing, intuitive, visual, verbal, sequential and global. The ILS contains 44 questions to determine the learner type.

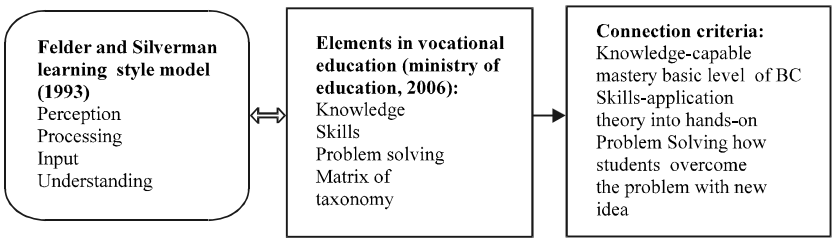

Fig. 1: Research framework

The taxonomy was used to identify the factors of cognitive learning. The cognitive process was easy to describe using this taxonomy to investigate the differences between the student's learning styles and their cognitive abilities.

RESULTS AND DISCUSSION

Type of learners in vocational education: The method of analysis applied from Sabine *et al*. (2007) used descriptive statistics to discover the distribution for each dimension of FSLSM. The description in Table 1 shows that the students tended to be visual learners with a mean score 0.844, followed by active learners (0.771 mean score) sensing with a mean score of 0 .671 and sequential learners with a mean score of 0.555. The other learning styles are as follows; reflective (mean score 0.228) intuitive (mean score 0.336,) verbal (mean score 0.161) and global learners (mean score 0.193). The findings also define the types of learners who would choose the first answer on learning style.

Student's cognitive abilities in vocational education: The final results of each student's test were confirmed by three teachers who acted as examiners. The scores given to the answers were based on the schema provided by the expert BC teachers. A statistical analysis of the results can be found in Table 2. The number of students who achieved "moderate" grade was at 26%. Weak marks were awarded to 19.2% of the students and a total of 32% of students failed. Only 2% of students achieved a "good" result and not a single student obtained an excellent score in this test.

The differences of type of learner and cognitive abilities in vocational education: The flow of quantitative analysis started from descriptive then followed by inferential. This study had managed the quantitative data based on research questions arrangement. Figures and tables presented to describe the data are easy to understand and it is a justification why the test is needed in particular research question. The current of quantitative findings add substantially to understanding student's learning styles especially in vocational education. Table 3 shows the summary of quantitative analysis. There are four dimensions of LS investigated and each dimension represent by type of learner that what students are and each type having the significant differences. BCC students are tended to be visual learners, therefore the contribution of this research described the characteristic of visual learner. The cognitive perception was investigate to know how students perception on their ability in cognitive. However, to measure their cognitive mastery an achievements test conducted and the significant level in the table represent with symbols for having significant and not significant.

Teacher accommodate learning styles in teaching: The main issue discussed in qualitative analysis is how teacher accommodate student's learning styles.

Table 1: Statistic of learner type

Dimention of FSLM																
	Processing (a)				PerceptionV (a)				Input				Understanding			
N	Ac	SD	Rf (b)	SD	Sen	SD	Int (b)	SD	Vis (a)	SD	Ver (b)	SD	Seq (a)	SD	Gl (b)	SD
128	0.771	0.207 8	0.228	0.207 8	0.671	0.209 7	0.336	0.220 4	0.844	0.158 1	0.160 1	0.159 9	0.555	0.193 6	0.193	0.445

Table 2: Student's grade

Variable	Frequency	Percentage	Variable	Frequency	Percentage
Excellent	0	0.0	Weak	40	19.2
Good	2	1.0	Failed	32	15.4

Table 3: differences between learners and cognitive

			Cognitive mastery	
Dimension	Type of learner	Cognitive	Elements	Significant
Processing	Active	Significant in knowledge and skills but not significant in problem solving	Knowledge	X
			Skills	X
			Problem solving	√
Perception	Sensing		Knowledge	X
			Skills	√
			Problem solving	X
Input	Visual		Knowledge	X
			Skills	√
			Problem solving	√
Understanding	Sequential		Knowledge	√
			Skills	√
			Problem solving	X

