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Disparity of Learning Styles and Cognitive Abilities in Vocational Education

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***Abstract*—**This study is conducted to investigate the disparity of between learning styles and cognitive abilities specifically in Vocational Education. Felder and Silverman Learning Styles Model (FSLSM) was applied to measure the students' learning styles while the content in Building Construction Subject consists; knowledge, skills and problem solving were taken into account in constructing the elements of cognitive abilities. There are four dimension of learning styles proposed by Felder and Silverman intended to capture student learning preferences with regards to processing either active or reflective, perception based on sensing or intuitive, input of information used visual or verbal and understanding information represent with sequential or global learner. The study discovered students are tending to be visual learners and each type of learner having significant difference whereas cognitive abilities. The finding may help teachers to facilitate students more effectively and to boost the student's cognitive abilities.

***Keywords*—**Learning Styles, Cognitive Abilities, Dimension of Learning Styles, Learning Preferences.

I. Introduction

THE cognitive process that contribute to student learning require that the student have the ability to manipulate information and ideas to solve problems and produce new knowledge. Many features of current cognitive theories on teaching and learning reflect earlier models of teaching such as Bruner's, Taba's, and various group-based and student-centered teaching models [1]. 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 VE requirements in a global context, and the demands of cognitive development [2] and cognitive research, summarized that learning does not automatically change and that understanding the learning content is difficult. Cognitive processes are not encouraged by passive learning.

VE students have their own learning preferences, considering they rely less on their cognitive abilities and more on their psychomotor talents, including physical movement, coordination, and use of motor skills [3]. They need to increase their cognitive abilities with a suitable approach so that they can be creative and innovative workers in order to do well in their work situation. The suitable approach in this case is perhaps the identification of the students' learning styles that equal to VE characteristics to produce suggestions on overcoming the problems. [4] Also states that the ability of students to learn basic principles and their ability to apply knowledge or explained what they learned.

A student's learning is influenced by a few factors. The basic issues of student learning as explored from group of researchers [5] including home background, learning environment, and government policies [6]. Another research indicates that family background factors determined academic performance [5] and [7] Azizi claimed that learning styles influenced a student's academic performance. Francis and Segun [8] 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 [1]. 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 maintain that adapting classroom teaching methods to suit students' preferred styles of learning improves the educative process [9]. However, opponents of learning style theories maintain that little empirical evidence is to support this proposition LS involved strategies that students tend to apply to a given teaching situation. Each individual can fit different styles that can result in students adopting attitudes and behaviors that are repeated in different situations.

II. Problem of Statement

The learning process is an interaction between students, teachers, and teaching materials. The emphasis should always be on the process of student learning. Ideally, the way teachers teach should match the way students learn. Teachers should be concerned with the students' learning styles. Learning styles have a descriptive range, from the relatively fixed natural disposition of the student to the modifiable preferences for learning and studying. Learning styles are a component of the wider concept of personality. Since LS plays such a critical role in the learning process, teachers should not neglect to address how to relate the learning styles

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into the teaching and learning process, especially with how these factors can contribute the students' achievement. Building Construction Course (BCC) is one of the vocational courses offered in certain Vocational School in Malaysia. It encompasses many areas of study for the Building Construction (BC) Industries, such as masonry, carpentry, plumbing, painting, and all areas related to building construction. Students learn both theory and practical skills in BC. The question is, how can they learn to become more effective in the theory portion of their classes if the typical vocational student prefers to learn by doing and practicing?

Vocational students must adapt their skills and knowledge to their lessons. They must develop the ability to solve problems and produce new ideas to prepare themselves for actual work situations. The factor of the student's learning styles and their academic achievements through cognitive learning were investigated in this study based on the issues concerning a student's weakness in examination analysis and related studies. The analysis of students' achievements, within few years back, showed a notable number of students who scored in grade 8E and 9G yearly. This study explores the possibility that one of the factors contributing to this is the students' learning styles. A few factors were investigated to identify how students in BCC use their LS and academic achievements through cognitive learning. This study was based on the body of existing knowledge on LS and their importance for both students and teachers. This study provided meaningful suggestions on overcoming the problem regarding LS for BCC students, which can be adapted to suit their cognitive learning needs to promote problem solving and generate new ideas, thereby increasing the students' academic achievements.

