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Research paper

Critical Thinking Dispositions among Polytechnic Students: Why Does it Matter?

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Abstract

This study explored the critical thinking dispositions of polytechnic students. The study was conducted in the northern zone of Malaysia on 194 polytechnic students from the Departments of Mechanical and Electrical Engineering. Data were collected using the Engagement, Maturity, and Innovativeness (EMI) critical thinking disposition assessment. Then, the data was analysed using the SPSS version 21 software. Analysis of data comprised of descriptive statistics (percentage, mean and standard deviation) and inferential statistics (one-way analysis of variance, independent sample t-test, and Pearson's correlation). The study points to no significant relation between gender and department. Further analysis showed that there is a strong relationship between CGPA and critical thinking disposition. Therefore, there is a need among students for special assistance in cultivating their critical thinking dispositions from the aspects of engagement and maturity.

Keywords: *Critical thinking dispositions; Polytechnic; Engagement; Maturity; Innovativeness.*

1. Introduction

Disposition is attributed to a learner's drive to think critically (Aljohani, 2012). Davies (2016) pointed out that disposition is a "cast or propensity for the brain" which is vital for practicing critical thinking. Dispositions are more of habits of mind or propensities to reply to circumstances in certain ways (Hattie & Donoghue, 2016). There are numerous cognitive skills and personal dispositions that constitute critical thinking (Borglum, 2016). Insight Assessment (2016) researched on the disposition toward critical thinking, and found that it can be understood in terms of positive habits of mind. It has likewise been a broadly studied impact of critical thinking (Hall & Mortellaro, 2015). Hawkins (2012) claimed that disposition has become an integral factor, knowing that one must have the capacity to think as well as eagerness to do as such.

One must be disposed to think critically as well as have the skills to do so (Helgesen, 2015). A person's dispositions and the quality of inward and outside motivators decide to some extent how every individual connects with what is on offer (Comas-Quinn, 2011). Critical thinking, as a fetish, interpellants subjects who in identifying with it seek to develop the strategies and dispositions of a critical thinker (Cary, 2015). Studies have considered looking at metacognitive factors, for example, the part of thinking disposition which offers a further imperative point of view (Stupple et al., 2017). Tseng (2014) emphasised that feats of critical thinking ability do to some degree expand on the possibility of dispositions. Tan (2017) mentioned that the scope of morality for a critical thinker should go beyond a person's actions and consequences to include one's attitudes and disposition. Thinking disposition auras may figure out which activities ought to be completed, the way to do it, and when it can be done (Mwalongo, 2014). Critical thinking dispositions reflect a critical spirit comprising of a pattern, responsibility, or slant to act fundamentally at a point by applying critical thinking abilities to attend to critical thinking principles and benchmarks (Vieira & Tenreiro-Vieira, 2016). Hürsen and Kaplan (2014) discussed that people's dispositions against critical thinking against can vary in terms of a few factors.

Poe (2016) stated that the advancement of critical thinking dispositions expands the application of critical thinking skills beyond a narrow instructional setting. Tsoi (2014) demonstrated that besides the teaching materials of a specific subject, the general standards of critical thinking dispositions and abilities are made expressly in teaching. The disposition to think critically represents an individual's inclination to take part in effortful thinking and an appropriate approach towards thinking tasks (Ku, 2014). Dong (2015) believes that a crucially important objective of teaching critical thinking is to cultivate students' critical thinking dispositions. Once these dispositions are set up in the early years of education, the instructional programme can progressively construct the refinement of the critical thinking skills being produced (Aizikovitsh-Udi & Cheng, 2015). Class content must be critically and substantively engaged for the dispositional aspect of critical thinking to be manifested (Boghossian, White, Elder, Funston, & White, 2017).

According to Balija (2015), critical thinking educators are capable of evaluating these dispositions and altering them. Learners with weak dispositions to critical thinking skills are not armed

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with enough tools to help them succeed to their full potential at college, the workplace, and life in general (Dennett, 2014). People without thinking dispositions are imperfect in utilising their thinking abilities (Sendag, Erol, Sezgin, & Dulkadir, 2015). Businesses, policymakers, and instructors are in agreement that the dispositional and skill dimensions of critical thinking ought to be viewed as a vital result of an education (McMath, 2016). Critical thinking is subsequently related with propensities of intellect or dispositions, particular activities and judgement (Furness, Cowie, & Cooper, 2017).

