LEARNING STYLES AND ACADEMIC ACHIEVEMENT AMONG BUILDING CONSTRUCTION STUDENTS

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To my beloved son, mother, father and sisters

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Thank you ALLAH for giving me strength, good health and guiding me through the PhD journey

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ABSTRACT

This study is conducted to identify how learning styles (LS) influence the students' academic achievement based on cognitive mastery and vocational elements in Building Construction Subject (BCS) involving the students and teachers of Building Construction Course (BCC) from three secondary vocational schools in Johor. 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. 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 quantitative data was analyzed in descriptive and inferential statistic involving parametric test; Chi Square and *Multivariate Analysis of Variance* (MANOVA). Kruskal-Wallis was used for non-parametric test for this study. The content analysis for interview was managed to analyze the narrative text from interview record. The study discovered that students in BCC 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. Research findings suggested a few framework of learning styles with vocational elements in BCS and concluded the need for a framework based on the dominant students' learning style through the cognitive mastery and vocational elements. 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 in Building Construction Subject.

ABSTRAK

Kajian ini dijalankan untuk mengenal pasti bagaimana gaya pembelajaran mempengaruhi pencapaian akademik pelajar yang berasaskan kepada penguasaan elemen kognitif dan vokasional dalam mata pelajaran Binaan Bangunan bagi pelajar-pelajar dan guru-guru Kursus Binaan Bangunan di tiga buah Sekolah Menengah Vokasional di Johor. Reka bentuk kajian kes deskriptif dijalankan dengan menggunakan pendekatan kuantitatif dan temu bual semi-struktur sebagai komponen sokongan telah diaplikasikan dalam kajian ini. Model Gaya Pembelajaran Felder-Silverman, Indeks Gaya Pembelajaran Felder-Soloman dan elemen kognitif dan vokasional yang merangkumi pengetahuan, kemahiran dan penyelesaian masalah dalam mata pelajaran Binaan Bangunan digunakan untuk menghasilkan soal selidik. Teknik persampelan bertujuan digunakan dalam pemilihan sekolah-sekolah yang terlibat dan persampelan rawak berlapis dalam pemilihan 128 pelajar sebagai responden kajian manakala persampelan bertujuan juga digunakan dalam temu bual guru-guru. Data-data kuantitatif telah dianalisa secara deskriptif dan inferensi melibatkan ujian parametrik seperti Ujian Khi Kuasa Dua dan *Multivariate Analysis of Variance* (MANOVA) manakala ujian bukan parametrik menggunakan Kurskal-Wallis. Analisa kandungan telah digunakan untuk menganalisis teks naratif yang mewakili yang mewakili rekod sebenar temu bual. Kajian mendapati pelajar-pelajar Kursus Binaan Bangunan adalah cenderung kepada pendekatan gaya pembelajaran visual. Gaya pembelajaran visual ini mewakili dimensi input dalam Model Gaya Pembelajaran Felder-Silverman dan hasil kajian menunjukkan terdapat perbezaan signifikan dalam kemahiran dan penyelesaian masalah tetapi tidak terdapat perbezaan signifikan dalam pengetahuan. Hasil temu bual dengan guru merumuskan guru menyesuaikan gaya pembelajaran pelajar dengan penguasaan aras kesukaran kognitif melalui pendekatan visual bagi meningkatkan pencapaian akademik pelajar. Hasil daripada kajian, beberapa kerangka mengenai gaya pembelajaran dan penguasaan pelajar terhadap elemen-elemen vokasional dalam mata pelajaran Binaan Bangunan dicadangkan dan seterusnya satu kerangka yang berasaskan gaya pembelajaran paling dominan pelajar melalui penguasaan elemen kognitif dan vokasional dirumuskan. Kajian telah mencadangkan *Cognitive Learning Styles Framework* (*C*-LSF) sebagai panduan bagi guru dan pelajar bagi meningkatkan pencapaian akademik dalam mata pelajaran Binaan Bangunan.

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LIST OF ABBREVIATIONS

AC	-	Abstract Conceptualization
AE	-	Active Experimentation
ASSIST	-	Approaches and Study Skills Inventory for Students
BC	-	Building Construction
BCC	-	Building Construction Course
BCI	-	Building Construction Industry
BCS	-	Building Construction Subject
CDC	-	Curriculum Development Center
CE	-	Concrete Experience
C-LSF	-	Cognitive Learning Style Framework
CMAT	-	Cognitive Mastery Achievement Test
ELM	-	Experiential Learning Style Model
FSLSM	-	Felder Silverman Learning Style Model
ILS	-	Index of Learning Styles
LS	-	Learning Styles
LSQ	-	Learning Styles Questionnaires
MANOVA	-	Multivariate Analysis of Variance
MBTI	-	Myer-Briggs Type Indicator
MOE	-	Ministry of Education
PLSPQ	-	Perceptual Learning Styles Questionnaire
RO	-	Reflective Observation
SPM	-	Sijil Pelajaran Malaysia
TVE	-	Technical Vocational Education
TVED	-	Technical and Vocational Education Division
VAKT	-	Visual, Auditory, Kinesthetic and Tactile
VE	-	Vocational Education

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Every year, the Malaysian Government spends a great deal of money on the improvement of the quality of education. Education is an expensive investment in the future of students, and much emphasis is placed on the curriculum and values of education to enable the students to meet the needs of the industry. Teaching and learning is the root of all advancement in all levels of education, namely, primary, secondary, college, and university. The difference between the levels is the level of difficulty that students face. The Taxonomy of Educational Objectives by Bloom (1956) classified learning into three major areas; cognitive, affective, and psychomotor.

The cognitive domain and level stated in educational settings help teachers understand and implement what they need to achieve in their teaching objectives. The structure of Bloom's Taxonomy contains knowledge, comprehension, application, analysis, synthesis, and evaluation. Anderson and Karthwolh (2001) revised Bloom's Taxonomy and changed the original number of categories by introducing the Four-Knowledge Dimension of Taxonomy: factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge. Splitter (1995), Caviglioli et al. (2004), and Tee et al. (2009), suggested that all educators should provide students with multiple skills and for teachers to cater their learning abilities with various teaching methods. Teachers, however, cannot assume that students will easily understand the learning content when they only sit in class and follow instructions. An

awareness of the interaction between students, teachers, and teaching materials must also be present.

Student learning is often taken for granted. Students are assumed academically capable of understanding lessons and assignments. The majority of them do pass, but for those who fail, the blame falls on the academic standards or teaching methods. Little consideration is given to the ways that students learn and the students' learning styles. Ideally, the way teachers teach should match the way students learn, as well as how they prefer to learn. Teachers must adapt their teaching approaches to suit the ways students learn and their learning styles.

The elements of learning styles (LS) appeared in the research literature as early as 1892 (Fatt, 2000). The term "learning styles" was probably first used by Thelen (Madeline et. al, 2003) who discovered group dynamics at work. LS may also be defined as the tendency to adopt a particular strategy of learning. Teachers, then, should have the ability to understand how students learn. According to Felder (1993), students and teachers may prefer one learning style in one subject but generally prefer one style for most subjects that they learn or teach. Therefore, teachers may use this information from Felder (1993) to make sure they utilize all different learning styles, and students can use this information by realizing how they like to receive information.

Schools, institutions, colleges, and universities should adopt a theory of learning based on the classroom approach. Various learning theories exist, and caution should be exercised during selection. The learning theories should suit the subjects' needs, such as cognitivism, behaviorism, and constructivism theories. The quality of teaching is measured by how effectively the learning approach the teacher selected functions to achieve the learning objectives in a particular subject. However, considering teachers usually do not know which approach will be the most effective, the measurement of a teacher's success is left to the students (Benke and Hermanson, 1988). The relationship between the teaching approach used and what the students learned, can be seen as a process where a teacher's beliefs will influence their teaching strategies, which will in turn influence student learning styles. A student's learning style represents the type of learner they become. Several inventories that can

identify what type of learner a student may be have been published. In a classroom where only one approach to learning is encouraged by a teacher, some students may possibly work and learn less effectively than others (Alan, 2009). For this reason, an awareness of learning styles is important for teachers.

