

## The Relationship between Personality Types, Learning Styles and Problem Solving Approach of Technical and Vocational Education Students

WIDAD OTHMAN, RIO SUMARNI AND LEE MING FOONG

*Faculty of Education, Universiti Teknologi Malaysia,  
81310 UTM, Skudai, Johor Darul Ta'zim, Malaysia  
E-mail: widadothman@oum.edu.my*

**Keywords:** Personality types, learning styles, problem solving approach, technical and vocational students

### ABSTRACT

Personality types and learning styles play an important role in higher education. They represent different individual preferences and strengths in learning; and can be a stimulus for developing new ways of learning. Engineering Drawing is one of the subjects for training students to become experts in graphic communication. Students who learn Engineering Drawing acquire a strong foundation, which enable them to work in the field of engineering or to continue their studies. This research reported here focused on the relationship between personality types, learning styles and problem solving at visualization level among final year Technical and Vocational Education (TVE) students in University Technology Malaysia. The Eysenck Personality Questionnaire (EPQ), Kolb Learning Styles Inventory (LSI) and Hatta Effective Problem Solving Approach were used to measure the different personality types, learning styles and effective problem solving for engineering drawing respectively. A total of 33 respondents from three different areas of TVE specifically Civil, Electrical and Mechanical Engineering were randomly selected as samples. The results showed that phlegmatic personality type students tend to have divergent learning style, followed by convergent and accommodator learning styles. The results also implied that sanguine personality type students tend to possess divergent learning style, followed by convergent learning style, while the melancholic personality type students preferred divergent and convergent learning styles. The method used by students to solve engineering drawing problems is a combination of imagination and sketching. However there is no difference amongst students with different personalities and learning styles in solving engineering drawing problems.

### INTRODUCTION

Ancient Greek philosophers had a good advice for us –“Know Yourself”. This is a useful advice, especially when we discuss about learning in higher education. With our limited knowledge, it is difficult to make rational choices (Eysenck, 1975) about learning. The differences that exist between personality type and learning style are aspects that represent individual differences which further complicates learning.

However, it is crucial to know the difference(s) so as to achieve success in

addition to allowing the individual to know their behavioral strengths and weaknesses in a more objective light (Eysenck, 1975; Shepherd, 2001). Miller (1991) also concluded that personality based learning style provides a more useful conceptual basis for understanding individual differences in learning. According to Heinström (2000), personality traits are expressed in learning styles, which are in turn reflected in learning strategies, which eventually produce a certain learning outcome.

Engineering Drawing is one of the subjects used to train students to become experts in graphic communication. Students who learn engineering drawing will acquire a strong foundation, therefore enabling them to work the field of engineering or to continue their studies. In the engineering world, Engineering Drawing is the medium of communication. It relates between theory and the picture of reality. It provides an accurate and complete picture for every object in terms of shape and size (Widad and Adnan, 2000).

According to Giesecke (1995), Engineering Drawing requires a mind with the ability to see an image in 3-dimensions. Information and specifications from the real object must be transferred to a drawing. Likewise, interpretation of information from a drawing to produce a reality must occur. The transfer from reality to a drawing and vice versa is not an easy task. It requires a teaching-learning process that encourages the use of mind literacy, which is the use of both hemispheres in thinking. Problem solving using mind literacy thinking style will generate students who are innovative, creative, critical and dynamic (Widad and Adnan, 2000). Therefore, teachers who are responsible for developing such students must be physically and mentally prepared (Angelika, 1987).

#### **STATEMENT OF PROBLEM**

To determine the relationship between personality types, learning styles and problem solving at visualization level among the final year Technical and Vocational Education (TVE) students in University Technology Malaysia (UTM). Expectations for this research were to provide an assessment instrument in Malay Language for educators to define students personality types and learning styles based on Eysenck Personality Questionnaires (1975) and Learning Style Inventory Kolb (1976). To also suggest a model of problem solving approach based on Hatta Effective Problem Solving Approach (2001).

#### **RESEARCH OBJECTIVES**

The specific objectives of the research were to:

1. Investigate the personality types among the final year TVE students in UTM.
2. Investigate the learning styles among the final year TVE students in UTM.
3. Determine the relationship between personality types and learning styles among the final year TVE students in UTM.
4. Identify the problem solving approach that students applied to solve Engineering Drawing Problems in Auxiliary View Drawings.
5. Examine the relationships between personality types, learning styles and problem solving at visualization level in Auxiliary View Drawings among the students.

#### **RESEARCH METHODOLOGY**

A case study design method with a qualitative approach was employed in this research project. Methods of data collection include observations, documentations, questionnaires and interviews (for Engineering Drawing Problem Solving). However, data for personality types and learning styles were collected through questionnaires. The gathered data were analyzed and presented as percentages, frequencies, means and graphs. Qualitative data were analyzed using triangulation method in single-case and cross-cases.