Willingness to inquire is indicative of a person's overall disposition to engage in critical inquiry (Hamby, 2014). In addition, dispositions may likewise impact the delivery of content by educators, the learning procedures in a critical thinking course, and the general learning process (Alosaimi, 2014). In another study, Andrews (2015) examined dispositions which include critical spirit, examining curiosity, the insight of psyche, energetic devotion to reason, and want of dependable data. Fahim (2014) concluded that the viability of educating critical thinking skills won't be boosted unless teachers consider the dispositional dimensions of critical thinking as well. A student may possess critical thinking skills but may not possess the inclination or disposition to exhibit them (Clark, 2015). Duran (2015) also explained that dispositions are fundamental characters that learners demonstrate as an indication that they are developing critical thinking skills. Theoretically, the disposition towards critical thinking has been characterised as a vital component of knowledge-building (Leng, 2013). Thus, dispositions and skills should be taught together (Orszag, 2015).

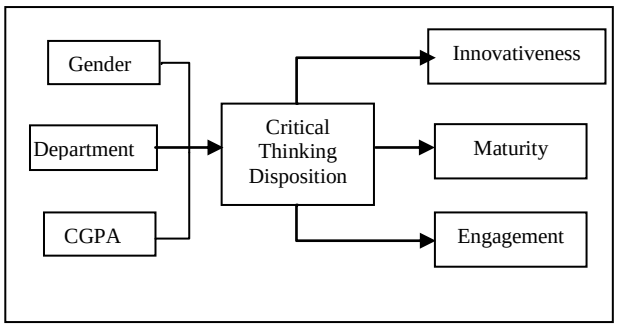


Fig 1: Theoretical Framework

2. Literature Review

Mental characteristics or dispositions recognise a skilled but advanced scholar from a gifted fair-minded thinker (Elder & Paul, 2011). The field of learning has known for decades that it ought to focus on the progressional advancement of critical thinking dispositions (Aizikovitsh-Udi & Radakovic, 2012). A theory on human disposition embodies the hope of critical thinking today (Quijano, 2013). Research activities and peer assessment may benefit the evolvement of dispositions and help students plan for efficient participation in work and community for the long duration (Schoenberger-Orgad & Spiller, 2014). Hall and Mortellaro (2015) who conducted research on critical thinking dispositions have likewise found that it is a broadly studied impact of critical thinking. Vierra (2014) reported that an optimal critical thinker should obtain both thinking skills and dispositions. In another study by McCormick (2014), critical thinking disposition was found to be articulated by the ideal critical thinker. The measurement of critical thinking disposition provides a picture of a person's ability to apply cognitive processes to problem-solving and the ability to learn critical thinking skills in a curriculum (Schroder, 2015).

Educators play an extraordinary part in creating students' critical thinking skills and dispositions (Demirhan & Köklükaya, 2014). Importantly, critical thinking dispositions are precursors and gateways to critical thinking activities (Bell & Loon, 2015). Dispositions are necessary since skills are not sufficient to enable a person to think critically if that person does not have the disposition or motivation to carry them out (Li, 2017). Preliminary work by El-shaer and Gaber (2014) showed that there were statistically significant improvements in students` critical thinking post-intervention compared to pre-intervention due to the effect of problem-based learning. The finding is consistent with findings of a past study by Yu, Lin and Wang (2015) which concluded that no implication was found among the groups in critical thinking dispositions due to the impact of technology-facilitated PBL pedagogy.

Educators reliably and methodically support critical thinking by implementing mathematics to real-life issues, empowering debate, and arranging investigative homework (Aizikovitsh-Udi & Cheng, 2015). In addition, Jou, Lin, and Wu (2014) stated that the overall critical thinking disposition of students in their study's experimental group was superior to those in the control group (p=.047). Atay (2012) observed that the "concept-mapping" strategy improves the critical thinking skills of students. The effect of instructional techniques does not bring on any huge contrasts to critical thinking dispositions (Kalelioğlu & Gülbahar, 2014). In addition, strong learning dispositions play a role in making progress in investigations and routines with regards to the law (Brosseit, 2015). Fonash (2017) found a different conclusion where the effects of an Inquiry-based Curricular Programme had no significant gains on the perspectives of critical thinking skills and dispositions.