Students in vocational education (VE) are exposed to an educational system that is oriented more towards getting a job, and their learning styles are different from students in academic fields. Thus, VE is possibly an educational pursuit oriented to provide the necessary knowledge and skills to perform a particular job, occupation, or professional activity in the labor market (International Labour Organization, 1995). VE is also connected to technology transfer, innovation, and development. In vocational teaching, as in many knowledge areas, identifying and understanding learner differences to adapt the institute's needs to best suit the learning conditions and aptitudes of the students is important. The need to adapt teaching strategies to student learning styles and preferences is a reality in the classroom, which can be observed in real situations or in virtual approaches. However, these findings do not suggest that individual methods should be created for each student in a classroom. The best form of interaction for each of them should be identified by building groups of learners with common characteristics (Luciana et al., 2008).

1.2 Background of the Problem

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. 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 (Ruth, 1992). In 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 (Tee et al., 2009). In their cognitive research, Johnson and Thomas (1992) summarized that

learning does not automatically change and that understanding the learning content is difficult. Cognitive processes are not encouraged by passive learning.

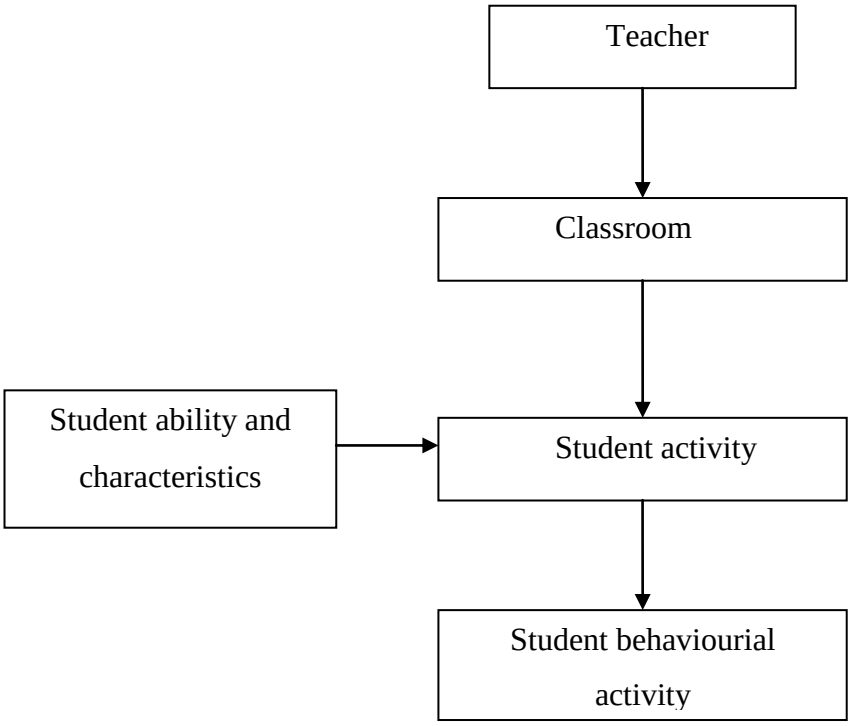
VE students have their own learning preferences, considering they rely less on their cognitive abilities and more on their psychomotor talents, including physical movement, coordination, and use of motor skills (Bloom, 1956). They need to increase their cognitive abilities with a suitable approach so 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. Bloom (1989) 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 by Muhammed et al. (2008) include home background, learning environment, and government policies. Martins et al. (2007) stated that family background factors determined academic performance, and Azizi et al. (2003) claimed that learning styles influenced a student's academic performance. Francis and Segun (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 (Ruth, 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 maintain that adapting classroom teaching methods to suit students' 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 this proposition 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.

1.2.1 Identifying Learning Styles

Learning styles can be classified into various categories, for example, sensory, auditory, visual, and tactile. Dunn and Dunn (1992) reported that learning styles is an individual reaction to several environmental, emotional, psychological, and sociological factors. In vocational schools, the VE students have their own characteristics, according to Brennan (2003). They are verbal learners who watch and see rather than read and listen. They are hands-on and learn by doing and practicing. They learn in groups and are dependent learners who need instructor guidance for clear understanding. Considering that the characteristics of students in VE are more hands-on, and that they learn by doing, an understanding of this type of LS will help teachers provide a teaching delivery method that matches their students' needs.

"Students' needs" is a term described by Posner et.al (1992) as a description of how students deal with curricular tasks by employing relevant learning structures. The goal in teaching VE students is to gain experience and to apply existing knowledge to new situations. The role of the teacher is to create learning environments for students handling the presented tasks. Figure 1.1 shows how a VE student's learning ability is influenced by various factors (John, 1995).



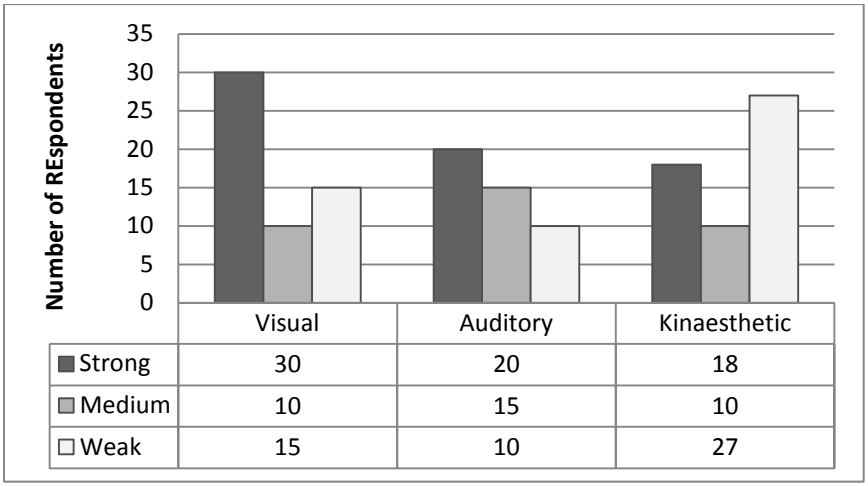
(Source: John, 1995)

Figure 1.1 : Adapting to students learning

VE encompasses a wide range of courses or skills that help students prepare to enter an occupational-based employment or workplace (International Labour Organization, 2000). The concept behind VE is to bridge theory and practical components, such as lab- and workshop-oriented knowledge to workplace knowledge, with specific skills. As a result, vocational students have their own LS. In here research on learning strategies among vocational students, Briggs (2000) concluded that vocational students benefited from three types of courses, namely, "hands-on courses," "mixed-courses," and "paper-based courses." She also classified the analysis of LS into visual, auditory, and kinesthetic (VAK) to create a basis for innovation in teaching and learning strategies.

A visual style relies on seeing and reading, auditory depends on listening and speaking, and a kinesthetic style focuses on touching and doing. Figure 1.2 shows the use of LS in hands-on courses. Hands-on courses refer to hairdressing, plumbing, professional craft catering, and painting. This group showed that their preference was for visual strategies. The figure illustrated three categories of students' score as

indicating strong, medium, and weak use of visual, auditory, and kinesthetic learning style strategies. The results show that the students most preferred visual learning strategies The results show that the highest number of students scored in visual strategies. This means that the students scored strongly in a range of visual strategies. Meanwhile, 20 students strongly used auditory learning strategies, and only 18 students strongly applied the kinesthetic approach to learning.

