

Critical Thinking Dispositions of New Intake Engineering Technology Students

Afiza Mohamad Ali¹, Muhammad Nadzri Abdul Aziz², Isarji Sarudin³, and Ainol Madziah Zubairi⁴,

ABSTRACT

Problem-solving and critical thinking abilities serve as important outcomes of any engineering programme. Engineering students are expected to solve problems, ask questions, research and discover relevant information, and consider new ideas. This paper presents the findings a study to determine the initial critical thinking dispositions of new intake engineering technology students in the effort to provide base-line data for the integration of critical thinking (CT) in the English syllabus of the engineering technology programme. This is part of a larger English curriculum review exercise with a special focus on the integration of soft skills. A 10-item self-assessment questionnaire was distributed to 1425 new intake engineering students. When the findings of the CT dispositions are considered, CT dimension of detecting bias and exaggeration was cited the most among respondents. Low CT dimensions are evaluation and compare and contrast. Additional findings from focus group interviews reveal peculiar yet interesting insights on CT among the students. Implications of the findings in relation to CT for engineering technology students are discussed.

Keywords: Critical thinking dispositions, Problem solving, Engineering students, Curriculum review, English as a Second Language (L2) learner.

1. INTRODUCTION

For engineering students, equipping them with the skills and knowledge required to be successful global engineers in the 21st century is one of the primary objectives of undergraduate educators. The emphasis is placed on project or problem-based learning methodologies in order to become effective communicators with good problem-solving and CT skills (Zulkifli Mohd

¹ DR AFIZA BT MOHAMAD ALI, Centre for Foundation Studies, Universiti Kuala Lumpur, Malaysia, drafiza@unikl.edu.my.

² MUHAMMAD NADZRI B. ABDUL AZIZ, Centre for Foundation Studies, Universiti Kuala Lumpur, Malaysia, mnadzri@unikl.edu.my.

³ ASSOC. PROF. DR. ISARJI B. HJ. SARUDIN, Centre for Languages, International Islamic University Malaysia, Malaysia, isarji@iiu.edu.my.

⁴ ASSOC. PROF. DR. AINOL MADZIAH BT. ZUBAIRI, Faculty of Education, International Islamic University Malaysia, Malaysia, ainol@iiu.edu.my.

Nopiah et al, 2009; Richard et al., 2007). Hence, engineering students are not only expected to be competent in hard skills or technical knowledge but also in the soft skill areas.

In addition, for students whose English is a second language (also known as L2 learners), it is more than just communication skills. It is also the attitude of communicating and thinking critically in that second language. Deterministic views and studies on the impracticality of CT among L2 learners have created rigid cultural borders between Western and Eastern culture, as Asian learners are often typified as quiet, lacking individual voice and CT skills due to their collective cultures compared to their Western counterparts. The problem possibly comes as the result of the spoon-feeding method that is characterized in English learners in Asia (Stapleton, 2002).

The need for students or graduates who are able to think critically has been reiterated numerous times in the past decade. The Ninth Malaysia Plan requires Malaysian tertiary universities to meet the needs of global employment and improve employability of local graduates (Ninth Malaysia Plan, 2006), through the acquisition of 'global' skills –communication and CT skills. They face a challenge from employers, where critical thought and good communication skills are highly valued and expected (Pithers 2000; Buffington, 2007; Jones, 1997).

The Malaysian Ministry of Higher Education's Malaysian Soft Skill Scale (My3S), which was introduced to measure the level of soft skills mastery among Malaysian final year undergraduate students in public and private higher education institutions nationwide, also stressed communication and CT skills among others (<http://www.sun2surf.com/article.cfm?id=46586>.) In spite of this, employers frequently complain that graduates lacked important soft skills like communication and analytical skills albeit being academically proficient (Roselina Shakir, 2009).

Hence, this preliminary study aims to investigate new intake engineering technology students' CT dispositions and basic understanding of that concept, in order to draw conclusions from the study which could assist in the curriculum review exercise of the university's English language courses that meet the needs of the stakeholders as a whole. The research questions were as follows:

1. What are the critical thinking dispositions of new intake engineering technology students?
2. What do engineering technology students understand in terms of 'critical thinking'?