Duncan et al. (2017) identified that dispositions are created after some time and are impacted by a person's surrounding environment. The critical thinking disposition concept recognises that setting and inspirations are key to critical thinking (Chen, 2017). Toplak, West, and Stanovich (2017) listed three thinking dispositions that are exceptionally pertinent to choice-making: effective open-minded thinking, future direction, and superstitious thinking. The scaffolding technique is utilised so as to establish critical thinking skills and dispositions (Weinstein & Preiss, 2017). Moreover, teachers need to practice critical thinking dispositions in their daily lives to enhance their teaching efficacy (Sulaiman, Kumar, Mohd, Syrene, & Rahim, 2017).

Mehta (2015) clarified that people with critical thinking dispositions are much more likely to apply their critical thinking skills suitably in both their individual and civic lives. The dispositional and skills dimensions of critical thinking should be treated as essential issues of an education (McMath, 2016). Cheng and Wan (2017) found that the connection between critical thinking disposition and skills is reciprocal. The results showed that when critical thinking disposition scores increased, CGPA scores had also increased (Demirhan & Köklükaya, 2014). Concept mapping is effective in increasing both critical thinking skills and dispositions (Lee, Lee, Gong, Bae, & Choi, 2016). Teachers' histories and identities impact their dispositions towards students (Turner & Drake, 2016).

3. Objectives of the Study

i. To determine the level of critical thinking disposition of polytechnic students.
ii. To evaluate the relationships between gender, department, and CGPA towards critical thinking disposition

4. Methodology

The subjects were second semester students who were selected randomly from two departments of Polytechnic Ibrahim Sultan (N=194). The questionnaire contained 31 items and three factors namely Engagement, Maturity, and Innovativeness (EMI) which are factors taken from a critical thinking disposition assessment created by Ricketts (2003). The questionnaire adopted a 5-point Likert scale (from 1 meaning ''strongly disagree'' to 5 meaning ''strongly agree'').

The Cronbach α values of Innovativeness, Maturity, Engagement were 0.79, 0.75 and 0.89 respectively. The independent variables in the study were gender, department, and CGPA, while the dependent variable in the study was students' scores. Information gathered from this investigation were analysed using the IBM SPSS Statistical package. During the resolving of the data gathered, the percentage, mean, standard deviation, one-way analysis of variance, independent sample t-test and Pearson's correlation analysis were used to analyse the data for further interpretation.

5. Findings

The presentation of results was done according to the two objectives of the study which are to determine the level of critical thinking dispositions of polytechnic students and to evaluate the relationships between gender, department, and CGPA towards critical thinking dispositions.

Table 1 Demographics (N=194)

Variable	Frequency	Percent
Gender		
Male	146	75.3
Female	48	24.7
Department		
JKM	52	26.8
JKE	142	73.2
CGPA		
<=2.50	22	11.3
2.51-3.00	58	29.9
3.01-3.50	85	43.8
3.51-4.00	29	14.9

Table 1 shows that more males (n = 146) had participated in the study compared to females (n = 48). 73.2% of the subjects were from the Department of Electrical Engineering, while the remaining 26.8% were from the Department of Mechanical Engineering. The 3.01-3.50 CGPA level group recorded the highest number of subjects at 43.8%, and the lowest number of subjects were in the CGPA <=2.50 group at 11.3% only.

Table 2 Mean Subscale and Critical Thinking Dispositions (N = 194)

Dispositions	M	SD
Innovativeness	4.0282	.52445
Maturity	3.5975	.48989
Engagement	3.8756	.51439

As shown in Table 2, the highest scores recorded were for the Innovativeness (M=4.0282, SD =0.52445) construct, followed by the Engagement (M =3.8756, SD =.51439) and Maturity (M =3.5975, SD =.48989) constructs.

Table 3 Mean Subscale and Critical Thinking Dispositions Score by Gender (N = 194)

Dispositions	Gender	N	M	SD
Innovativeness	Male	146	4.0074	.53583
	Female	48	4.0917	.48808
Maturity	Male	146	3.6014	.49876
	Female	48	3.5856	.46678
Engagement	Male	146	3.8811	.51112
	Female	48	3.8586	.52932

Referring to Table 3, females scored higher on total Innovativeness than males (M=4.0917). It also indicates that males had higher scores than females in the specific critical thinking dispositions of Maturity (M=3.6014) and Engagement (M=3.8811).