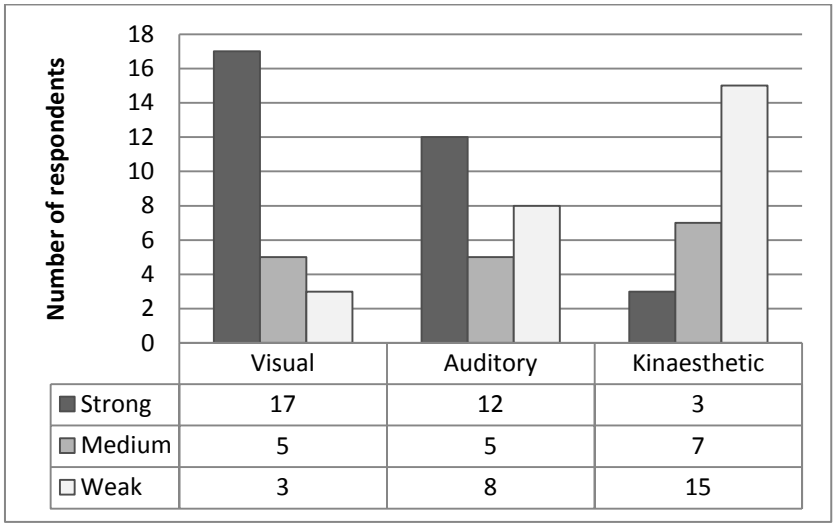


	Visual	Auditory	Kinaesthetic
Strong	30	20	18
Medium	10	15	10
Weak	15	10	27

(Source: Briggs,2000)

Figure 1.2: Students' Learning Styles in Hands-on Courses

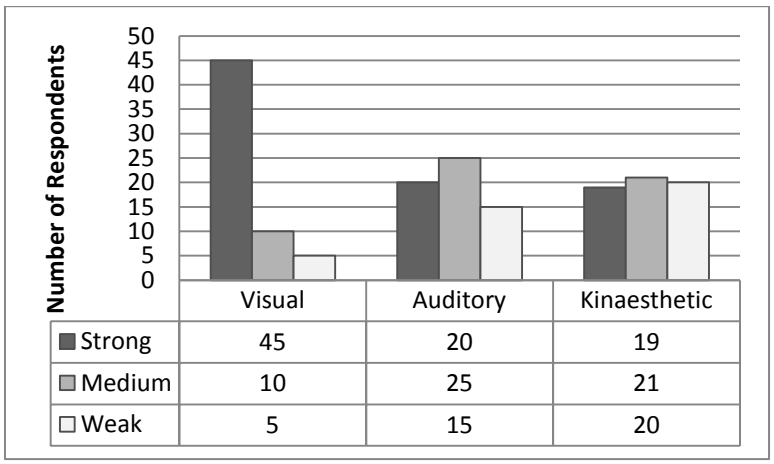
Briggs (2000) used the same method of using learning strategies for "mixed" courses. Mixed courses refer to courses that involve a mixture of paper-based and hands-on materials. Mixed courses represent the course related to engineering education and performing arts. The result showed that this group preferred visual strategies the most and kinesthetic strategies the least. Figure 1.3 shows that the students preferred visual learning styles (17 students) over both auditory (12 students) and kinesthetic styles (3 students).



(Source: Briggs,2000)

Figure 1.3: Students' Learning Styles in Mixed Courses

Figure 1.4 shows the profiles of LS for students in a paper-based course. The students investigated were involved in business, public service, and health science courses. The results showed a strong use of visual strategies among students in "paper-based" courses. Forty-five students preferred visual study approaches, 20 who preferred auditory, and 19 students who preferred kinesthetic. Generalizing course groups is difficult, even when they are aggregated. However, students in paper-based courses appeared to choose visual and auditory strategies more than students did in hands-on courses.



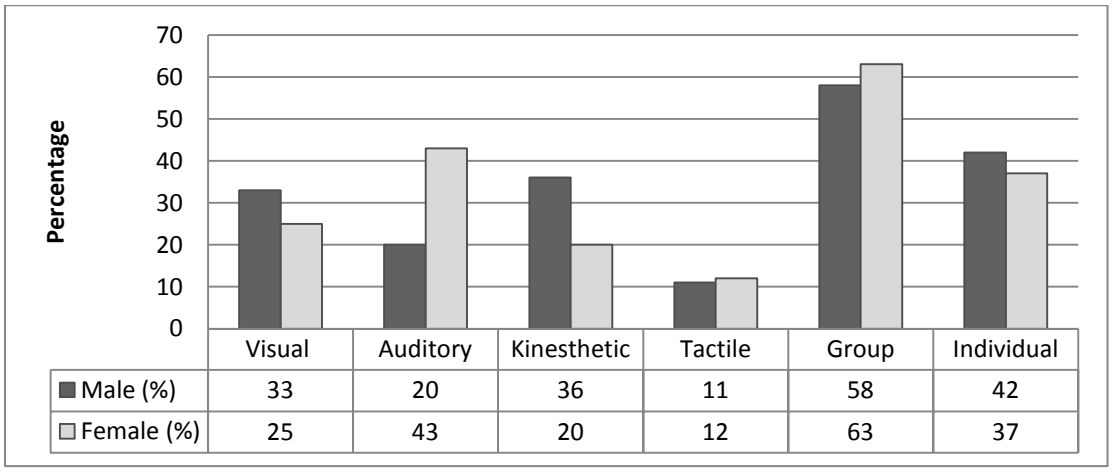
(Source: Briggs,2000)

Figure 1.4: Students' Learning Styles in Paper-Based Courses

The concept of LS is understood by VE teachers as a legitimate way of expressing individual differences in the way their students learn. However, the

fundamental concept of LS is and understanding of the characteristics and dimensions of various learning strategies. Research conducted by Peter (2003) indicated that understanding students' LS and preferences is very important for teachers. Peter also suggested an LS model among VE practitioners. A survey conducted by Muhammad et al. (2010) involved 48 pre-service Engineering teachers with a major in mechanical, electrical, or civil engineering to identify their learning styles. This study was designed to prepare students to become future teachers when they completed their degrees in Technical and Vocational Education. The pre-service teachers were students attending schools during their practicum. They taught engineering subjects containing both task theory and hands-on components. The characteristics of engineering education are similar to VE, meaning that the results could be used to represent how the pre-service teachers accommodated various learning styles and learning preferences. As future teachers, they needed to equip themselves with strong skills in behavioral, cognitive, and constructivist basics so that they will be able to accommodate students' learning styles.

The study used Perceptual Learning Styles Questionnaires (PLSPQ) distributed to 48 students, 20 males and 28 females. The results are illustrated in Figure 1.5, which shows that male students preferred visual (33%) and kinesthetic (36%) learning, whereas female students were more likely to be auditory learners (43%). Both female (63%) and male students (58%) liked to learn in groups.