2. LITERATURE REVIEW

Phillips & Bond (2004), Tapper (2004), and Barnett (1997) mention that CT is a defining characteristic of the university student. Critical thinking, defined as the careful and deliberate determination of whether to accept, reject or suspend judgment (Moore & Parker, 2004) and the process of reasonably deciding what to believe or do - decision making (Ennis & Millman, 1985), has become of paramount importance among educators and one of the skills all language courses strive to teach. Workplaces and universities require workers and students who are proficient in critical thinking and reading skills to identify and solve problems (Chamot, 1995). Such high expectations require more than just memory skills - students need to use English as a *communicative vehicle* to explain, justify, analyse, infer, critique and evaluate (Bloom, 1956).

But what is an ideal critical thinker? The "Consensus Statement Regarding Critical Thinking and The Ideal Critical Thinker" (Facione, 1990) states:

*"The ideal critical thinker is **habitually** inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit."* (p.3)

Being a critical thinker means having certain kinds of CT skills (eg. analysis, evaluation and self-regulation), knowledge (e.g. background knowledge) as well as dispositions or habits (eg. willing to question, compare and contrast, suspend judgment, being open-minded, self-confident, and analytical; in short, having a willingness or attitude to engage in sustained CT) (Facione, 1990b). To Sternberg (1985), CT means solving problems using strategies and skills whereas Lipman (1991, p.106) defines it as critical reflective thought "as arising out of perplexity and doubt, and involving a search for material that would resolve this doubt". The attention is not just on the practical skills, and knowledge, but it also mostly involves the dispositional or habitual spirit of inquiry which is action-oriented and regarded as essential to be instilled into students (Ruland, 1999).

The call for CT among L2 university students is highlighted by Crismore (2000), who claims that since the 1980s, English language educators all over the world have been told that a successful university experience for L2 students requires that they develop the essential CT and reading skills. However, the idea of inculcating CT among L2 learners has raised much

concern especially among native English researchers whose views centred on L2 learners' distinctive and deep-rooted cultural patterns of thought which the researchers claimed were not conducive to radical change such as to that of CT (Samuelowicz, 1987, cited from Watkins et al., 1991; Flowerdew and Miller, 1995; Allison, 1996; Ballard, 1996; Richards and Skelton, 1991). Nonetheless, many studies have shown that CT can be taught and inculcated among L2 learner (Pally, 2001; Moore, 1995; Afiza Mohamad Ali and Nuraihan Mat Daud, 2003).

There is no consistent evidence that all L2 language students faced problems in adapting to academia in terms of cultural differences (Belcher and Braine, 1995, cited from Johnston, 1998). Littlewood (2000) examined 2,307 students from eight Asian countries: Brunei, China, Hong Kong, Japan, South Korea, Malaysia, Thailand, and Vietnam and found that Asian students are critical - "Asian students do not, in fact, wish to be spoon-fed with facts from an all-knowing 'fount of knowledge'. They want to explore knowledge themselves and find their own answers" (p. 34). Stapleton (2002) conducted a survey on the attitudes of 70 Japanese university students and found that the students were not shy to voice opinions to their teachers. Stapleton also found that the students had a firm grasp of elements of CT.

3. METHODOLOGY

This preliminary study utilized a self-assessment survey in which students rate themselves as 'often', 'sometimes' and 'rarely' in their tendencies to think critically. The items in the survey were adapted from the main CT dispositions formulated by Abdullah (1994), namely, 1) disposition to question, 2) disposition to compare and contrast information, 3) disposition to find cause and motives, 4) disposition towards getting the truth of the matter, 5) disposition to reflect on causes and implications, 6) disposition to detect bias and exaggeration, 7) disposition to evaluate arguments and 8) disposition to compare factual and subjective statements. 10 items were included in the survey in order to capture the perceptions of students' CT dispositions. The survey was administered to 1425 engineering technology university students. Responses to the survey were analysed using the SPSS software version 12. A focus group interview was conducted to further explore the students' general understanding and experiences of CT.