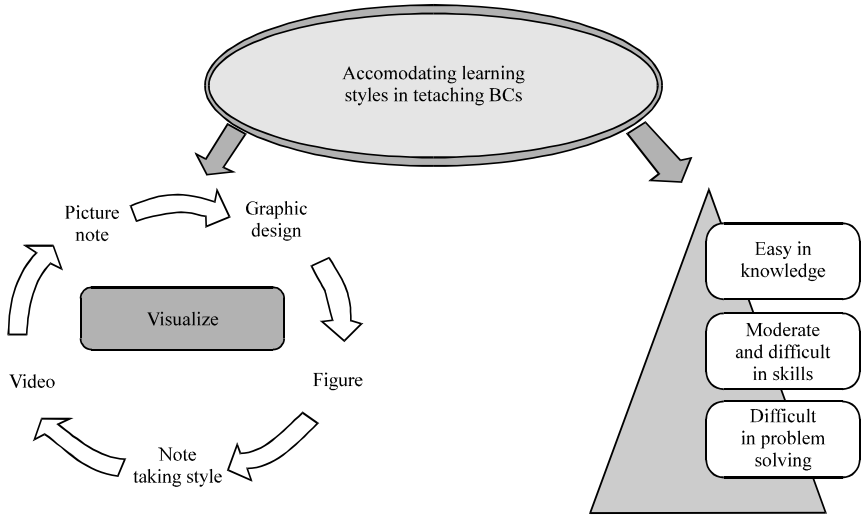

Fig. 2: Accommodating learning styles and cognitive

The focused factors are how teachers accommodate LS in their teaching and student's ability in cognitive learning building construction subject was selected. This study focused on exploring type of learners found among VE students in BCC from three different VS as well as the differences between the learning types. The result of this study indicated that the input dimension represented the dimension of BCC student learning styles. The findings also showed that vocational students tend to be visual learners and they best learn from visual displays such as diagrams, illustrated textbooks, overhead transparencies, power point presentations, videos and handouts. Visual learners learn through seeing, enjoy visual stimulation, usually take detailed notes to absorb the information can get the benefits from illustrations and presentation that use color and they try to find something to watch if they are bored. Figure 2 shows overall teachers opinion based on interview. Teachers are prefer to teach in visualize method including preparing their own module (not provided by Ministry of Education) and they also agree with students ability in cognitive so researcher concluded with pyramid figure because it showed the level of difficulty. Teacher should aware how to combine student's LS with the concept of learning to achieve learning goal (Mohamad *et al*., 2014).

Research suggested the framework based on cognitive and student's learning styles. The concept of framework proposed because learning framework provides the overall parameters, conditions and support for various learning and teaching styles, information-seeking behaviors and multiple intelligence approaches to learning in any type of classroom or learning environment (Kuchi *et al*., 2003). Research find out most students in are visual learner and there have differences in skills and problem solving on cognitive learning. A visual's characteristics used skills related to demonstrate with diagrams, pictures or charts to certain topic where the skills needed. A visual type also can assist student in the difficult part of problem solving. The problem solving usually need students produced some ideas to overcome the problem. Refer to the test given the land slide situation was given measure the how student solve the problem. A visual's characteristics are very useful to help students write the procedure systematically. They can use the picture and video with their experienced to explain how.

Research proposed: Cognitive-Learning Style Framework (C-LSF) as shown in Fig. 3 to assist students how they should learn and also can be applied to other subjects to enhance their academic achievement. Students and teachers should use visual type of learning in skills element because skills element in this research refer to application and evaluation level from Bloom *et al*. (1956), apply and evaluate from Anderson *et al*. (2001). Teachers can use all the methods in visual characteristic and students can apply how to learn based on drawing picture, diagrams or charts when the self-learning. Skills elements in BCS need to use learned material in new situation of learning. It includes the application of such things as concepts, methods and theory to solve the problem. Practical is essential in this level, therefore apply the visual methods of learning are more effective when students learn in skills for cognitive learning. The subject selected also contained the hands-on task, thus students need to understand the whole procedure of the task given and present in writing in very good technique. These will be identified in their examination to master the highest