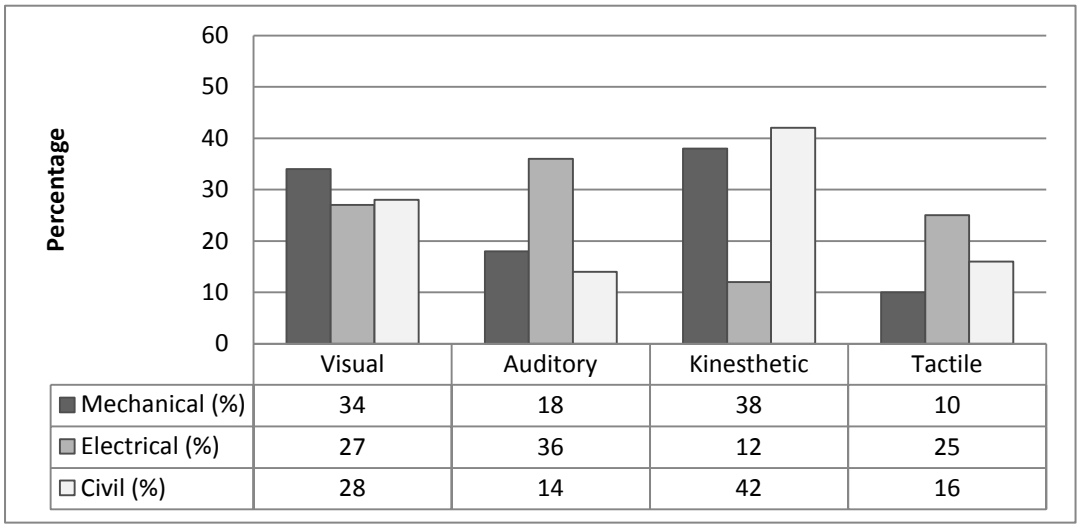


	Visual	Auditory	Kinesthetic	Tactile	Group	Individual
Male (%)	33	20	36	11	58	42
Female (%)	25	43	20	12	63	37

(Source: Muhammad, et.al, 2010

Figure 1.5: Pre-Service Teachers in Engineering Education Learning Styles

Figure 1.6 presents the results from the study based on the students' major. The results show that 38% of mechanical engineering students were kinesthetic learners, whereas 34% of them were visual learners. Electrical engineering students prefer auditory learning styles (36%) while civil engineering students scored the highest for kinesthetic learning style (42%).



	Visual	Auditory	Kinesthetic	Tactile
Mechanical (%)	34	18	38	10
Electrical (%)	27	36	12	25
Civil (%)	28	14	42	16

(Source: Muhammad, et.al, 2010)

Figure 1.6: Learning Styles among Major Subject

Auditory learners learn better in a lecture class and by listening to someone. Many students also like to learn by doing exercises and drills in class. This is one of the characteristics of a kinesthetic learner. Tactile learners are the rarest of the other learning preferences. However, most students were undecided regarding tactile learning styles. The dominant learning style of engineering pre-service teachers was visual, and these teachers were comfortable with pictures, images, and graphs while studying and retaining information. Muhammad et Al. (2010) also showed that, in terms of visual learning, the majority of students agreed that when learning a new skill, they would rather watch someone demonstrate the skill than listen to someone talk about the skill.

Richard and Stephen (1998) stated that two methods of assessing learning styles, self-reports and observed behavior, were used. Self-reports use the learning material preferred by the students. They will show whether a student's awareness is in line with that individual's actual performance." Observed behavior requires the

teachers to give the students information in a variety of ways and observe what version the student picks. Both these methods contribute in assessing the learning style of the student. They are, however, not without their problems. One way of improving learning performance is to adapt the mode of each student's style. Research is needed to find the most efficient ways of doing this (Richard and Stephen, 1998).

1.2.2 Student Learning

Meeting the students' needs requires the teacher to identify several aspects about the students' learning, such as the individual learner characteristics, learner characteristics within the wider community, learning processes within the learning environment, and learning process within the curriculum (Richard & Stephen, 1998; Jones & Charlton, 1998). In Malaysia, the focus is on the learning process within the curriculum. The school curriculum contains core subjects and elective subjects based on the students' achievements and choices. The secondary school system consists of academic, technical, vocational, Islamic, and private schools. Every school in Malaysia has a different curriculum. In vocational schools, two curriculums are used: vocational courses and skill-based courses. Vocational courses are based on a major field, such as Building Construction, Electronics, Machine Shop Practice, Welding, and Office Technology Management, to name a few. The curriculum is divided into 45% academic subjects and 55% vocational subjects (Curriculum Department of Technical and Vocational, 2003). This study focused on Building Construction Subjects (BCS) to investigate the factors needed for students' learning and students' learning styles.

The main subjects in BCS are theory and practical work, thereby placing the field under the mixed-course category of learning. Students study the theory of BC then apply it during practical work. According to the Curriculum Department of Technical and Vocational (2003), BC is an important skill in the construction industry. Early exposure is important for students who have an interest in construction

and have chosen it as their career path. BC is one of the vocational subjects in that students can choose to learn more about the construction process. Students' knowledge in both the theoretical and practical aspects is assessed. Some of the criteria evaluated in the main examination (Malaysian Examination Board 2003) were:

i) Knowledge and theory understanding

ii) Experience while doing the practical work – skills

iii) Application a situation to another new situation

iv) Creativity and problem solving ability will produce new idea

The Malaysian Examination Board (2003) reported that students lack the ability to solve problems in Parts C and D. Based on the results analysis for "Sijil Pelajaran Malaysia" (SPM), the subject, BC Technology, showed the lowest level of achievement. Table 1.1 shows the results for three schools in Southern Zone Peninsular Malaysia. A large number of failures (9G) was shown over the years.

Table 1.1: Result Analysis of 'Sijil Pelajaran Malaysia' in Building Construction Technology 2006-2009

SCHOOLS	YEAR	GRED PERCENTAGE (%)								
		1A	2A	3B	4B	5C	6C	7D	8E	9G
SCHOOL I	2006	0	0	0	1	3	1	5	6	11
	2007	0	0	1	0	3	4	10	3	8
	2008	0	0	1	1	4	4	10	3	8
	2009	0	1	2	3	7	2	7	4	7
SCHOOL II	2006	0	0	3	1	3	2	10	6	7
	2007	0	0	0	1	4	4	4	6	10
	2008	0	0	2	0	0	3	6	10	12
	2009	1	0	5	3	2	5	5	5	4
SCHOOL III	2006	0	0	0	0	4	7	6	10	16
	2007	0	0	0	1	4	7	5	7	16
	2008	0	0	0	0	0	2	4	9	17
	2009	0	3	1	1	2	6	3	10	5

(Source: Three Vocational Schools in Southern Zone,2010)

An analysis of school-based assessment in BC Modules using the modular system shows that a few students were able to obtain good scores in Parts C and D. Table 1.2 presents the school-based assessment analysis.

Table 1.2: Analysis of Students Achievement in Building Construction Modules

PARTS	MODULES	MARKS/PERCENTAGES						
		0-5	6-10	11-15	16-20	21-25	26-30	%SCORE
A	**I**	2.44	9.76	29.27	58.54	-	-	**87.81**
	II	2.50	5.00	50.00	45.00	-	-	**45.00**
B	**I**	-	-	7.5	50.00	-	-	**95.00**
	II	-	-	2.50	10.00	52.50	35.00	**97.50**
C	**I**	17.50	50.00	27.50	5.00	-	-	**32.5**
	II	35.50	32.50	20.00	7.50	5.00	2.50	**15.00**
D	**I**	20.00	67.5	7.50	7.50	-	-	**15.00**
	II	10.00	55.00	32.50	5.00	-	-	**5.00**

(Source: Vocational School in Southern Zone, 2010)

Teachers agree that one of the factors that influence students' learning is teaching style. Various inventories, questionnaires, and indexes were produced to identify the student's learning styles. One of the learning style models is the Felder and Silverman Learning Styles Model (FSLSM), which is designed to identify students' learning styles based on the information processing and dimensions that students acquire in their learning (Felder and Silverman, 1988). The original FSLSM was developed by Richard Felder and Linda Silverman to address the student learning in engineering education (Felder and Silverman, 1988). However, studies show that the usefulness of FSLSM has since extended to various subject disciplines, such as language, medical, science, and engineering-related disciplines (Chipo, 2007).