4. FINDINGS

The findings are presented based on the two research questions. The results are presented based on the percentages of responses according to the statements in the questionnaires. Findings from the interviews were subjected to thematic-content analysis.

4.1 Engineering Technology Students' Critical Thinking Dispositions

According to the findings indicated in Table 1, the students were divided in terms of their opinion concerning CT dispositions. About 49.1% of the students, which was the highest percentage of CT disposition, stated that they often had CT disposition to detect bias and exaggeration (49.1%), while only 20.4 % indicated that they often had Ct dispositions to evaluate arguments and to compare factual and subjective statements.

1) To detect bias and exaggeration (D6)	49.1%.
2) To compare factual and subjective statements (D8)	47.2%
3) To compare and contrast information (D2)	47.1%.
4) To find cause and motive (D3)	45.1%
5) To question (D1)	45.1 %

The least 'often' dispositions are presented below:

1) to evaluate arguments (D7)	20.4%
2) to compare factual and subjective statements (D8)	20.4%

(For overall findings, see Appendix 1).

Table 1: Critical thinking dispositions of new intake engineering technology students

	DISPOSITIONS	SCALE % (OFTEN)
1.	Disposition to question truth	26.7
2.	Disposition to question motives and intention	45.1
3.	Disposition to compare and contrast information	47.1
4.	Disposition to find cause and motive	45.1
5.	Disposition towards getting the truth of the matter	39.0
6.	Disposition to reflect on causes and implications	40.9
7.	Disposition to detect bias and exaggeration	49.1
8.	Disposition to evaluate arguments	20.4
9.	Disposition to compare factual and subjective statements	20.4
10.	Disposition to compare factual and subjective statements.	47.2

4.2 Engineering Technology Students Understanding of the term Critical Thinking

4.2.1 Perceptions of CT

The students gave varying definitions of CT. Based on the data from the focus group discussion, most of the students stated that CT was *something positive and beneficial to university students in order to solve problems*. Other definitions of CT included:

- *thinking outside the box*
- *decision making by looking at the positives and negatives of an issue*
- *something unachievable which you do not know how to go about it*
- *thinking done only during an emergency hence should be done quickly*
- *something difficult to be done and can be stressful*
- *thinking or talking about critical issues like politics*
- *Bill Gates and Tun Mahathir*
- *Risk takers and bravery*

4.2.2 Applications of CT

The students were asked to indicate the applications of CT and most of the students' responses concentrated on asking their family and friends for their opinions to help make decisions in relation to tertiary education related to continuing one's education, answering exam questions or completing assignments. One student said,

Something like when I want to further my studies. I asked my siblings for their opinions about my choices.'

Another application of CT expressed by the students during the focus group discussion was regarding making a choice between work and continuing education. For example, one student stated,

I got offers to work during my studies so I need to think really deep whether or not I should stop studying or working... so I got the advice from my mother and friends... and I decided to continue studying.

In asking the students how likely they were to question their peers, family members or their lecturers on certain issues or information, most of them claimed that they did not question to a point of showing disrespect to the person. This is especially true during classroom interactions with their lecturers. One of them stated that questioning benefits the learner as it could help the clarification of subject-matter content. However, he would not question too much as he did not want the lecturer to see him as a 'rebel' in class who "asks too much". Most of the students agreed with him on this but added that they did not ask 'why' the lecturer said things but rather, 'what' the lecturer said. When asked why this was so, some of the students said that they did not see the reason to do so as the lecturer should know what he or she was talking about. Hence, to the students, questioning could be seen as to obtain further information or clarification but not to a point of countering or challenging that information.

5. DISCUSSION

The focus of the study was to investigate new intake engineering technology students' critical thinking dispositions and awareness of CT prior to starting a university education. The quantitative findings indicate that nearly half of the new intake students had the tendencies to think critically in terms of dispositions to detect bias and exaggeration, to compare factual and subjective statements, to compare and contrast information, to find cause and motive, and to question motives and intention. While these results indicate the main CT dispositions that students were inclined to, it is interesting to note that

students were less disposed towards evaluating arguments (D8) and questioning the truth (D1).