A. Research Objectives

i. To identify the learning styles of Building Construction students.
ii. To identify the students' perception of their own cognitive abilities in Building Construction.
iii. To determine the cognitive abilities of students in Building Construction.
iv. To analyze the differences between Felder–Silverman Learning Styles dimensions and the mastery in cognitive abilities of Building Construction students.

III. Research Methods

This study applied quantitative research which the researcher decided what to study; ask specific, narrow questions; collect quantifiable data from participants; analyzes these numbers using statistic and conduct the inquiry in unbiased, objective manner [10]. The Index of Learning Style proposed by Felder Solomon [11] and questionnaires developed by researcher were used in this study. Validity and reliability of the instruments were made through pilot studies have proven based on constructing validity and expertise judgments. There are 128 BCC students are involved as respondents in this study. The selections of schools are based on certain criteria of teachers who involved in important role of BCC curriculum at ministry level. Various techniques for analyzing the data collected from three Vocational Schools were used. The methods of parametric and non-parametric and involved the descriptive and inference statistics. The tests applied were Kruskall-Wallis H, descriptive analysis Chi-Square Test and Multivariate Analysis of Variance Test (MANOVA). A descriptive statistical analysis of related decisions about the samples from the study were discussed and followed by the results of the inferential statistical analysis used to determine relationship between variables.

IV. Results

A. To Identify the Learning Styles of Building Construction Students

ILS was given to 128 BCC students from three Vocational Schools in Johore. The method of analysis applied from Sabine [12] used descriptive statistics to discover the distribution for each dimension of FSLSM. This model defined learning styles as the characteristic strengths and preferences for taking take in and processing information [13], [14]. The processing dimension is active and reflective attributes, the perception dimension refers to sensing and intuitive, the input dimension contains the visual and verbal styles and understanding dimension includes sequential and global preferences. Table I summarizes the dimension of ILS represented by mean. The description in Table I shows that the BCC students tended to be visual (Vis) learners with a mean score .844, followed by active (Ac) learners (.771 mean score), sensing (Sen) with a mean score of .671 and sequential (Seq) learners with a mean score of .555. The other learning styles are as follows; reflective (Rf) (mean score .228), intuitive (Int) (mean score .336,), Verbal (Ver) (mean score .161), and global (Gl) learners (mean score .193). The findings also define the types of learners who would choose the first answer on the ILS.

TABLE I
DIMENSION OF ILS

N	**PROCESSING**				**PERCEPTION**			
128	AC (A)	SD	RF (B)	SD	SEN (A)	SD	INT (B)	SD
	.771	.2078	.228	.2078	.671	.2097	.336	.2204
	INPUT				UNDERSTANDING			
128	VIS (A)	SD	VER (B)	SD	SEQ (A)	SD	GL (B)	SD
	.844	.1581	.161	.1599	.555	.1936	.193	.445

B. To Identify the Students' Perception of Their Own Cognitive Abilities in Building Construction

The items in questionnaires were developed based on three variable; knowledge, skills and problem solving ability to identify students' understanding of their own cognitive learning. The questions on the questionnaire were constructed using the subject specific matter and decisive test schedules from both of the modules in Building Construction; Building Technology and Construction Material. The Kruskal-Wallis H Test was chosen to analyze the data and identify students' perception, and how influenced with the three cognitive

dimensions in BC. The questionnaire developed by likert scale which is a nominal scale and the non-parametric test was used. The Kruskal-Wallis H Test is a one way ANOVA except this test was used with ordinal data and was used to measure the difference between three or more data types in the same sample. Table II explains the results of the Kruskal-Wallis test and shows the significant results of three variables. It is shows that there was a significant difference between group of students and knowledge [$\chi^2(2,N=128) = 8.030$, $p<.05$] and group of students and skills [$\chi^2(2,N=128) = 7.101$, $p<.05$]. However, the was no significant difference between group of students and problem solving abilities [$\chi^2(2,N=128) = 2.358$, $p>.05$].