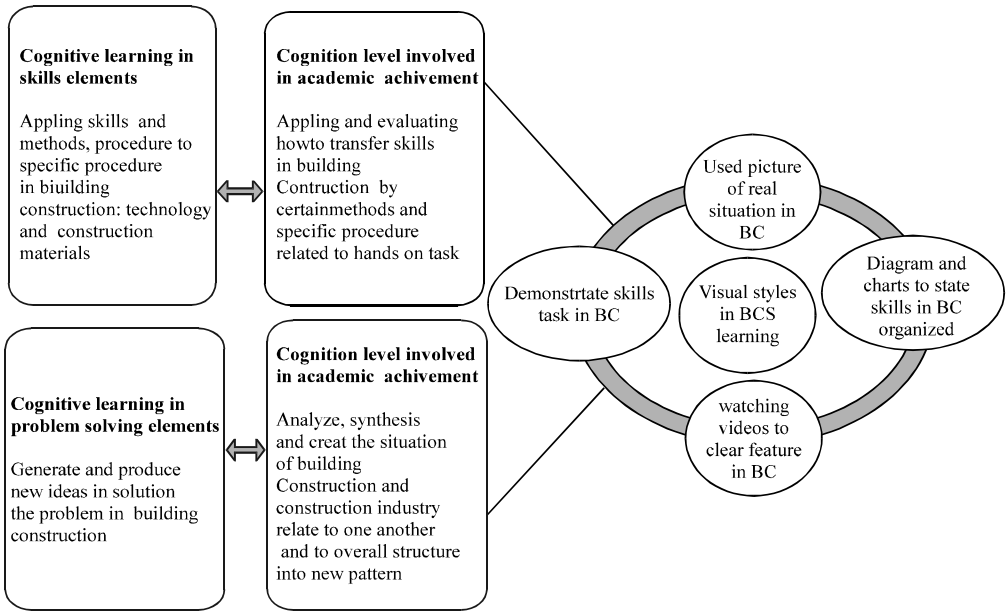

Fig. 3: Cognitive-learning style framework

level of cognitive learning. At this level students tend to consolidate their thinking and become receptive to other points of view. Cognitive learning in skills need student to fulfill the criteria of how to applying skills in building construction and what is the methods used, know the procedure how to apply skills either specific procedure or general procedure and they also need to apply skills through strategic work plan. Therefore, skills is needed because of vocational students also prepare themselves to world of research. They need vocational skills in specialized job related. In order to complete the learning objectives in BCS, skills also require that students know and understand how they can perform a practical task according the procedure given. As a result visual characteristic may help students to understand their skills level and teachers to deliver the content more effective. The basic step hands-on task is demonstration; this method will be successful when teachers can combine with videos and hands-out contained picture and charts.

Problem solving in vocational subject is the way to relate classroom learning to real life situation or problem. Therefore researcher recommended how visual characteristic will capable to master the problem-solving element. Problem solving in cognitive learning is how to generate and produce new ideas in solution the problem or situation. The level of cognitive in problem solving consists; analyze, synthesis and create. This level of cognitive include the factors of demonstrate, planning, interrelatedness, sketching, manipulating idea, generate idea, design, combine, application, preparing report, producing project and inventing product as recommended by taxonomies. This element is the highest level of cognitive thus student's need a good method to learn at the same time teachers need the angle how to provide the meaningful method of teaching. The synthesis part in Bloom *et al.* (1956) require to put ideas together to form something new using generalize and reconstruct something even as analyze and create part proposed from Anderson *et al.* (2001) it need to break material into constituent parts and determine how parts relate to one another and to an overall structure purpose. It is also need put elements together to form coherent or functional whole, recognize elements into a new pattern or structure. Therefore, visual criteria will support students and teachers to understand the problem solving elements and students will master the difficult part in cognitive learning.