These findings were supported by students' responses in the focus group discussion - that they were more prone to finding out what friends or family had to say about an issue by means of comparing and contrasting opinions but not to a point of evaluating or questioning the input further. In a way, the students felt that getting opinions from others was good for making an informed decision. However, they did not reveal that they had to argue the opinions further. They merely commented the pros and cons of each opinion. The findings of this study demonstrated that the students were more inclined to learn for meaning, with emphasis on understanding the supposed meaning of the issue, rather than further questioning or evaluating the arguments or opinions analytically, especially in class with their lecturers. This conforms to the study by Nora Nasir (1997) on ESL learner difficulties in Malaysia. She found that students generally were reluctant to speak their minds or question in class as this was seen as undermining the credibility of the teacher which was uncalled for and disrespectful.

The second research question addressed students' understanding and experiences of CT in their lives. For a few of these students, CT seems to mean having the skills to make decisions and solve problems, particularly looking at the pros and cons or many sides of an issue, which is actually the ability to compare and contrast. This is consistent with the quantitative findings above in terms of the students' disposition to compare factual and subjective statements and information. In fact, this is further confirmed by their application of this type of CT disposition by suspending judgment prior to deciding their course of action ie further studies. It is important to take note of such perceptions in view of the fact that they are consistent with CT literature in terms of the definition of CT. It may also mean that this group of students had some general or surface understanding of CT attributes as a result of their prior learning.

CT was also seen as a difficult and impossible feat to achieve. As far as these students are concerned, CT may not be a dominant practice in their lives nor in their past education as it is not in their culture to be critical. The foregoing discussion can be linked with the unique culture of Asian students, "all of which have been greatly influenced by religious beliefs and systems of thought that honour and nurture conformity, obedience and passivity" (Gieve, 2000, p.57).

Some of the students thought that CT could only be done in an emergency situation which then required fast thinking to address the situation. As a result, the person could feel very pressured and stressed. This notion can be linked with the example given by a student in terms of the relationship between CT

and politics. It is interesting to observe that these students were able to relate to CT with politics even though university students are not allowed to get involved in politics. It is also interesting to note that background knowledge and extensive reading were deemed important in order to reflect criticality in politics. This is congruent with the study by Stapleton (2001), who investigated whether content familiarity had an effect on forty-five 2nd year Japanese undergraduates. Results from the study illustrated that the group which received treatment on content familiarity scored significantly higher ($p < 0.01$) than the control group on the CT test. This implicates the role of learner's background knowledge in CT. A case study by Afiza Mohamad Ali (2006) also indicates the importance of knowledge, which comes from doing extensive reading, inevitably aids one in acquiring more information for discussion and argumentation purposes, which in this case, is linked to politics by the student in the present study.

Qualitative findings also showed the striking equation of famous people to CT in terms of being "risk-takers and brave" in voicing out ideas and making decisions. Although this may be slightly slanted with regards to the disposition of a critical thinker, one cannot help but see that being brave here has to do with the critical thinker as an active person compared to a passive one, and one who dares to take risks or in this sense, to question or evaluate arguments.

Nonetheless, this reflects the real life scenario in Malaysia where politics takes a dominant role in Malaysian daily life. Such peculiar perceptions of CT may illustrate students' basal understanding of CT and that they need to be taught the skills and benefits of CT in relation to being engineering students at tertiary level.

6. CONCLUSIONS

The findings of this study indicate that nearly half of the new intake engineering technology students had the tendency to think critically. In view of the fact that the respondents were first semester students, there is an urgent need for the university authority to come up with the appropriate strategy and approach to enhance the students CT dispositions because students at the tertiary level are expected to solve problems, ask questions, research and discover relevant information, and consider new ideas. With the constraints of time and culture, the other fifty percent of the tertiary students need to be given the right input in order to acquire the critical thinking skills and dispositions. In terms the English curriculum review exercise, there should be a special focus on the integration of this soft skill with English with emphasis on extensive reading. At the same time, the university authority will face a more difficult task of exposing all their students to tertiary level academic

rigours that require the students to ask analytical questions rather than asking for meaning. While the engineering technology students in this study generally embrace CT, there must be the right support given to them in order to be graduates of higher education learning who are equipped with desired soft skills and hard skills for the working world. Nonetheless, living in a culture which upholds conformity, harmony, obedience, and passivity at all levels of education makes this a very daunting task.