The updated FSLSM reduced the five dimensions of learning styles into four because of pedagogical reasons associated with the teaching requirements. The number of dimensions was changed because of pedagogical reasons associated with teaching needs. The four dimensions are, namely, processing, perception, input, and understanding (Felder, 1993). FSLSM is an appropriate learning style model with which to study and interpret students' learning in vocational education. The Index of Learning Style (ILS) was developed by Felder and Soloman (1997) to measure the dimension of FSLSM. The ILS can help identify the dimensions of learning and the

type of learner based on a 44-item questionnaire. Each dimension is associated with 11 forced-choice items, each either with an option (a) or (b) to match up to one or another category of the dimension. The details of ILS are further explained in the chapter on literature and research methods. FSLSM is a learning style model often used in other subject disciplines that can provide a more detailed description of LS. No specific model of is LS proposed to measure LS for vocational students, but FSLSM characteristics can be used. The dimension of FSLSM and the items in the Felder–Soloman Learning Styles Index are suitable for identifying students' learning styles in the BC Course (BCC).

In a related research, Muhammad et al. (2011) classified 68 vocational students into four learning types according to the Index of Learning Styles (ILS). The dimension of creative thinking in problem solving among students was also investigated. The results showed that the dominant type of learners was the visual learner. They also observed a significant difference between visual learners who used creative thinking in problem solving ($p<0.05$). Visual students choose to manipulate ideas as a creative problem solving skill. Other types of learners included active, sensing, and sequential learners. The result showed that the students who are active, sensing, and sequential learners are no different in terms of their problem-solving strategies because they used creative thinking elements.

In summary, students who are visual learners use previous knowledge to solve a problem. They are also able to apply solutions based on pictures to an actual situation. They can also relate the facts to the topic that teachers teach in class. This agrees with the description of a visual learner given by Fleming (2001), who stated that visual learners prefer maps, charts, graphs, diagrams, and different spatial management. Table 1.3 shows the types of learners and their use of creative thinking in problem solving.

Table 1.3: Types of Learners and Creative Thinking

Styles	**Creative thinking in problem solving**								***p***
	Manipulating idea		Exploring knowledge		Identify the factors		Using logic		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Active	1.75	.35	1.89	.54	0.68	.58	0.68	.65	.577
Sensing	1.34	.39	0.98	.25	2.01	.68	0.67	.34	.609
Visual	2.39	.28	1.22	.45	1.01	.33	0.16	.65	.038
Sequent	0.95	.54	1.53	.33	0.56	0.55	1.97	.47	.549

(Source: Muhammadvet.al, 2011)

Standardized tests do not measure student achievement perfectly. Vocational students do not perform as well on standardized tests as academic students. Based on the analysis above, teachers from three schools were interviewed to discuss how they overcame the problem. They proposed a few techniques for teaching and learning. They concluded that because they must finish the syllabus, they were not able to spend more time helping the weaker students. A checklist showing the techniques used by the teachers to overcome weaknesses in their students is shown in Table 1.4 based on the interviews. This checklist is a modification of a checklist developed by Nurul (2003) and shows how teachers can cater to students' learning preferences. According to the table below, teachers have no specific way to determine student learning preferences and know of no other way to record their students' performances beside examination results. This is unfortunate, given teachers should know if their students have the ability to master certain cognitive levels in their lessons.

Table 1.4: Teachers Strategies for Student's Performance

Techniques	**Often**	**Sometimes**	**Rarely**
Drilling style	√		
Motivation camp	√		
Small group discussion	√		
Personal approach		√	
Special workshop		√	
Self learning approach		√	
Memorizing			√
Knowing students preferences		√	
Variety teaching method	√		

(Source :Nurul,2003)

According to the feedback from classroom observation (Ruth 1992), the vocational teachers did the following:

i. Used slightly more class time for instructional activities
ii. Spent less time lecturing and explaining or presenting material
iii. Worked more with students in small groups and individually
iv. Used textbooks and worksheets less
v. Used a wider variety of tools
vi. Engaged students more in task or activities in which students exercised a degree of control, such as physical demonstrations, practice and performance, and role playing
vii. Used paper and pencil tests less and performance appraisals more

The basic element in measuring student achievement is the ability of students to master a subject. The cognitive domain is the root of learning. In BCS, the structure of the subjects is based on the cognitive level. Bloom's Taxonomy (1989) was used in the curriculum, and the specific needs of the vocation were considered. The elements proposed in the curriculum were knowledge, skills, and problem solving. This study merged Bloom's Taxonomy (1956) with a revised taxonomy by Anderson and Krathwohl (2001) to determine students' learning abilities in BCS. The elements measured were determined by the criteria evaluated by the SPM and structured from the Malaysian Examination Board (2003). The students' learning styles were also investigated to determine if there was a connection with the students' mastery of the subject.

Integrating student learning styles can create a new way of learning, involving skills such as problem solving. A summary was done by Rehm (1987) to interpret the data obtained in a case study of a VE classroom that revealed VE students creating their own styles and processes. They worked more on tasks that allowed them to interact with other students rather than with the teacher. Understanding and identifying student LS may help teachers identify the needs of their students and address them appropriately, as well as help their students achieve their learning goals. Teachers should be aware of their students' cognitive levels so that they can determine if a student uses more than one LS. Many studies deal with learning styles

in general education, engineering education, or vocational education. However, the majority of adaptive systems focusing on LS incorporate only some aspects of traditional LS models rather than an all-purpose model that shows how an LS can be used as guide for the cognitive, behavioral, and psychomotor skills of a student (Sabine & Silvia, 2007).

1.3 Statement of Problem

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 into the teaching and learning process, especially with how these factors can contribute the students' achievement.

Building Construction Course is one of the vocational courses offered in certain Vocational School in Malaysia. It encompasses many areas of study for the 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, based on examinations for the BC subject from 2006 to 2009, 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. This study also suggested a cognitive learning framework using LS in BCC to help teachers assess the LS of their students.

1.4 Research Objectives

i. To identify the learning styles of Building Construction students

ii. To identify the students' perception of their own cognitive learning in Building Construction

iii. To determine the cognitive mastery of students in Building Construction.

iv. To analyze the differences between Felder–Silverman Learning Styles dimensions and the mastery in cognitive learning of Building Construction students.

v. To explore how Building Construction teachers can accommodate their students' learning styles.

vi. To explore how teachers accommodate students' learning and cognitive mastery in Building Construction Subject?

vii. To produce a student learning framework for Building Construction Education based on the students' learning styles and cognitive learning.

1.5 Research Questions

i. What are the types of learners that represent Building Construction Students?

ii. What are the differences between each type of learner in Building Construction based on Felder and Solomon's Index of Learning Styles?.

iii. How do Building Construction students perceive their own cognitive learning?

iv. How do the students master their cognitive learning in Building Construction subjects?

v. What are the differences between processing dimension (active and reflective learning styles) and the students' mastery of cognitive learning?

vi. What are the differences between the perception dimension (sensing and intuitive learning styles) and the students' mastery of cognitive learning?

vii. What are the differences between the input dimension (visual and verbal learning styles) and the students' mastery of cognitive learning?

viii. What are the differences between the understanding dimension (sequential and global learning styles) and the students' mastery of cognitive learning?

ix. How can teachers accommodate their students' learning styles in Building Construction Subject?

x. How do teachers accommodate students' learning styles in terms of cognitive mastery in Building Construction Subject?

xi. What are the learning framework elements based on the learning styles and cognitive learning of BC Education?

1.6 Hypotheses

Research Question (ii): What are the differences between each type of learner, in Building Construction, based on Felder & Solomon's Index of Learning Styles?

Ho: There is no significant difference between active, sensing, visual and sequential styles among BCC students.

Ha: There is significant difference between active, sensing, visual and sequential styles among BCC students.

Research Question (v): What are the differences between processing dimension (active and reflective learning styles) and students' mastery of cognitive learning?

