19. RELATIONSHIP BETWEEN CRITICAL THINKING WITH PERCEPTIONS TOWARDS TEACHERS AND LEARNING APPROACHES

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Introduction

The ability to think critically is important among students in higher education as the content of education at this level requires higher order thinking such as the ability to apply critical evaluation, give evidence for their opinions, and argue the validity of facts they receive from teachers. However, Norris (1985) said that critical thinking ability is not prevalent among students. Most students do not obtain good scores in tests that measure the ability to identify assumptions, evaluate arguments and make inferences. Paul (1990) also agreed and said that resistance to using critical thinking is prevalent among many higher-education faculty.

One perspective of analysing the weakness of students' thinking ability is by looking at the students' learning process. In this research, students' learning process will be studied by using Biggs' (1993) theory of student learning. This theory states that students' learning outcomes are influenced by three factors: first, the student factors, that is the experiences students have prior to entering the educational process; second, the teacher factors, which refer to teacher characteristics such as teacher formative experiences, training experiences and teacher properties; and third, the process variables, referring to the actual activities taking place in the classroom.

At this point of time, it is useful to ask what are the characteristics that students should have to encourage the acquisition of critical thinking skills. A good thinker possesses certain abilities: cognitive abilities, as well as thinking strategies and skills. Yet what sets good thinkers apart is not simply superior cognitive ability or particular skills; rather it is their tendencies to explore, to inquire, to seek clarity, to take intellectual risks, to think critically and imaginatively. These tendencies can be called "thinking dispositions" (Tishman, Jay & Perkins, 1992). In this research, the term critical thinking disposition is defined as a cluster of preferences, attitudes, and intentions, plus a set of capabilities that allow the preferences to become realised in a particular way (Salomon, 1994).

Baron (1987), Ennis (1987) and Tishman et. al. (1992) stressed the importance of dispositions and made the strong claim that being a good thinker means having the right thinking dispositions. Knowledge about effective thinking is not enough; we also need to have the will to use that knowledge and to develop the habit of thought. Just as having the ability to think critically does not guarantee the disposition to do so, having certain critical thinking skills does not mean that one will use them, and in fact, research shows that students often fail to use the thinking skills they are taught. For example, a research on reasoning and argument showed that, when explicitly asked, people can easily give

plenty of reasons opposite their favoured side of the case – that is, they have the ability. However, typically, they fail to do so – that is, they lack the disposition (Perkins, Farady & Bushey, 1991).

Teachers' perceptions, attitudes, behaviour toward the teaching of thinking and their teaching methods and activities may influence students' success in developing their thinking skills. It is possible that many factors will determine the success of the teaching of thinking in the classroom, but undeniably, the teacher factor seems to be the most responsible. One characteristic of the teachers' role is the method of teaching used. The conventional method of transmitting knowledge involves the rigid version of students sitting quietly and receiving information they need. In such an environment, an inclination to be passive with respect to knowledge tends to develop. Students do not become disposed to seek and evaluate information on their own; rather they learn to count on the environment to automatically feed them information (Tishman et. al., 1992). A favourable teacher behaviour therefore should be able to cultivate good thinking dispositions and skills. Rather than requiring them to passively take in information, teacher interacting with students will encourage them to ask questions, probe assumptions, and seek justifications.

The qualitatively different approaches to teaching have been found to relate to students' qualitatively different approaches to learning (Trigwell et. al., 1999) and in many studies these learning approaches have been found to relate to the quality of the outcome of student learning. The relationship between the way students approach their learning and the way teachers approach teaching have also been examined. Student-focused approach to teaching is associated with deep approach to learning, and teacher-focused information transmission approach to teaching is associated with surface approach to learning (Trigwell et. al., 1999).

Research Objectives

This research aims at:

1. Examining the direct relationship between students' critical thinking dispositions and critical thinking skills.
2. Examining the direct relationship between students' perceptions of teachers' teaching approaches and critical thinking skills.
3. Examining the direct relationship between students' learning approaches and critical thinking skills.
4. Examining the direct relationship between critical thinking dispositions and learning approaches.
5. Examining the direct relationship between students' perceptions of teachers' teaching approaches and learning approaches.
6. Exploring the indirect relationship between critical thinking dispositions, learning approaches and critical thinking skills.
7. Exploring the indirect relationship between students' perceptions of teachers' teaching approaches, learning approaches and critical thinking skills.