REFERENCES

- Adams, P., Heaton, B. and Howarth, P. (eds.) (1991). *Socio-Cultural Issues in English for Academic Purposes*. London: Macmillan, for Modern English Publications in association with The British Council.
- Afiza Mohamad Ali (2005). *Reasoning Strategies, Dispositions and Identity in Critical Reading-Thinking among Malaysian EAP Students*. Unpublished PhD Thesis. Lancaster University, United Kingdom.
- Afiza Mohamad Ali. (2000). *Developing Critical Thinking through the Use of Questions: An Empirical Research*. Unpublished Master Dissertation. International Islamic University Malaysia.
- Afiza Mohamad Ali and Nuraihan Mat Daud. (2003). Using High Cognitive Questions in ESL Classrooms to Develop Critical Thinking Skills, in Ambigapathy Pandian (ed.) *Research and Reflections in Literacy Education*, University Putra Press: Serdang, pp. 153-164.
- Allison, D. (1996). Pragmatist Discourse and English for Academic Purposes. *English for Specific Purposes*, 15, 2: 85-103.
- (2010, August 9). Assessment of My3S at IPTAs to start in July. *The Sun2Surf*, <http://www.sun2surf.com/article.cfm?id=46586>.
- Ballard, B. (1996). 'Through language to learning: Preparing overseas students for study in western universities'. In H. Coleman (ed.). p.148-168.
- Barnett, R. (1997). *Higher Education: A Critical Business*. Buckingham: SRHE and Open University Press.
- Broadbear, J.T. (2003). Essential elements of lessons designed to promote critical thinking, *The Journal of Scholarship of Teaching and Learning*, 3, 3: 1-8.

- Browne, M. N., & Freeman, K. (2000). Distinguishing features of critical thinking classrooms. *Teaching in Higher Education*, 5, 3: 301-309.
- Belcher, D. and Braine, G. (eds.) (1995a). *Academic Writing in a Second Language: Essays on Research and Pedagogy*. Norwood, New Jersey: Ablex.\
- Bloom, B. S. (1956). *Taxonomy of educational objectives: Handbook 1. The Cognitive Domain*. New York: McKay.
- Buffington, M. L. (2007). Contemporary Approaches to Critical Thinking and the World Wide Web. *Art Education*, 60, 1: 18- 23.
- Chamot, A. U. (1995). Creating a community of thinkers in the ESL/EFL classroom. *TESOL Matters*, 5, 5: 1 and 16.
- Coleman, H. (ed.) (1996). *Society and the Language Classroom*. Cambridge: Cambridge University Press.
- Crismore, A. (2000). Helping ESL and EFL university students read critically: A 2000's Challenge. *Opinion Papers*. ERIC Document Reproduction Service. ED 450592.
- Duron, R. et al., (2006). Critical Thinking Framework for Any Discipline. *International Journal of Teaching and Learning in Higher Education*, 17, 2: 160-166.
- Ennis, R.H. and Millman, J. (1985). *Cornell Critical Thinking Test, Level Z*. Pacific Grove: Critical Thinking Press and Software.
- Facione, P. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational and assessment*. The APA Delphi Report. ERIC Document Reproduction Service. ED 315423.
- Flowerdew, J. and Miller, L. (1995). On the notion of culture in L2 lectures. *TESOL Quarterly*, 29, 2: 345-373.
- Gieve, S. N. (2000). *Discourse Learning and 'Being Critical': The Case of a Malaysian English Language Teacher Education Programme*. Unpublished PhD Thesis. Lancaster University, Lancaster.
- Johnston, B. H. M. (1998). *Some Proposals for Teaching Analytical Writing: A Principled, Holistic, Pedagogic Approach*. Unpublished PhD Thesis. University of Southampton.

