



The Dispute Between Thinking Styles and Thinking Skills Among Technical Students

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Abstract: Thinking style is one thing that can help students in solving problems by knowing the students' own style. The style of thinking is not an ability but more towards how to use the existing abilities of each individual. Similarly, thinking skills can help students to solve problems and can make students smart in thinking about things. Thinking skills can be formulated as the process of using the mind to find a solution or understanding of something. Thinking skills also allow students to integrate each newly experienced experience into each individual's mind box. The aim of this study was to identify the thinking style patterns and the level of thinking skills between the demographic factors among technical students. The design of this study was descriptive and inferential with a quantitative approach. A total of 273 technical students from the Faculty of Technical and Vocational Education (FPTV) at Universiti Tun Hussein Onn Malaysia (UTHM) were randomly selected as a sample. They consist of Building Construction (BBB), Catering (BBC), Welding and Metal Fabrication (BBD), Electrical and Electronics (BBE), Creative Multimedia (BBF) and Refrigeration and Air Conditioning (BBG). A set of modified questionnaires from past studies were used as research instruments. Majority of technical students have a balanced thinking style and follow by critical and creative thinking style. Among the three types of skills, majority technical students have high level of practical thinking skills, followed by creative thinking skills and analytical thinking skills. It is hoped that this study can provide guidance to students, lecturers and institutions to improve teachers' teaching and learning methods and techniques based on students' thinking style and thinking skills.

Keywords: Thinking styles, thinking skills, analytical, practical, creative, technical students

1. Introduction

Malaysia is now making strides towards a fourth-wave industry-based economy that emphasizes automation technology as a stimulus indicator to economic growth. The increase in students in both public and private institutions has shown good development (Ali et al., 2018). Technical and Vocational Education (TVE) is important in producing

highly skilled talent and at the same time can meet the needs of the country and this talent is an important investment as a driver of economic progress dominated by the industrial sector (Mansor, 2017). In addition, TVE is also one of the ways to train students with skills as well as prepare graduates for the world of work (Thangaiah, Jenal & Yahaya, 2020). The development of skilled workers can help the economic transformation from a middle-income country to a high-income country and it is one of the agendas of the 11th Malaysia Plan (2016-2020) (Haji Zainal Abidin, 2021). This is because quality graduates are expected to succeed in the increasingly challenging world of work in this era of globalization (Mohamed Makhbul & Abd Latif, 2019).

Therefore, it is not surprising that the terminology of thinking skills is not unfamiliar to Malaysians in general and educators in particular. The use of thinking skills in the teaching and learning process can encourage students to acquire new information, store, organize and relate it to existing knowledge (Thavarajah, 2021). Thinking skills are also significant in producing more robust citations according to current needs and developments and are the most basic skills that can be developed. In addition, with an understanding of individual thinking style can explain new ideas and views in an activity (Osman et al., 2020). Every individual needs a thinking style to avoid failure and solve problems better (Maya, Sari & Zanthly, 2018). Creative and critical thinking style can help students to test the truth of a problem so as not to make decisions in wrong conclusions (Syarif, Fatchurahman & Karyanti, 2019).

2. Problem Statement

The study found that graduates find it difficult to get employment opportunities (Hanapi et al., 2018). In general, employers need employees who have skills in problem-solving in various ways. This makes it easier for employers to get good job results. In addition, skilled workers also experience problems caused by them being weak in problem-solving (Hanapi et al., 2018). This is because, since they do not apply thinking skills from the beginning. The demand of employers today is too high where employees need to master thinking skills in their field of work because employers need employees who can handle challenging tasks comparable to the currents of globalization (Musta'amal et al., 2015).

In addition, most technical students in institutions face difficulties in understanding learning in the classroom and result in students' ability to complete assigned tasks in limited circumstances and this will result in the results of completed assignments being of low-quality (Jamil, Sepikun & Muhammad, 2021). The study of Mahamod and Lim (2017), showed that many instructors submit questions that are focused on the simple level only during the teaching and learning process question and answer sessions or tests conducted, namely knowledge and understanding only. Therefore, the teaching and learning process which is focused on examinations causes efforts to produce students who are balanced in terms of intellectual, spiritual, emotional, and physical as contained in the Philosophy of National Education (PNE) cannot be fully implemented (Daud & Ab Rahman, 2020).