Literature Review

A large body of research provides evidence that college students can experience significant gains in critical thinking. One study by Giancarlo and Facione (1994) among 193 high school students found a significant positive correlation of r = .41 between scores of critical thinking dispositions and critical thinking skills. This correlation between overall critical thinking skills and overall critical thinking dispositions suggested that up to 16.8% of the variance in critical thinking skills test scores was potentially attributable to the differences in students' critical thinking dispositions scores. Another study by Colucciello (1997) also found a significant positive correlation of r = .32 among 328 nursing undergraduates. This suggested that in this sample, about 9% of the variance in skills test scores can be associated with the variance in overall critical thinking dispositions scores.

Facione and Facione (1997) conducted a study on 1557 nursing students using the CCTST and the CCTDI upon entry to their college programmes. The correlation of the total scores on the CCTST and CCTDI was r = .20 ($p < .001$). They again collected data from 793 students who completed both the CCTST and CCTDI at exit from nursing programmes in different colleges and universities. Again a positive correlation was found ($r = .17$, $p < .001$). A stronger relationship was also found between the students' disposition score on the CCTDI at programme entry and their skills test score on the CCTST at exit ($r = .23$, $p < .001$) (Facione & Facione, 1997).

The studies looking at critical thinking dispositions and critical thinking skills yielded a positive and significant correlation ranging from .17 to .41 (Facione et. al., 1995; Giancarlo & Facione, 1994; Colucciello, 1997; Facione & Facione, 1997). All the studies conducted usde college or university students as their sample. These studies provided evidence that critical thinking dispositions influence critical thinking skills and the dispositions can be regarded as a significant predictor of critical thinking skills among university students. In other words, students with high scores on critical thinking dispositions will also score highly on the critical thinking skills test.

Findings correlating critical thinking dispositions and learning approaches have been confounded by the differences in measuring learning approaches, styles and strategies. Sadler-Smith and Smith (2004) however have categorized all the various instruments into two types; (a) those instruments and inventories measuring cognition-centred approaches, and (b) those measuring learning-centred approaches. The concern of this research is the learning-centred approaches and it uses Biggs' (1987) Study Process Questionnaire that differentiates students into surface learners or deep learners.

Based on the studies of different types of instruments measuring learning approaches, styles and strategies, one study found that there was a significant difference of students' critical thinking dispositions according to different types of learning styles (Roberts, 2003) while another study reported no significant difference (Rudd et. al., 2000). These contradictory findings may be due to the different learning styles measured. However, no report was found between Biggs' (1987) learning approach and critical thinking dispositions.

Another relationship of variables is between teaching approaches and critical thinking skills. The role of teachers in students' learning is studied from students' perceptions of teachers' teaching approaches. Two teaching approaches are identified, the information transmission/teacher-focused (ITTF) and the conceptual change/student-focused. Evidence suggests a direct relationship between teaching approaches with critical thinking skills. For instance, teachers who only impart information do not teach thinking well (Kember, 1997), differences of teaching methodology in student-centred classes rather than instructor-centred classes according to McKeachie's (1970) review promote higher level retention and thinking (e.g. Gibson, 1985; Suksringarm, 1976; Fishbein, 1975; Smith, 1977), and instructional techniques such as having a paper critiqued by an instructor, working on independent research project, giving a class presentation predict self-reported growth in critical thinking skills (Tsui, 1999).

Teaching approaches also have a significant relationship with students' learning approaches. It was reported that teachers adopting learning facilitation approach is negatively and significantly related with surface approach to learning and those teachers adopting knowledge transmission is negatively and significantly related with students' deep approach to learning (Kember & Gow, 1993). Similar results documented the significant relationship between an information transmission/teacher-focused approach to teaching with surface approach and conceptual change/student-focused approach to teaching with deep approach to learning (Trigwell, Prosser & Waterhouse, 1999; Trigwell, Prosser, Ramsden & Martin, 1999). Gibbs and Coffey (2004) reported that teachers who increased their conceptual change/student-focused approach to teaching have students using less surface approach to learning.

All the findings indicated significant relationship between an information transmission/teacher-focused (ITTF) approach to teaching with surface approach to learning and between a conceptual change/student-focused (CCSF) approach to teaching with deep approach to learning (Gibbs & Coffey, 2004; Gow & Kember, 1993; Prosser & Trigwell, 1998; Ramsden, 1991, 1992, 1997; Trigwell & Prosser, 1991; Trigwell, Prosser & Waterhouse, 1999; Trigwell, Prosser, Ramsden & Martin, 1999). There is a general consensus in higher education that the idea of a student-focused or student-centred approach is an enriching, supporting teaching approach which is more likely to lead to students' intellectual growth (Trigwell, 2002). Therefore, it is important to establish this relationship between teachers' teaching approaches and students' learning approaches in relation to the development of critical thinking skills.