Sixty students from a population of 102 final year Bachelor of Technology with Education students specializing in Civil, Electrical and Mechanical Engineering were selected randomly as samples. The samples selection was done using the proportionate cluster sampling procedure (Wiersma, 1991). However, 27 of the sample did not respond to the questionnaire and were excluded from the research. Then, eight students who excelled in solving auxiliary view drawing problems were interviewed to determine the best pattern of problem solving. Purposeful sampling was used to select the samples.

The instrument used for data gathering comprised three parts namely; the restructured Eysenck Personality Questionnaire (EPQ) in the first part, the Kolb Learning Styles Inventory (KLSI) in the second part, and closed-ended questions related to Auxiliary View Drawing in the third part. There were a total of 120 items in EPQ, 9 items in KLSI and 3 items in Auxiliary View Drawing Problem Solving Inventory. The reliability index for EPQ and KLSI were 0.83 and 0.82 respectively whilst experts in Engineering Drawing verified the Auxiliary View Drawing Problem Solving Inventory.

### RESULTS AND DISCUSSIONS

Tables 1-4 show the results of this research. *Figs. 1 to 3* are graphic representations of respondents' personality types, learning styles and the problem solving approach for auxiliary views.

To determine the students' personality types, data collected were analyzed into two dimensions: Introversion-Extroversion and Emotional Stability – Emotional Instability. These two dimensions intersect each other and form four temperaments that represent the personal categorical personality types, namely Melancholic, Phlegmatic, Sanguine and Choleric. For the Introversion-Extroversion dimension, 66.67% of students were inclined towards the introvert personality while 33.33% showed extrovert personality. In the Emotional Stability–Emotional Instability dimension, a majority of respondents were emotionally stable and the rest (36.36%) were emotionally unstable as illustrated in Table 1. The results showed that students possess the following personality types: Phlegmatic, Melancholic, Sanguine and finally Choleric. *Fig. 1* shows graphically the personality types of respondents.

More than 40% of students possess the abstract conceptualization learning style as shown in Table 2. An approximately same number of students have the concrete experience or active experimentation learning style. Only about 8% are included towards the

TABLE 1  
Respondents' personality types

Dimension Personality	f	Percentage (%)
<i>Introversion-Extroversion</i>	33	100
Introversion	22	66.67
Extroversion	11	33.33
<i>Emotional Stability</i>	33	100
Stable	21	63.64
Unstable	12	36.36
<i>Categorical Personality</i>		
Melancholic	8	24.25
Phlegmatic	14	42.42
Sanguine	7	21.21
Choleric	4	12.12
Total	33	100

reflective observation learning style. To investigate students learning styles, data collected were analyzed into four categories: accommodator, divergent, convergent and assimilator. The results indicated that more than 50% of students showed divergent learning style. About 18% of them possess the assimilator learning style, about 15% tended to have convergent learning style while about 12% showed the accommodator-learning style. *Fig. 2* shows a graphic representation of learning styles.

The findings indicated that phlegmatic personality type students tended to have divergent learning style, followed by convergent and accommodator learning styles. The results also implied that sanguine personality type students tended to possess divergent learning style, followed by convergent learning style, while the melancholic personality type students preferred divergent and convergent learning styles as shown in Table 3.

Table 4 illustrates the demography of the eight best respondents selected to determine auxiliary view drawing problem solving approach. From the data collected through interviews, observations and documentations,

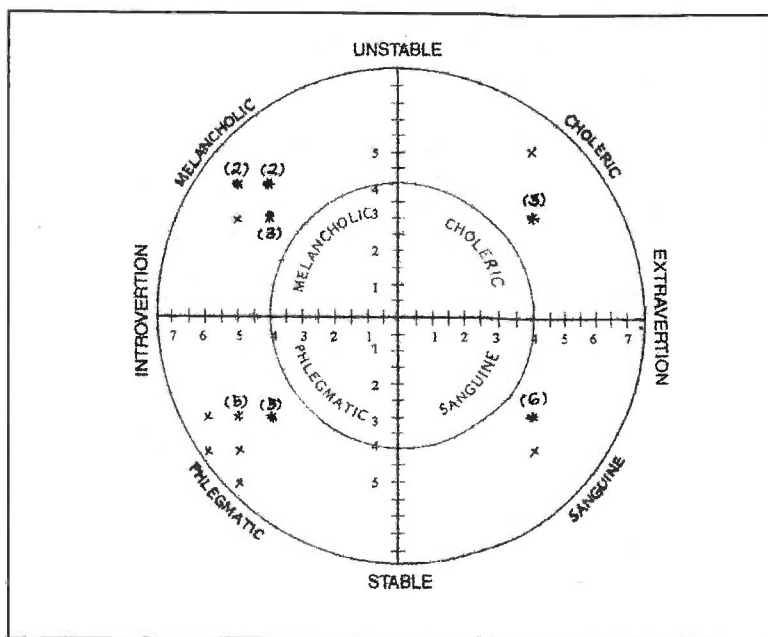


Fig. 1: Graph personality types of respondents

Note: \* = coordinate with frequency more than 1 and the number beside showed the real frequency of that coordinate.