Similarly, students also argue that using the right-thinking style takes a long time to solve a problem. Therefore, students ignore the style of thinking that should be used to produce better and excellent work. Moreover, the attitude of a handful of students is only to learn to get adequate results only (Chew & Nadaraja, 2016). This is because during the teaching and learning process students are not exposed to the right-thinking style and fail to apply the right-thinking style to obtain excellent exam results (Aminuddin, Md. Sabil & Jamian, 2020). In addition, there are also students who do not have a thinking style (Kunyo & Mohammad Yasin, 2021).

In addition, gender also influences thinking style. Gender factors are important and often studied factors. Gender issues have been considered as an important influencing factor on students' thinking style. The field of study also contributes to the factors that influence thinking skills. This can be seen from the study of (Rule & Stefanich, 2012) stated that differences in fields affect thinking skills because each field that students are involved in is not the same as other students' fields. Furthermore, not only thinking skills but also thinking styles are also influenced by the field of study. According to Aljaberi (2015), students' thinking style differs according to the student's field of study because each subject in the field is different, and students need to know the appropriate style for them.

Academic achievement is one of the issues that will be influenced by thinking skills (Allen, Grigsby & Peters, 2015). This is because the higher the academic achievement of the student the higher the use of their thinking skills. In addition, the existing examinations need to be revamped to further increase the focus on thinking skills so that students can think critically (Abosalem, 2016). In addition, academic achievement is also influenced by thinking style. This is because, if students do not know the correct thinking style according to the suitability of students, then the student's exam results will be stagnant, and the lessons learned are just to sit for the exam only (Kiamsin & Talin, 2018). Therefore, research objectives are:

- a) To identify thinking style patterns among technical students based on demographic factors.
- b) To identify students' perceptions of the level of thinking skills among technical students based on demographic factors.
- c) To identify differences in the level of thinking skills based on the thinking style of technical students.

3. Methodology

The purpose of the study design is to get answers to the research questions. The results of a study are based on the methodology and design of the study. Descriptive quantitative methods were chosen by the researchers to be used in this study.

3.1 Population and Sample

The sample of this research consisted of 273 students from the Faculty of Technical and Vocational Education who were randomly selected. This is based on the Krejcie and Morgan (1970) samples size table which sets the number of samples required for a study to be conducted based on the population.

3.2 Research Instruments

The research instruments consist of four sections namely A, B, and C which was modified from past studies. Section A is for the demographic respondents which have four items, Section B has 34 items related to creative and critical thinking styles. The items in this section are from Creative-Critical Style Test (Chua, 2004). This questionnaire has a special scoring concept because each item of the question is not based on correct or incorrect answers. Each answer answered by the respondent will be taken into account if it is relevant and section C of the researcher will focus on questions related to Sternberg Thinking Skills acquired by technical students at Faculty of Technical and Vocational Education (FPTV). The modified instrument contained 18 items containing 6 analytical items, 6 practical items, and 6 creative items where questions 1 to 6 were analytical questions, questions 7 to 12 were practical questions and questions 13 to 18 were creative questions. In this section, the researcher chose likert scale and a ranking scale to construct the questions. Likert scale is an item submitted to obtain a level of agreement on the statement submitted.

4. Results and Discussion

The results of the data collected from the instrument of the questionnaire have found that it is a normal distribution based on the analysis report from the software SPSS version 26.

4.1 The Thinking Style Patterns Among Technical Students Based on Demographic Factors

Table 1 shows the thinking style patterns among technical students based on demographic factor. The results of the study for this question show that overall technical students at FPTV have a balanced thinking style followed by a critical thinking style and students also have a creative thinking style. But none of the students have a high creative thinking style and a high critical thinking style.

In terms of gender, the results of the study show that the pattern of thinking style for both sexes is a balanced thinking style. This is because the way of learning used by each gender is the same way of learning. In addition, the syllabus used by lecturers or teachers is the same syllabus for all students and it is to achieve the learning objectives that have been set in the curriculum syllabus. This can be attributed to creative and critical thinking as well as innovative thinking to be the focus in efforts to produce a balanced human capital to address current and future challenges (Puteh et al., 2012).