Table 4 Mean Critical Thinking Skill Dispositions Score by CGPA (N = 194)

CGPA		Innovativeness	Maturity	Engagement
<=2.50	Mean	3.7545	3.3434	3.6753
	N	22	22	22
	Std. Deviation	.53428	.35784	.42156
2.51-3.00	Mean	4.0255	3.5709	3.7771
	N	58	58	58
	Std. Deviation	.41679	.43531	.46964
3.01-3.50	Mean	4.1047	3.6799	3.9773
	N	85	85	85
	Std. Deviation	.52620	.53174	.51440
3.51-4.00	Mean	4.0172	3.6020	3.9261
	N	29	29	29
	Std. Deviation	.64866	.50141	.60171

Table 4 indicates that participants with 3.01-3.50 CGPA recorded the highest total scores compared to others for Innovativeness (M =4.1047, SD =.52620), Maturity (M =3.6799, SD =.53174), and Engagement (M =3.9773, SD= .51440).

Table 5 One-Way ANOVA of Critical Thinking Disposition Differences by CGPA (N = 194)

Variables		df	F	Sig.
Innovativeness	Between Groups	3	2.672	.049
	Within Groups	190		
Maturity	Between Groups	3	2.916	.035
	Within Groups	190		
Engagement	Between Groups	3	3.121	.027
	Within Groups	190		

Table 5 shows that there is a statistically significant difference between groups. It can be seen that the significance values are p=0.049 for Innovativeness, p=.035 for Maturity and p=.027 for Engagement, all of which are below 0.05.

Table 6 Pearson correlation between Innovativeness, Maturity, and Engagement (N = 194)

		Innovativeness	Maturity	Engagement
Innovativeness	Pearson Correlation	1	.517**	.837**
	Sig. (2-tailed)		.000	.000
Maturity	Pearson Correlation	.517**	1	.506**
	Sig. (2-tailed)	.000		.000
Engagement	Pearson Correlation	.837**	.506**	1
	Sig. (2-tailed)	.000	.000	

It appears in Table 6 that there is a statistically significant correlation between the three variables as indicated by the sig. (2-tailed) value of 0.000 for Innovativeness, Maturity, and Engagement.

Table 7 Independent Sample T-Test Between Gender Towards Critical Thinking Dispositions

Variable	N	Mean	SD	df	T	Sig.
Male	146	3.8300	.45615	192	-.209	.558
Female	48	3.8453	.39660			

Table 7 exhibits an independent sample t-test which led to the discovery of critical thinking disposition according to gender. The t-test reported that there was no significant difference (t=-2.09, p>0.05) between males (M=3.83, SD=0.45615) and females (M=3.8453, SD=0.39660).

Table 8 Independent Sample T-Test Between Departments Towards Critical Thinking Dispositions

Variable	N	Mean	SD	df	T	Sig.
JKM	52	3.9107	.32506	132.508	1.747	.019
JKE	142	3.8056	.47463			

Table 8 shows that the t-test result had delivered a non-significant outcome, demonstrating that there is no difference between departments towards critical thinking dispositions (t=1.747, p=0.083>0.05) when comparing males (JKM=3.9107, SD=0.45615) and females (M=3.8453, SD=0.39660).

Table 9 Pearson Correlation Between Critical Thinking Dispositions and CGPA

Variables	N	r	Sig.
Critical Thinking Dispositions	194	0.182	0.11
CGPA			

As can be seen in Table 9, the two-tailed Pearson correlation analysis showed that there is a significant relationship between critical thinking skills with CGPA at the 0.05 level. However, the difference is very low at a coefficient value of 0.182. Therefore, it can be concluded that the higher the critical thinking dispositions, the higher the CGPA

6. Conclusion

The point of this research was to examine the viewpoints of critical thinking dispositions. The academic achievement (CGPA) of polytechnic students was found to be associated with critical thinking dispositions, thus more efforts should be focused on improving critical thinking dispositions by educators. As mentioned in the introduction, using the various delivery methods of teaching could be a way to increase critical thinking dispositions (Boghossian et al., 2017). The t-test revealed that there was no significant difference between gender and department towards critical thinking dispositions. Participants with 3.01-3.50 CGPA recorded the highest total scores compared to others for Innovativeness, Maturity, and Engagement.

It shows that students with higher CGPA possess higher critical thinking dispositions too. From the three constructs, the highest scores recorded were for Innovativeness, followed by Engagement and Maturity. It shows that some improvements must be made to increase engagement and maturity simultaneously. These findings further support the idea of Hürsen and Kaplan (2014) who discovered the need for special assistance for students to establish critical thinking dispositions in the aspects of engagement and maturity. Consequently, the suitable teaching delivery methods for polytechnic students should be identified, and the plausible correlation between critical thinking dispositions and teaching delivery method should be investigated as suggested by McMath (2016).

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