TABLE 2  
Respondents' learning style

Dimension Learning Style	f	Percentage (%)
Concrete Experience (CE)	8	22.22
Reflective Observation (RO)	3	8.34
Abstract Conceptualization (AC)	16	44.44
Active Experimentation (AE)	9	25.00
Total	36	100
Categorical Learning Style		
Accommodator	4	12.12
Divergent	18	54.55
Convergent	5	15.15
Assimilator	6	18.18
Total	33	100

Note: 3 of the respondents have 2 types of Dimension Learning Style

the students showed a complementary application of the two styles of visualization. All respondents, regardless of their learning style and personality types use imagination and sketching to solve auxiliary view drawing problems. The combination usage of imagination and sketching which resulted in visualization enable these students to search for an alternative solution that is more effective. Fig. 3 shows the detailed approach used by the eight best students to solve auxiliary view drawing problems.

Surprisingly most of the TVE students tend to be introverts and emotionally stable. Introverts prefer order in life (Eysenck, 1975), a quality that will assist these future teachers to be systematic. And being emotionally stable with positive thinking and self-control will enable them to be confident and disciplined teachers. For TVE students, being introverts is not something out of the ordinary, since they spend much time working

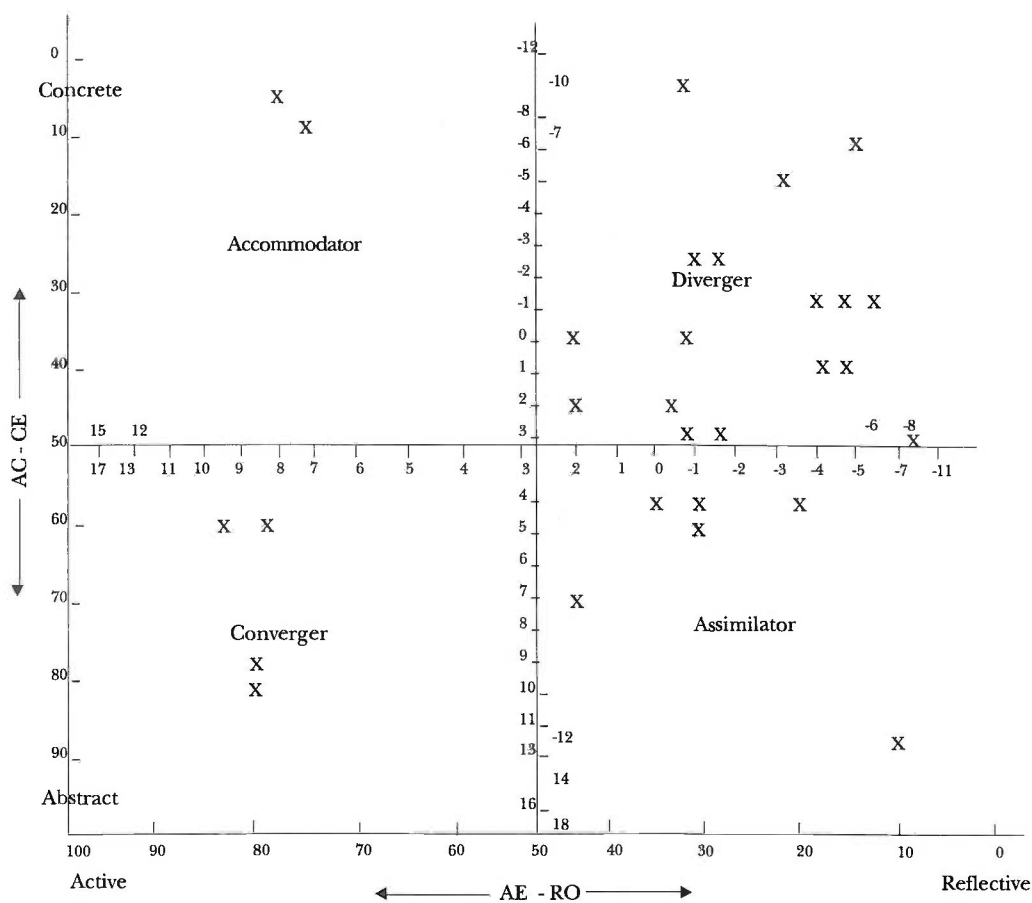


Fig. 2: Grid learning styles of respondents visualization ability  
 Note: \* Respondent that did not following the specific step.