In terms of program, the majority of fields have a balanced thinking style. This is because the assignments given by the lecturers are the same assignments according to their respective fields. In a several faculty subjects combined combine several areas and, in the class, students have to discuss and do assignments in groups. This is supported by Yee et al (2018) who stated that students always make group discussions to share and gave ideas to complete the tasks given by the lecturer and students in working together in-group members to complete the tasks given by the lecturer directly able to apply a balanced thinking style between students despite different fields.

If it can be seen from the academic achievement factor, it also shows that the majority of students have a balanced thinking style. This is because every student regardless of their level of academic achievement is taught and educated from the beginning on how to solve problems. The ability to think creatively and critically can be applied to students through discovery and problem-solving.

In addition, the results of the year of study show that the majority of students have a balanced thinking style. But the majority of year 1 students represent a balanced thinking style. This is because this year most of the early 20s are between 21 to 23 years old. So, this is because the age factor also affects the thinking style of each individual. This is supported by Ling who says that the younger the age of an individual the higher their creativity and critical (Ling, 2015). Likewise, vice versa, the culmination of a creative and critical decline for an adult is if he or she is getting older.

Table 1 - The thinking style patterns among technical students based on demographic factors

Demographic factor	Very creative		Creative		Balanced		Critical		Very critical		Total		
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	
Gender	Male	0	0	23	8.24	62	22.71	28	10.26	0	0	113	41.21
	Female	0	0	25	9.16	88	32.23	47	17.2	0	0	160	58.61
	Total	0	0	48	17.4	150	54.94	75	27.48	0	0	273	100
Programme	BBB	0	0	10	3.66	20	7.33	14	5.13	0	0	44	16.12
	BBC	0	0	5	1.83	30	10.99	13	4.76	0	0	48	17.58
	BBD	0	0	8	2.93	30	10.99	8	2.93	0	0	46	16.85
	BBE	0	0	12	4.40	21	7.7	13	4.76	0	0	46	16.85
	BBF	0	0	2	0.73	33	12.09	15	5.49	0	0	50	18.58
	BBG	0	0	11	4.03	16	5.86	12	4.4	0	0	39	14.29
	Total	0	0	48	17.58	150	54.96	75	27.47	0	0	273	100
CGPA	CGPA > 3.70	0	0	12	4.4	35	12.82	16	5.86	0	0	63	23.08
	3.00 < CGPA > 3.69	0	0	34	12.45	112	41.03	58	21.25	0	0	204	74.73
	2.00 < CGPA > 2.99	0	0	1	0.37	3	1.1	1	0.37	0	0	5	1.84
	CGPA < 1.99	0	0	1	0.37	0	0	0	0	0	0	1	0.37
	Total	0	0	48	17.59	150	54.95	75	27.48	0	0	273	100
Year 1	Sem 1	0	0	8	2.93	17	6.23	9	3.2	0	0	34	12.36
	Sem 2	0	0	3	1.1	19	7	17	6.23	0	0	39	14.33
Year 2	Sem 1	0	0	4	1.47	21	7.7	8	2.93	0	0	33	12.1
	Sem 2	0	0	0	0	17	6.23	8	2.93	0	0	25	9.16
Year 3	Sem 1	0	0	13	4.76	17	6.23	4	1.47	0	0	34	12.46
	Sem 2	0	0	6	2.2	20	7.33	10	3.66	0	0	36	13.19
Year 4	Sem 1	0	0	6	2.2	26	9.52	11	4.03	0	0	43	15.75
	Sem 2	0	0	9	3.3	15	5.49	8	2.93	0	0	32	11.72
Total	0	0	49	17.96	152	55.73	75	27.38	0	0	273	100	

4.2 The Level of Thinking Skills Among Technical Students Based on Demographic Factors

Table 2 shows the level of thinking skills among technical students based on demographic factors. The results of the study show that the majority of technical students in FPTV have a high level of practical thinking skills then followed by creative and then analytical. This is because the respondents are technical students and most of the subjects studied contain practical elements. So that students are used to being exposed to practical thinking skills. This is supported by Che Hassan, Mohd Daud and Abdul Karim (2020) said that TVET is hands-on learning that is practical and requires real experience to sharpen students' practical skills.