The studies reviewed above showed how teachers' teaching approaches influence critical thinking skills and students' learning approaches. Teaching approaches affect students' approaches to learning most directly, and this in turn affects their learning outcomes (Entwistle & Tait, 1990). As critical thinking skill is also considered a cognitive outcome in the learning process, both teaching approaches and students' approaches to learning may have a direct and indirect effect on critical thinking skills.

Another important relationship is between students' learning approaches and critical thinking skills. Those students adopting deep approach to learning were associated with

higher quality learning outcomes (Prosser & Millar, 1989; Trigwell & Prosser, 1991; van Rossum & Schenk, 1984), academic performance (Mayya et. al., 2004), and increased knowledge (Murphy & Alexander, 2002). In relation to critical thinking skills, Gadzella et. al. (1997) found a direct, positive and significant correlation between deep-processing learning and critical thinking skills. Critical thinking skills were also related to students' grades (Gadzella et. al., 1997).

There is no evidence on the direct relationship between students' critical thinking dispositions, learning approaches and critical thinking skills. Yet studies have found a significant relationship between critical thinking dispositions and critical thinking skills. One study reported a significant difference of learning styles on critical thinking dispositions (Roberts, 2003) and a positive and significant correlation between learning approaches and critical thinking skills (Gadzella et. al., 1997). Research has found direct relationships between these variables but not simultaneously. Therefore, it is important to study the relationship between these three variables simultaneously and explore whether students' learning approaches play the role of mediator in this relationship. It is hypothesised that students with higher scores on critical thinking dispositions are those who adopt deep approach to learning and consequently, will score higher on tests of critical thinking. In contrast, those students having lower scores on critical thinking dispositions will adopt the surface approach to learning and in turn, will have lower scores of critical thinking skills.

Findings in the studies of teachers' teaching approaches, students' approaches to learning and critical thinking skills also yielded no direct relationship. Numerous qualitative and quantitative studies, however, have established significant relationship between teachers' teaching approaches and students' learning approaches. Teachers' teaching approaches affect how students approach their learning and this in turn affects learning outcomes (Biggs, 1993; van Rossum & Schenck, 1984). Although these studies do not look at critical thinking as a learning outcome, a study by Gadzella et. al. (1997) has found a significant relationship between students' learning approach and critical thinking skills. However, these studies do not look at the relationship of all three variables simultaneously. Thus, it is crucial to investigate the simultaneous relationship of these three variables and explore whether learning approaches play the mediating role in this relationship. It is hypothesised that teachers adopting the conceptual change/student-focused approach to teaching will be correlated with students with deep approach to learning and these students will have higher scores in critical thinking skills. Conversely, teachers who adopt an information transmission/teacher-focused approach to teaching will correlate with students who adopt surface approach to learning, and these students will have lower critical thinking scores.

Theoretical Framework

The conceptual framework of this research is based on the fact that critical thinking skill is a cognitive outcome in the education process, and thus it becomes an important variable in student learning. The acquisition of this skill in the learning process is related to various factors in teaching and learning.

The study is structured within the presage-process-product (3P) model of student learning developed by Biggs (1999, 1993) as illustrated in Figure 1. Presage variables are variables that deal with teacher characteristics (Dunkin & Biddle, 1974). These include teacher formative experiences, teacher training experiences and teacher properties. Context variables are those variables over which the teacher has little or no control. These include student formative experiences, student characteristics, school and community contexts, and classroom contexts (Dunkin & Biddle, 1974).

Presage variables and context variables influence process variables. Process variables include the actual activities that take place in the classroom (Dunkin & Biddle, 1974). Process variables affect product variables. Product variables concern the outcome of teaching (Dunkin & Biddle, 1974). One measure of outcomes is immediate student growth, which can be measured by evaluating student learning of the subject matter and attitudes toward the subject.

Biggs (1993) offered the 3P model as a way of explaining why students learn differently. This model connects where students are when they approach the learning task with what they do learn, and both of the above aspects with the outcomes. Biggs has adapted the model from Dunkin and Biddle's presage-process-product model from the context of classroom teaching (Dunkin & Biddle, 1974). This model is illustrated in Figure 1.