This study has concluded that vocational students have their own characteristics and preferences in learning. They tend to be visual learners and capable of using the knowledge elements in cognitive learning. However, they struggle to master skills and problem solving abilities as evidenced by their marks from the questionnaires. The clear indication is student need to think however the thinking task is not easy and its need tools or guided by teacher to help students understand the learning content (Yee *et al.*, 2013). C-LSF will be the best guideline in Vocational education as it will improve learning in all elements of cognitive learning and it is a reasonable approach for tackling student weak. The results from this

study added to teachers and student understanding of learning styles and the elements of vocational education especially in building construction courses. The components proposed in C-LSF showed how the variables investigated in this study are meaningful and substantiated the conceptual framework in this study.

CONCLUSION

In conclusion, the research proposed that the Cognitive Learning Styles Framework (C-LSF) could act as a guideline for teachers to facilitate students to learn more effectively and to boost the academic achievement.

REFERENCES

Adesoji, F.A. and S.M. Olatunbosun, 2008. Student, teacher and school environment factors as determinants of achievement in senior secondary school chemistry in Oyo State, Nigeria. J. Int. Soc. Res., 1: 13-34.

Anderson, L.W., D.R. Krathwohl and B.S. Bloom, 2001. A Taxonomy for Learning, Teaching and Assessing: A Revision of Blooms Taxonomy of Educational Objectives. Allyn & Bacon, Boston, Massachusetts.

Bloom, B.S., M.D. Engelhart, E.J. Furst, W.H. Hill and D.R. Krathwohl, 1956. A Taxonomy of Educational Objectives: Handbook 1, The Cognitive Domain. Longmans Green, New York.

Felder, R.M. and B.A. Soloman, 1997. Index of Learning Styles Questionnaire. North Carolina State University, Raleigh, North Carolina.

Felder, R.M. and J. Spurlin, 2005. Applications, reliability and validity of the index of learning styles. Int. J. Eng. Educ., 21: 103-112.

Felder, R.M. and L.K. Silverman, 1988. Learning and teaching styles in engineering education. Eng. Educ., 78: 674-681.

Felder, R.M. and R. Brent, 2005. Understanding student differences. J. Eng. Educ., 94: 57-72.

Felder, R.M., 1993. Reaching the second tier learning and teaching styles in college science education. J. Coll. Sci. Teac., 22: 286-290.

Felder, R.M., D.R. Woods, J.E. Stice and A. Rugarcia, 2000. The future of engineering education II. Teach. Methods Work Chem. Eng. Educ., 34: 26-39.

Kuchi, R., R. Gardner and R. Tipton, 2003. A Learning Framework for Information Literacy and Library Instruction Programs at Rutgers University Libraries. Rutgers University Libraries, Newark, New Jersey.

Martins F., P.A. Brai and I.A. Adenji, 2007. Class factors as determinants of secondary school student's academic performance in Oyo State. J. Soc. Sci., 14: 243-247.

Mohamad, M.M.B., Y.M. Heong and T.T. Kiong, 2014. Conceptions of learning through learning styles and cognitive dimension in vocational education. J. Tech. Educ. Training, 6: 32-41.

Sabine, G., R.V. Silvia and L. Tommaso, 2007. In-depth analysis of felder-silverman learning styles dimensions. J. Res. Technol. Educ., 40: 79-93.

Thomas, R.G., 1992. Cognitive theory-based teaching and learning in vocational education. P.hD Thesis, University of Minnesota, Saint Paul, Minnesota. https://eric.ed.gov/?id=ED345109

Tsvigu, C., 2007. Students experiences, learning styles and understanding of certain calculus concepts: A case of distance learning at the Zimbabwe Open University. P.hD Thesis, University of the Western Cape, Pretoria, South Africa, http://etd.uwc.ac.za /xmlui/handle/11394/2433.

Yee, M.H, M.J. Yunos, R. Hassan, M.M. Mohamad and W. Othman *et al*., 2013. Contributing factors towards difficulties in generating ideas among technical students. J. Tech. Educ. Training, 5: 14-27.