In terms of gender, the majority of students mastered practical thinking skills but female students mastered analytical thinking skills because female students are more knowledgeable and cleverer in terms of evaluating, analyzing

information, and understanding women better than men. This is supported by Mohamad Lutpi and Ramli (2021), stating that things involving reading and research are more in favor of female students while students prefer something like riding, doing an activity that involves movement and male students are more active in using abilities in something (Mohamad Lutpi & Ramli, 2021).

If viewed from the program factors, the fields of BBC, BBD, BBE, and BBG have a high level of practical thinking skills. This is because each of this program requires practical training in their learning syllabus and that is the main thing to ensure that students are proficient in the field that the students are involved in. The process of practical teaching differs from theoretical teaching because it is implicit and difficult to teach only by conversation (Connel et al, 2020). In addition, BBB students have a high level of mastery of analytical thinking skills because students in this program use these skills more in the student syllabus. The subjects BBB students use are more focused on problem-solving, analyzing information than doing practical skills. This is supported by Hassan et al (2007) said that building construction students will more often use the method of analyzing problems and evaluating a problem than practicing. As for the BBF program, the level of mastery of thinking skills is creative. This is because BBF students do not carry out any workshop or laboratory work and most students do the work using computers and software. Therefore, they need to use creative thinking skills by learning how to use various types of gadget techniques (Rahbania, Rasouli & Attaran, 2016).

In addition, the findings for academic achievement also found that all students who obtained a CGPA of 3.70 and above have high practical and creative thinking skills. This is because, while doing practical work, students also use their minds to find other ways how to solve problems if the practical work does not get the desired results. This is supported by Ali and Mustaffa (2017) who stated that students with high practical mastery indirectly have high creative thinking skills because every step of the work requires students to use their minds to imagine and know the results of practical done. For students who get a CGPA of 3.00 to 3.69 have a high mastery of analytical thinking skills because these students are more analytical than analyzing and evaluating the information obtained from practicing it. For students who get a CGPA of 2.00 to 2.99 have practical thinking skills only, they can practice practical or work carried out even weaker from using thinking to solve problems.

In addition, for the results of the year of study, students in year 1 semester 1 mastered practical thinking skills. This is because before students enter FPTV students have been exposed to the practical basics. So, students are accustomed to practical thinking skills and proficient in practical (Abdul Aziz & Abd Rahman, 2018). For semester 2 students master a high level of mastery in creative thinking skills because in this semester students are exposed to subjects that require using creative skills in producing a product or prototype. For year 2 both semesters mastered the level of creative mastery because before entering year 2 students had taken subjects involving creative elements. Thus, students can practice these elements in the future. Year 3 students, on the other hand, have mastery of thinking skills, the majority of students are practical thinking skills. This year most students have to take subjects that involve workshops and have to master them to do practical. For year 4 semester 1 students, the majority of students master the level of analytical and creative mastery because in year 4 semester 1 students are taking a final master's project where this project is one of the requirements for students' bachelor's degree and this project teaches students to use analytical thinking skills for problem-solving and creative for their creative abilities, making explorations for student's undergraduate projects. Next, for semester 2 the level of student mastery is practical. This is because each year of study students will be exposed to various practical or learning that use a lot of "hands-on" rather than theory. This is supported by Mohamad Lutpi and Ramli (2021) said that the longer students seek knowledge related to the field of students the higher the skills of students to practice the matter.

Table 2 - The level of thinking skills among technical students based on demographic factors

Demographic Factors	Analytic						Practical						Creative								
	Low		Moderate		High		Low		Moderate		High		Low		Moderate		High				
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%			
Gender	Male	1	0.37	6	2.2	104	38.1	1	0.37	7	2.56	10	38.8	6	3	1	0.37	9	3.3	10	38.1
	Female	0	0	7	2.56	155	56.78	0	0	6	2.2	15	56.0	3	4	0	0	7	2.56	15	56.6
	Total	1	0.37	13	4.76	259	94.88	1	0.37	13	4.76	25	94.8	9	7	1	0.37	16	5.83	25	94.7
Programme	BBB	1	0.37	2	0.73	42	15.38	1	0.37	2	0.73	35	14.6	5	1	0.37	3	1.1	41	15.0	