TABLE 3  
 Association between categorical learning style & categorical personality

C.L.S	Melancholic		Phlegmatic		Sanguine		Choleric		T
	f	%	f	%	f	%	f	%	
Accommodator	1	3.03	1	3.03	1	3.03	1	3.03	4
Divergent	4	12.12	7	21.21	5	15.15	2	6.06	18
Convergent	1	3.03	3	9.09	1	3.03	0	0	5
Assimilator	2	6.06	3	9.09	0	0	1	3.03	6
Total	8	24.24	14	42.42	7	21.21	4	12.12	33

Note: C.P=Categorical Personality, C.L.S=Categorical Learning Style.

TABLE 4  
Demography of the selected respondents

Respondents	Learning style	Personality types	Score of auxiliary view drawing problem solving
1	Assimilator	Phlegmatic	100.00%
2	Accommodator	Sanguine	89.19%
3	Divergent	Phlegmatic	68.52%
4	Divergent	Phlegmatic	68.52%
5	Convergent	Phlegmatic	68.52%
6	Assimilator	Phlegmatic	57.87%
7	Assimilator	Phlegmatic	57.87%
8	Divergent	Sanguine	57.87%

with non-living objects such as tools, equipment and machines.

The results are similar to that of Child's (1993). In his research, Child found that university students with science educational background are more inclined to be introverts and emotionally stable compared with those with arts background. Similarly, TVE students in UTM were from Science background. Besides that, most of the subjects offered in their present course are related to science and engineering. Furthermore, educators who are emotionally stable will not be problem makers compared to those who are emotionally unstable (Child, 1993). They possess high self-confidence, calm when facing problems, controlled and act rationally to achieve their aims (Shepherd, 2002). Results also showed that TVE students tend to have phlegmatic personality. According to Eysenck (1975), phlegmatic personalities are passive, careful, thoughtful, peaceful, controlled, reliable, even-tempered and calm.

In learning style, TVE students showed the tendency towards the dimension abstract conceptualization with a diverging categorical learning style. Kolb (1984) emphasized that a high score in abstract conceptualization indicates an analytical, conceptual approach to learning that relies heavily on logical thinking and rational evaluation. Possessing a divergent learning style is an advantage to TVE students since their excellent imaginative ability will be

useful in subjects that need good imagination such as design and engineering drawing. They also make good teachers because of their tendency to be interested in people and emotional elements.

Results from this study indicated that there is no difference in problem solving amongst the students with different personalities and learning styles. The approach to solve auxiliary view drawing problem used by the eight best students was the combination of imagination and sketching as shown in *Fig. 3*. Therefore, educators or instructors have a responsibility to create a learning environment that is most responsive to the unique needs of learners according to personality types and learning styles help students understand themselves better as they also understand better why others may behave differently. A further benefit is individual strengths can be acknowledged and honored (Goby and Lewis, 2001).

In addition, students will be able to modify their behavior when confronted with problems related to people or in a difficult learning situation especially in Engineering Drawing subjects. Beside students, educators or instructors gain benefits too. By reflecting on their students' personality types and learning styles, they can be rectifying a mismatch that might occur between their own teaching styles and their students learning styles. Beside, these teachers can provide a more appropriate motivation to students when teaching

Engineering Drawing. They should also guide students in using a more effective and accurate Engineering Drawing Problem Solving Approach.

Results from this research emphasized the need for more researches particularly in learning styles and its relationship with personality types, supported by an effective and conducive learning environment. Furthermore, educators or instructors should understand teaching-learning practices that recognize individual differences (Claxton and Murrell, 1988), including personality types and learning styles. Then they should apply learning styles and personality types to provide students with an education that address both their strengths and weaknesses (Felder, 1996). For example, usefully linking Kolb's cycle to educational practice by relating teaching methods to four common experiential methods placed within the sequence of Kolb's model: planning for experience, increasing awareness, reviewing and reflecting on experience, and providing substitute experiences (Healey and Jenkins, 2000); or provide a not too dissimilar list of instructional activities that may support different personality educators or instructors should be aware that there is no one "best learning style" or "best personality type". Each of the learning styles and personality types has their own strengths and weaknesses.

### CONCLUSIONS

In this paper, personality types and learning styles among selected TVE students were determined. The approach to solve Auxiliary View Problems in Engineering Drawing was determined. However, further research need to be conducted to determine if the results of this study can be generalized to the whole population of TVE students in UTM, and whether similar results would be found by comparing the TVE students from other universities to the general student body.

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