TABLE II
KRUSKAL-WALLIS TEST STATISTICS

	KNOWLEDGE	SKILLS	PROBLEM SOLVING
Chi-Square	8.030	7.101	2.358
Df	2	2	2
Asymp. Sig.	.018	.029	.308

a. Kruskal Wallis Test
b. Grouping Variable: School

C. To Determine the Cognitive Abilities of Students in Building Construction

To determine that students could develop their cognitive abilities in Building Construction Subjects, the achievement test was given to the 128 students. The test contained the questions focused on the cognitive dimensions in Building Construction; knowledge, skills and problem solving ability. The structure of the questions reflected standard examination questions so that they would be familiar to the students. The mark distribution was based on the level of difficulty for the questions and taxonomy requirements. Table III presents the mark distribution for the achievement test. The grade system refers to criterion-referenced tests and teachers must identify their students' current skill level and their ability to achieve the learning objectives.

TABLE III
STUDENTS' MARKS IN ACHIEVEMENT TEST

	FREQUENCIES	PERCENTAGES
Excellent	0	0
Good	2	1.0
Medium	54	26.0
Weak	40	19.2
Failed	32	15.4
Total	128	61.5

D.To Analyze the Differences between Felder–Silverman Learning Styles Dimensions and the Mastery in Cognitive Abilities of Building Construction Students

An analysis of the results for research question (v) used Multivariate Analysis of Variance (MANOVA) which is a complex statistic similar to ANOVA but the multiple dependent variables are analyzed together [15]. In MANOVA, independent variables are the factor. In this study, the factors were the learning styles and dependent variables were the BC cognitive dimensions. The current of quantitative findings add substantially to understanding students' learning styles especially in vocational education. Table IV shows the summary of quantitative analysis based on descriptive and MANOVA 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 tending to be visual learner; 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 (X) not significant.

TABLE IV
MANOVA SUMMARY

TYPE OF LEARNER	DIFFERENCES OF LEARNER	COGNITIVE PERCEPTION	COGNITIVE ABILITIES ELEMENTS	
ACTIVE	Each type of learner having significant difference	Significant in knowledge and skills but not significant in problem solving	Knowledge	X
			Skills	X
			Problem Solving	√
SENSING			Knowledge	X
			Skills	√
			Problem Solving	X
VISUAL			Knowledge	X
			Skills	√
			Problem Solving	√
SEQUENTIAL			Knowledge	√
			Skills	√
			Problem Solving	X

V. CONCLUSION AND DISCUSSIONS

This study identified the differences between cognitive abilities and type of learner. Cognitive abilities were classified into knowledge, skills and problem solving ability based on the BCS curriculum and taxonomy structure. The result showed there was no significant difference between active learners and knowledge and skills, but that there was a significant difference when in the problem solving abilities if active learners were assessed. One possible explanation for the problem solving results mentioned above is that the knowledge is as the ability to retrieve information by remembering or recalling ideas. It is easy for student to show their knowledge; this explanation was consistent with the new taxonomy by Anderson and Kratwohl [16]. That described the first level of the processing dimension is retrieval.

Research finding also showed active learner is not significant differences in skills cognitive mastery. "Skills" in this study refers to how student can apply theory into practical task in workshop. In the skills element BCC students solved the questions with quite similar solution because they did the same task in practical work then the procedure given by teachers with the same instruction. Skills are important because to refer the individual development and especially in vocational education.

The next elements in cognitive abilities investigated is problem solving. The inferential statistic showed there is

significant difference between active learners with problem solving ability element in cognitive mastery. Problem solving can differentiate creativity of students handle the problem situation in building construction. Problem solving ability in is derived from what is student's ability to overcome the problem given then produce some solution such as new idea. Another possible explanation in this situation it, the problem solving teaching method requires teachers to engages various styles so that students will mastery this element. Teacher should more creative to teach problem solving. Garon and Cano [17] found that student-teachers devoted less than 20% of instructional time to problem solving. Cano and Martinez [18] also suggested that cognitive abilities are important to educators and can be used to challenge students to develop a higher level of critical thinking.

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 results from this study added to teachers and student understanding of learning styles and the elements of Building Construction Courses.

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