BBC	0	0	2	0.73	46	16.8 5	0	0	1	0.37	46	16.8 5	0	0	3	1.1	44	16.1 2
BBD	0	0	3	1.1	41	15.0 2	0	0	2	0.73	28	16.1 2	0	0	5	1.83	41	15.0 2
BBE	0	0	2	0.73	44	16.1 2	0	0	2	0.73	33	16.8 5	0	0	3	1.1	44	16.1 2
BBF	0	0	5	1.83	45	16.4 3	0	0	1	0.37	49	17.9 5	0	0	0	0	50	18.3 2
BBG	0	0	2	0.73	37	13.5 5	0	0	1	0.37	38	13.9 2	0	0	2	0.37	36	13.1 9
Total	1	0.3 7	15	5.85	255	93.3 5	1	0.3 7	9	3.3	26 3	96.3 4	1 37	0. 37	16	5.86	25 6	93.7 9

4.3 Differences in The Level of Thinking Skills Based On the Thinking Style of Technical Students

Table 3 shows differences in the level of thinking skills based on the thinking style of technical students. The results of ANOVA analysis showed that there was a significant difference in the level of analytical thinking skills between the five types of thinking styles of technical students. This is because, according to Sternberg (1999) says analytics is better at solving problems, formulating strategies, organizing, and presenting the information. Thus, analytical thinking skills differ from creative and critical thinking styles. Where creative is more in nature has high intellectual power and is willing to accept and be able to try new ideas. Students who have these analytics usually achieve high scores for intelligence tests but they lack creative and critical thinking (Syaparuddin & Elihami, 2020).

Moreover, there was no significant difference in the level of practical and creative thinking skills between the five types of thinking styles of technical students. This is because the characteristics of practical and creative thinking skills have the same characteristics of creative and critical thinking styles. For example, the ability in a critical thinking style to solve problems can be enhanced with creative thinking skills. For practical thinking skills, Raja Ismail and Ismail (2018) say that practical thinking skills are related to creative and critical concepts. This is because creative and critical elements need to be given more specific emphasis in practical to get the result of good thinking style and thinking skills.

In addition, the mean of creative thinking style is higher than other thinking styles. This is because, a high mean indicates that it is stronger on analytical, practical, and creative thinking skills. For example, creative thinking styles have higher levels of analytical, practical, and creative mastery than other thinking styles. Therefore, students who have a creative thinking style have a high level of mastery of thinking skills.

Table 3 - Differences in the level of thinking skills based on the thinking style of technical students

Thinking Skills	Thinking Styles					
	Very Creative	Creative	Balanced	Critical	Very Critical	
Analytic	N	0	40	149	72	0
	Mean	0	4.08	3.93	4.04	0
	SD	0	0.40	0.34	0.43	0
	P	0.047				
Practical	N	0	40	149	72	0
	Mean	0	4.19	4.07	4.16	0
	SD	0	0.42	0.33	0.41	0
	P	0.627				
Creative	N	0	40	149	72	0
	Mean	0	4.10	4.01	4.07	0
	SD	0	0.38	0.36	0.37	0

5. Conclusion

Each student has their own advantages and disadvantages as well as thinking style and thinking skills. Each student has their own style of thinking and thinking skills. Every style of thinking can be practiced in the lives of students in order to use it as best as possible and to produce an excellent result. Similarly, with thinking skills, each type of thinking skills of students can be honed through experience, training or by participating in any activity organized by the institution so that the skills can be honed. The results of this study show that technical students at FPTV have a balanced thinking style as well as high practical thinking skills. In addition, there was a significant difference of analytical thinking skills with the thinking style of technical students at FPTV.

As a result of the findings of this study, students and lecturers can use it for self-improvement of students and lecturers can use it to find out methods to apply thinking styles and thinking skills that are appropriate for students. The information obtained is very important for an educator to know and know the students in more depth and be able to have an appropriate teaching approach during the teaching and learning process. In addition, indirectly this study can provide a positive impact and efforts to the good development of students and institutions. In addition, it can also provide efforts to the development and advancement of education in Malaysia.

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