Knowledge:

Ho: There is no significant difference between active and reflective processing dimensions.

Ha: There is a significant difference between active and reflective processing dimensions.

Skills:

Ho: There is no significant difference between active and reflective processing dimension

Ha: There is a significant difference between active and reflective processing dimension

Problem Solving abilities:

Ho: There is no significant difference between active and reflective processing dimensions

Ha: There is a significant difference between active and reflective processing dimensions

Research Question (vi) What are differences between perception dimension (sensing and intuitive learning styles) and students' mastery of cognitive learning?

Knowledge:

Ho: There is no significant difference between sensing and intuitive learning styles.

Ha: There is significant difference between sensing and intuitive learning styles

Skills:

Ho: There is no significant difference between sensing and intuitive learning styles.

Ha: There is a significant difference between sensing and intuitive learning styles.

Problem Solving abilities:

Ho: There is no significant difference sensing and intuitive learning styles.

Ha: There is a significant difference sensing and intuitive learning styles.

Research Question (vii): What are differences between input dimension (visual and verbal learning styles) and students' mastery of cognitive learning?

Knowledge:

Ho: There is no significant difference between visual and verbal learning styles.

Ha: There is a significant difference between visual and verbal learning styles.

Skills:

Ho: There is no significant difference between visual and verbal learning styles.

Ha: There is a significant difference between visual and verbal learning styles.

Problem Solving abilities:

Ho: There is no significant difference visual and verbal learning styles

Ha: There is a significant difference visual and verbal learning styles.

Research Question (viii What are differences between understanding dimension (sequential and global learning styles) and students' mastery of cognitive learning?

Knowledge:

Ho: There is no significant difference between sequential and global learning styles

Ha: There is a significant difference between sequential and global learning styles

Skills:

Ho: There is no significant difference between sequential and global learning styles

Ha: There is a significant difference between sequential and global learning styles

Problem Solving abilities:

Ho: There is no significant difference sequential and global learning styles.

Ha: There is a significant difference sequential and global learning styles.

1.7 Research Conceptual Framework

The framework provides all the parameters, conditions, and support various learning (Kuchi et al., 2003). 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 students' academic achievement in BC 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 students' perception and mastery through their academic achievement. The cognitive learning focused on Bloom's Taxonomy (1956) and Anderson and Krathwohl's Taxonomy (2001).This study used BC modules, which focused more on the three major vocational elements, namely, knowledge, skills, and problem solving to measure the cognitive mastery.

Figure 1.7 illustrates the framework used in this study. This study applied the FSLSM (Felder, 1993), which classified learning styles into four dimensions: processing, perception, input, and understanding. Using the Index of ILS proposed by Felder and Soloman (1997), 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. A 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 students' learning styles and their cognitive abilities.

This study used Bloom's Taxonomy (1956) combined with the revised taxonomy proposed by Anderson and Krathwohl (2001). The original taxonomy

provided carefully developed definitions for each factor in the cognitive domain. The categories were ordered from simple to complex and from concrete to abstract (David, 2002). The levels in Bloom's Taxonomy are knowledge, comprehension, application, analysis, synthesis, and evaluation. Knowledge is the rote recall of previously learned materials, which includes facts and definitions. Comprehension is described as the ability to make sense of a material. Application is the ability to use learned material in new situations. Analysis is the ability to break a material into its component parts. Synthesis refers to the ability to put parts together and see the greater whole. Evaluation is the ability to judge the value of a material based on specific criteria.

Anderson and Krathwohl's revised taxonomy used the verb forms of the words used by Bloom in the cognitive dimension. The revised taxonomy contains the following categories: remember, understand, apply, analyze, evaluate, and create. Remember means retrieving relevant knowledge from long-term memory. Understand means determining the meaning of instructional messages. Apply means carrying out a procedure in a given situation. Analyze refers to breaking the material into its constituent parts. Evaluate means making judgments based on criteria. Create means putting elements together to form something new. The combination of the two taxonomies produced the matrix used to categorize the vocational elements in BCS proposed by the Ministry of Education (2006). The vocational elements are knowledge, skills, and problem solving.

Knowledge in BCS is defined as the basic facts that students should know about BC. This is the lowest level in the taxonomy. This study used words from the taxonomy to match the learning outcomes specified in the BC learning modules. Skills are defined as the students' ability to apply theory to practical tasks. This definition is equivalent to the Application and Evaluation level in Bloom's Taxonomy. Skill is concerned with practical tasks and work procedures that students should exhibit. The most difficult component in BCS is problem-solving ability, which corresponds with the Analyze and Synthesis categories in Bloom's taxonomy. The problem background section of this papers states that BCC students have weak problem-solving abilities. One of the purposes of this study is to use the characteristics of learners to provide features based on learning styles to help students overcome this weakness. The arrangement of students' learning styles, vocational

elements, and matrix of taxonomy (Bloom, 1956; Anderson & Krathwohl, 2001), all contributed to this study and to a new conceptual framework of learning, which can enhance the abilities of both teachers and students.