- Jones, E. A. (1997). Problem-solving and critical reading outcomes expected by faculty, employers and policymakers. *Assessment Update*, 9, 6: 1-10.
- Littlewood, W. (1999). Defining and developing autonomy in East Asian contexts. *Applied Linguistics*, 20, 1: 71-94.
- Lipman, M. (1991). *Thinking in Education*. New York: Cambridge University Press.
- Moore, R. A. (1995). *The Relationship between Critical Thinking, Global English Proficiency, Writing, and Academic Development for 60 Malaysian Second Language Learners*. Unpublished PhD Thesis. Indiana University, Indiana.
- Moore, B.N. and Parker, R. (2004). *Critical Thinking* (7th edition). Mountain View, CA: Mayfield Publishing.
- Nora Nasir (1997). *ESL Learner Difficulties in the Malaysian Literature Classroom*. Unpublished PhD Thesis. University of Strathclyde.
- (2006). *The Ninth Malaysia Plan 2006-2010*. Putrajaya: The Economic Planning Unit, Prime Minister's Department. Pp. 257.
- Pally, M. (2000). 'Film and society: A course for analyzing readings, writing and critical thinking'. In M. Pally (ed.). p.158-178.
- Pally, M. (ed.) (2000). *Sustained Content-based Teaching in Academic ESL/EFL: A Practical Approach*. Boston: Houghton-Mifflin.
- Pithers, R. T. (2000). Critical thinking in education. *Educational Theory*, 42, 3: 237-249.
- Pithers, R. T. and Soden, R. (2000). Critical thinking in education: A review. *Educational Research*, 42: 237-249.
- Richards, K. and Skelton, J. (1991). 'How critical can you get?'. In P. Adams, B. Heaton, and P. Howarth (eds.). p.25-41.
- Roselina Shakir. (2009). Soft skills at the Malaysian institutes of higher learning. *Asia Pacific Education Review*, 10: 309-315.
- Ruland, J. P. (1999). *Relationship of Classroom Environment to Growth in Critical Thinking Ability of First Year College Students*. Unpublished PhD Thesis. University of Albany, State University of New York.

- Samuelowicz, K. (1987). Learning problems of overseas students: Two sides of a story. *Higher Education Research and Development*, 6: 121-34.
- Savage, R.N., Chen, K.C. and Vanasupa, L. (2007). Integrating Project-based Learning throughout the Undergraduate Engineering Programme. *Journal of STEM Education*. 8, 3 &4: 15-27.
- Stapleton, P. (2001). Assessing critical thinking in the writing of Japanese university students: Insights about assumptions and content familiarity. *Written Communication*. 18, 4: 506-548.
- Sternberg, R. J. (1999). *Nature of Cognition*. Boston: MIT Press.
- Tapper, J. (2004). Student perceptions of how critical thinking is embedded in a degree program. *Higher Education Research and Development*, 23, 2: 199-222.
- Watkins, D., Reghi, M. and Astilla, E. (1991). The-Asian-learner-as-a-rote-learner stereotype: Myth or reality? *Educational Psychology*, 11, 1: 21-34.
- Zulkifli Mohd Nopiah, et al. (2009). Improving Generic Skills Among Engineering Students through Problem-Based Learning in Statistics Engineering Course. *European Journal of Scientific Research*, 33, 2:270-278.

APPENDIX 1

Overall critical thinking dispositions of new intake engineering technology students

	DISPOSITIONS	SCALE		
		OFTEN	SOME TIMES	RARELY
1.	Disposition to question truth	26.7	64.8	8.5
2.	Disposition to question motives and intention	45.1	44.9	9.9
3.	Disposition to compare and contrast information	47.1	42.5	10.4
4.	Disposition to find cause and motive	45.1	44.9	9.9
5.	Disposition towards getting the truth of the matter	39.0	48.0	13.0
6.	Disposition to reflect on causes and implications	40.9	51.0	8.1
7.	Disposition to detect bias and exaggeration	49.1	43.9	7.1
8.	Disposition to evaluate arguments	20.4	58.5	21.1
9.	Disposition to compare factual and subjective statements	20.4	58.5	21.1
10.	Disposition to compare factual and subjective statements.	47.2	46.6	6.2