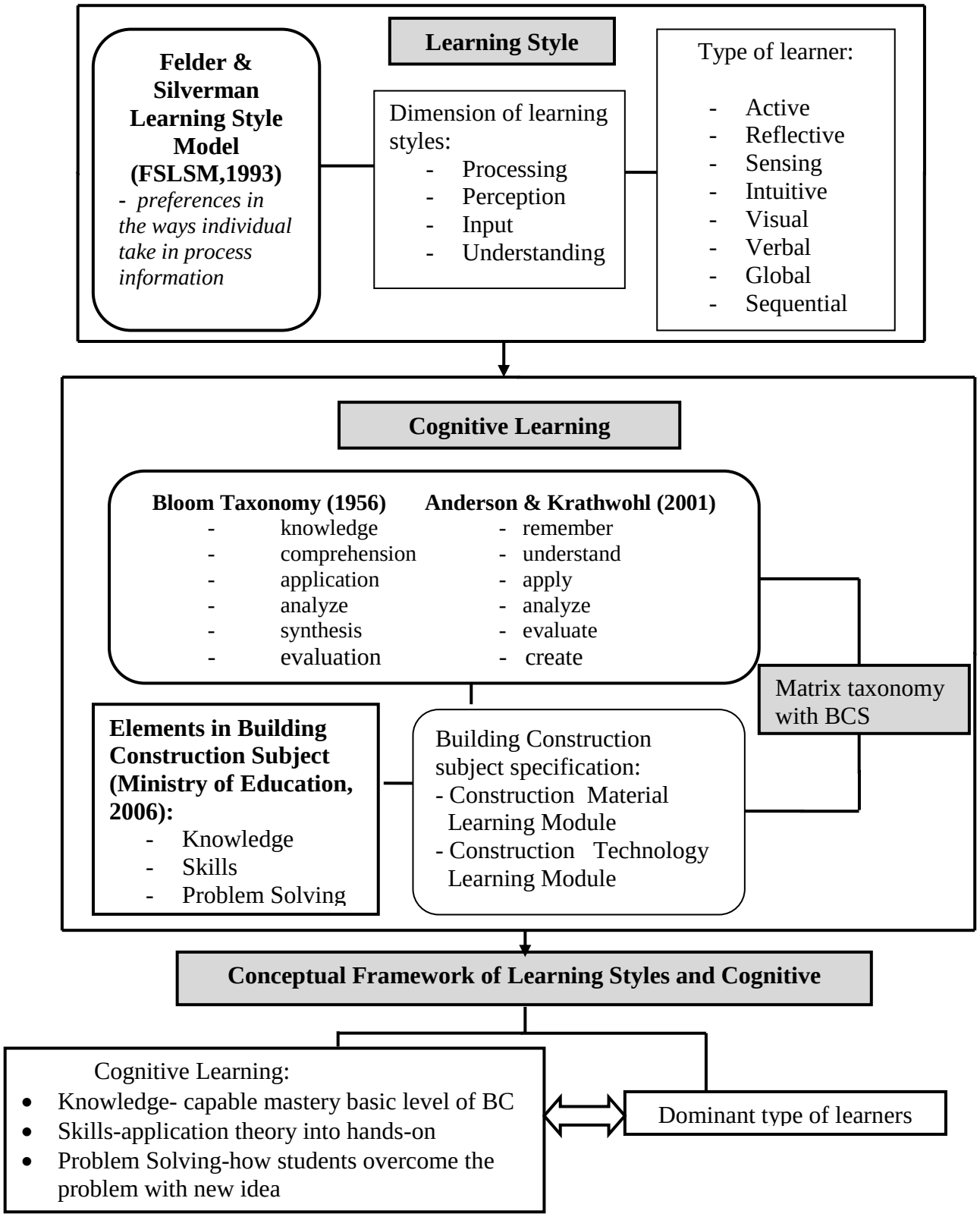


Figure 1.7: Research Conceptual Framework

1.8 Significant of Research

This study contributed new knowledge to the field of vocational education Discussions on learning styles may fluctuate every year. Nevertheless, learning styles are always debated all over the world. This study focuses on combining the cognitive level, vocational elements, and learning styles to improve the students' learning, especially on the Building Construction Course in Vocational Schools. The results of this study will contribute to the improvement of students' learning and the teachers' ability to assist their students using the learning framework produced at the end of this study.

1.8.1 Teachers

Educators and researchers have long been concerned with identifying how individuals teach (Joseph, 2009). Understanding learning styles may help teachers or educators facilitate structure and validate successful learning for all students. Dunn and Dunn (1992) report that students show increased academic achievement, improved attitudes toward instruction, and improved discipline when taught using their preferred learning styles than their non-preferred styles. Teachers must be able to identify their students' learning styles in an efficient manner to make sure that optimal learning is achieved. The students should have the ability to master a particular subject to increase the students' achievements. The concept of vocational curriculum involves cognitive and behavioral practices (Stephen, 2003). In the BC curriculum for VS in Malaysia, both aspects are major concerns. Using the cognitive perspective in taxonomy, students were evaluated on their cognitive mastery in BCS based on three elements: knowledge, skills, and problem solving. Identifying their learning styles also contributed to the factors and relationship based on the different types of learners in the mastery of learning content. With these three reasons, the results of this study can benefit teachers, students, curriculum designers, and other researchers.

1.8.2 Students

Knowing students' learning styles can help enhance teaching and learning in many ways. Teachers should know their students' learning styles. It will be easy for them to prepare learning materials based on the students' preferences. Teachers can motivate students by matching their teaching styles and the students' learning styles. Providing learning materials using the characteristics of learning styles and conducting the activities can make learning easier for students even in difficult cognitive levels such as problem solving.

This research can enhance the students' style of learning. The vocational concept is concerned with behavior and cognitive learning. However, Most of the students are aware of their behavior, which can be used to get hints for calculating students' learning styles (Sabine et. al, 2009). The suggestions of the learning framework in this study will help the student plan effective learning strategies and overcome solving problems, especially in the difficult part of BCS. They can prepare their own learning materials so that students will know which part they need to focus on. Taking notes can be done in various ways. Based on the concept proposed in this study, the students can design their own notes and self-learning module.

1.8.3 Curriculum Designer

This research also aims to provide suggestions to curriculum designers on improvements that can be made in vocational subjects in terms of the pedagogical approach especially in BCS. Research findings can enlighten to curriculum designers (Technical and Vocational Curriculum Department) come up with new methods of learning content. Currently, curriculum design is not concerned with vocational students' learning styles that are needed to achieve a cognitive level. Therefore, this research may help design the curriculum, especially for difficult topics, and match the curriculum with students' abilities.

The findings of this study may help other researchers shed light on the advantages of knowing students' learning styles and the benefits of such to students' learning achievements. The findings of this research can also be applied in other vocational subjects because of the similarity in the basic concept used.

1.9 Research Assumption

Learning is different for each student and depends on his or her individual learning preferences. Learners in VE usually prefer hands-on activities rather than thinking or writing activities. However, they have to learn both practical and theoretical tasks in a classroom. The cognitive level and skills are also different. Cognitive skills are important factors for skilled workers in an industry so that they can produce new ideas in their work tasks. The new learners in VE have to investigate how to adapt their skills to their cognitive level to fulfill the need. Learning style is also one of the factors that influence students' learning. The type of learning style can determine the type of student. Many learning style tools can identify students' learning styles; a wrong option is not possible. In this study, the FSLSM LSI is one of the learning style tools used to identify the students' LS types. The taxonomy measured uses cognitive levels of students in terms of skill, knowledge, and problem solving to cater to their learning in BCS. The learning framework suggested in this study can contribute new learning concepts for vocational students.

1.10 Scope of the Research

i. The BCC curriculum; Construction Technology and Building Materials are measured based on three variables; skills, knowledge, and problem solving at a cognitive level.

ii. The ILS Felder and Soloman measured types of students' learning in four dimensions: processing, perception, input, and understanding.

iii. The cognitive level using Bloom's Taxonomy and Anderson and Krathwohl's Taxonomy, as well as students' learning styles in BCC for VS.

iv. The teachers' opinions analyzed as supporting material for the students' feedback by ILS, achievement test, and questionnaires.

v. The elements of the learning framework that this research created based on variables investigated using statistical and verbal discussions.

1.11 Definition of terms

i. Academic Achievement

Academic achievement has become an index of a student's future. Academic achievement has been one of the most important goals of the educational process. It is also a major goal, which every individual in every culture is expected to attain. Academic achievement is a key mechanism through which adolescents learn about their talents, abilities, and competencies. It is an important part of developing career aspirations (Malati, 1987). Academic achievement and career aspirations during adolescence are often correlated (Felner and Minsuk, 1995). Crow and Crow (1969) defined academic achievement as "the extent at which a learner is profiting from instructions in a given area of learning, that is, achievement is reflected by the extent at which a skill or knowledge has been imparted to him." In this study, academic achievement refers to the degree at which students possess certain behavioral methods based on their abilities in cognitive learning. The achievement focused on Building Construction subjects.

ii. Cognitive

Ruth (1992) defined cognitive as the process of knowing, perception, and the products of such acts or processes. Cognitive is a body of knowledge focused on describing, explaining, and understanding cognition. Bobby (2008) and Piaget (1977) described cognitive as the mechanism of the mind of processing new information. Piaget believed that the development of a child occurs through a continuous transformation of thought processes. In this study, cognitive can be identified by how students in VE can use the level of thinking from lower order to higher order in theory-based subjects for them to describe, explain, and understand what they are learning.

iii. Cognitive Level

Bloom (1956) defined cognitive level as the development of intellectual skills based on thinking and knowledge. Anderson and Karthwohl (2001) revised Bloom's "domain" to "knowledge dimension." They classified the domains into cognitive processes and created the cognitive levels. The present research focuses on the cognitive level of the BC curriculum students and applies it in the elements of VE needs, namely, skills, knowledge, and problem solving.

iv. Cognitive Process

Bloom (1956) and Karthwohl's (2001) cognitive process in taxonomy provides a comprehensive set of classifications for the learners included in the instructional objectives. Classifying instructional objectives using this taxonomy helps determine the levels of learning included in an instructional unit or lesson. In this study, the cognitive

process is the step of applying learning styles in BC, focusing on skills, knowledge, and problem solving.

v. Cognitive learning

Cognitive learning refers to the mental process in several aspects of differential psychology associated with individual differences in the learner and learning environment (Richard and Stephen, 1998). The formal definition of learning describes the process as a relatively permanent change in behavior based on an individual's interactional experience with his or her environment. Learning is an important form of personal adaptation. Elizabeth (2004) describes cognitive learning in terms of analytical and global characteristics. Cognitive learning in this study is focused on the mental process of students learning BCS in terms of knowledge, skills, and problem-solving abilities.

vi. Cognitive Mastery

The Bloom (1956) and Karthwohl (2001) cognitive processes in taxonomy provided a comprehensive set of classifications for learners included in instructional objectives. Mastery learning was proposed more than thirty years ago as an early form of adaptive curriculum (Corbett, 2007). Mastery learning lends itself most readily to individualized instruction and fundamental principles adapted from whole class instruction. This study will investigate cognitive mastery, which is the process of student cognitive mastery of the learning content of BCS.

vii. Learning Style

Learning style is a component of the wider concept of personality (Thomas and Amit, 2007). Kolb (1984) defined learning style as the generalized differences in learning orientation based on the degree at which people emphasize the four modes of learning process. Gregorc (1979) defined learning style as distinctive and observable behaviors that provide clues to the mediation abilities of individuals and how their minds relate to the world and how they learn. Fleming (2001) defined learning style as an individual characteristic and preferred ways of gathering, organizing, and thinking about information. Felder and Silverman (1988) defines learning style as the strengths of the characteristics and preferences in the ways individuals take in and process information. Dunn (1990) described learning style as the way to obtain difficult information. Reid (1987) defined learning style as the learning process of an individual. If accommodated, this learning style can improve attitude towards learning. In this study, the learning style defines the strategies used by students to learn in vocational subjects, especially BC.

viii. Vocational Education

The International Organization Labour (2000) defined vocational education as the wide range of courses or skills that help students prepare for employment or the workplace. It is the mastery of a skill in a certain field (International Organization Labour, 2000). The Ministry of Education (2006) described vocational education as the preparation of students to be competent workers to fulfill industry needs. Chappell (2003) defined vocational education as a combination of skills, knowledge, problem solving, and entrepreneurship to prepare students to be more creative in producing new ideas. It is also contained in the BC subject specification proposed by the Malaysian Ministry of Education (2003). In this study, vocational education refers to the

vocational course in a vocational school. The focus of this study is BCC.

ix. Processing Dimension

According to Felder and Silverman (1993), the processing dimension is a set of attributes with which students process information and convert it into knowledge. In this dimension, Felder and Silverman classified processing dimension into two types of learners, active and reflective. This study uses this term based on the FSLSM to classify the students' learning styles in BCC.

x. Perception Dimension

Felder and Silverman (1993) defined the perception dimension as the way a student perceives a word. The attributes of perception dimension are sensing and intuitive. This study investigates the number of students that tend to be both types of learners.

xi. Input Dimension

Input dimension investigates from which sensory channel the students prefer to receive the external information (Felder and Silverman, 2003). The channels of students used in this research are visual and verbal.

xii. Understanding Dimension

Felder and Silverman (1993) defined the understanding dimension as how the student progresses in the understanding process. Based on this

dimension, the understanding process represents two types of learners, namely, sequential and global, which were the learning styles investigated in this research.

xiii. Active

Felder and Silverman (1993) described active learners as those that learn effectively by actively working with the learning material and trying things out. They prefer to do things in groups. In this study, the term active learner refers to students who participate in their learning either in class or in workshops. The scope of active learners is students in BCC in vocational schools.

xiv. Reflective

Felder and Silverman (1993) described reflective learners as those who prefer doing things on their own with time to think about the task before doing it. They prefer to reflect on the material. They also prefer either to work alone, or in a small group together with one good friend. The research used Felder–Silverman LSI to identify which type of learner the BCC students are .

xv. Sensing

Sensing learners like to learn facts with concrete learning materials. Felder and Silverman (1993) described them as learners who like to solve problems with standard and sensible approaches. They tend to be more practical and work more on detail (Thomas & Amit, 2007). for BCC students in vocational schools to identify the sensing learning styles Felder-Silverman LSI will be used in this study.

xvi. Intuitive

Intuitive learners prefer ideas and theories particularly when they grasp new ideas an innovation. Sabine et.al (2002) stated that intuitive learners prefer to learn abstract learning materials, discover possibilities, and have creative relationships. This study will relate the situation of intuitive learners using the part of BC syllabus, which concerns problem solving and creative thinking.

xvii. Visual

Fleeming (2001) describes visual learners as learners who prefer maps, charts, graphs, diagrams, and different spatial arrangements. The research focused on how students in the BCC use a variety of techniques on visualization to apply to their learning and understanding.

xviii. Verbal

Felder and Silverman (1993) identified the verbal learners as learners who like to listen to information and engage in discussion, especially when they speak and listen to their own words. The Felder–Silverman LSI was used to identify the verbal learners in this study.

xix. Sequential

Thomas and Amit (2007) define sequential learners as learners who prefer linear reasoning and step-by-step procedures, and materials. They learn in small incremental steps and have a linear learning progress. They tend to follow logical stepwise paths in finding solutions (Sabine et al., 2002).

xx. Global

Sabine et al. (2002) describes global learners as learners who use holistic thinking processes and learn in large leaps. They are strong integrators and synthesizers. They also make intuitive discoveries and connections to see the overall pattern.

xxi. Knowledge

Bloom (1956) defined knowledge as the recall of previously learned materials and represents the lowest level of learning in the cognitive domain, considering s no presumption that the learner understands what is being recalled is made. In this study knowledge, this term will be used based on the cognitive level of BC required.

xxii. Skill

The National Skills Development Act of 2006 (Act 652) defined skill as the work-based and industry-oriented activities that aim to provide the knowledge, skills, and attitude required for the effective and efficient performance of a task or job. Skill in this study refers to how students can apply their theory knowledge in the practical tasks given to them. Skill for the vocational schools level is the basic level of how students can come close to actual work in Building Construction.

xxiii. Problem Solving

Problem solving is a means of helping students develop decision-making skills. It also helps teachers alter their teaching methodology. The problem-solving method of teaching incorporates problem solving activities but places the responsibility for learning on the student

(Bettina, 1998). Problem solving in BC in this study context is derived from the students' ability to overcome the problems given to them, then produce new ideas. Actual situations related to building construction, such as landslides and building failure will be given to the students. They need to think about solving the problem. This is a high level of cognitive required in BC curriculum.

xxiv. Learning Framework

Kuchi et. al (2003) defined learning framework as something that provides the overall parameters, conditions, and support for various learning and teaching styles, information-seeking behaviors, and multiple intelligence approaches to any type of classroom or learning environment. This study proposed a learning framework contained in the element of learning styles and cognitive for Building Construction, specifically in Vocational Education.

1.12 Chapter Summary

The purpose of this study is to identify students' learning styles and the differences between the types of learners and their cognitive mastery in BCS. Cognitive mastery is concerned with students' academic achievements and related to vocational elements in BCS. Students' achievements may be affected by various factors like intelligence, study habits, and attitudes. The learning styles have three major components: psychology, cognitive, and affective. Considering the major problem in students' achievement in the BCC is having lower scores at the cognitive level, the learning style factor should be investigated. Thus, this study explores the various factors from previous research and empirical findings to identify how students' learning styles can assist students in enhancing their learning in BCS.

The focused group investigated in this study was made up of students from three Vocational Schools. This chapter discussed the problems that students and teachers face in BCS. Based on these problems, this study examined the variables stated in the research problem statement. The conceptual framework was designed using theories and models that reflected the purposes of this study to limit the scope of research. Research objectives and research questions were developed to test the hypotheses based on the problem statement and the related research conceptual framework.

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