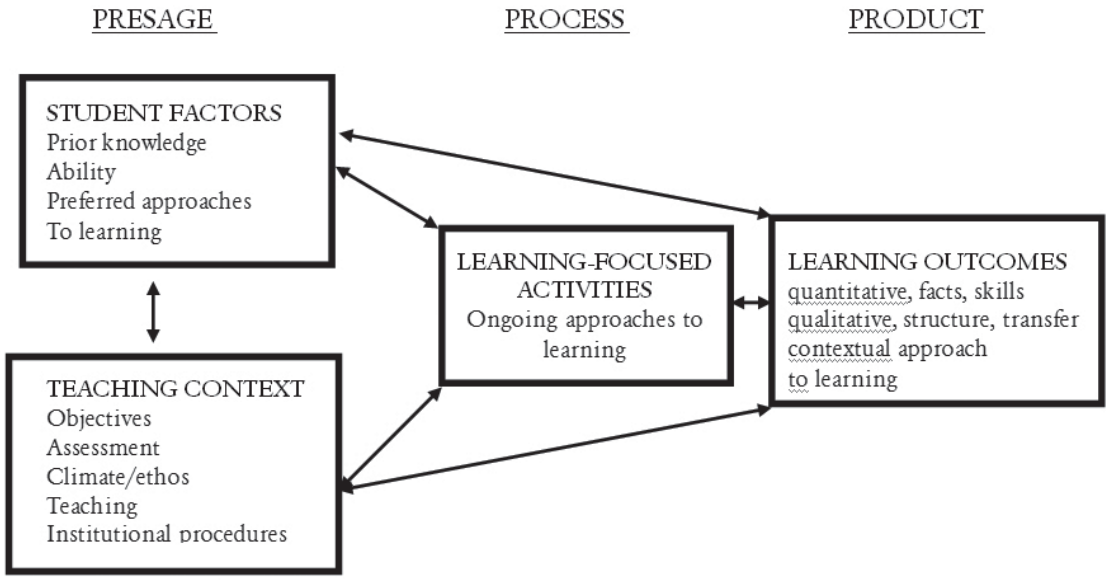

Figure 1: The "3P" model for teaching and learning (Biggs, 1993)

Conceptual Framework

From the models of classroom teaching (Dunkin & Biddle, 1974) and presage-process-product (3P) model for teaching and learning (Biggs, 1993), a conceptual framework has been constructed for the present study. By using the presage-process-product model, the relationship between students' critical thinking dispositions (student

presage variables), teaching approaches (teaching context presage variables), learning approaches (process variables), and critical thinking skills (product variables) will be investigated. The conceptual framework is illustrated in Figure 2.

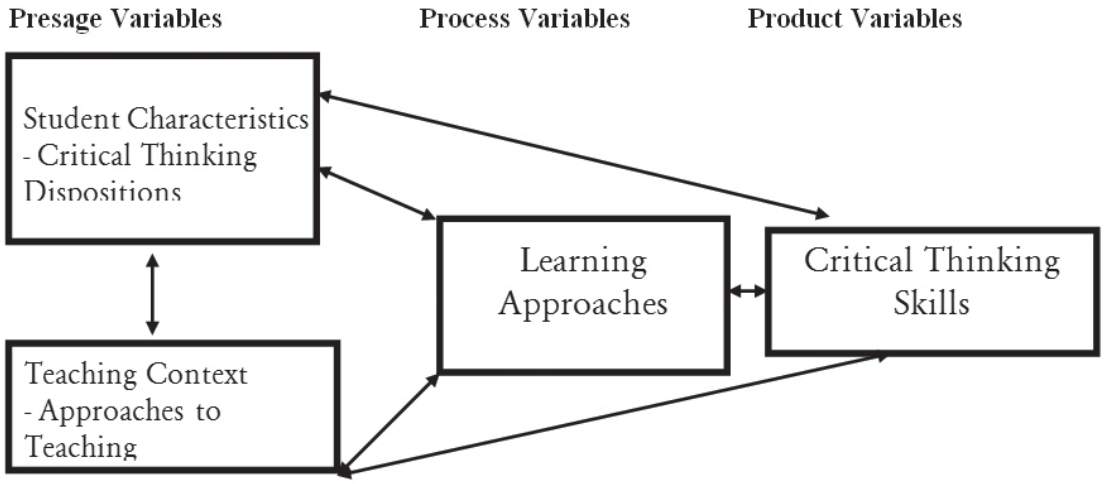

Figure 2: A conceptual framework for examining the relationship of student and teacher variables on students' critical thinking skills

Method

Participants

The participants of this study involved 426 undergraduate and graduate students in higher educations in Klang Valley, Malaysia. Three universities were chosen which were Universiti Kebangsaan Malaysia (UKM), International Islamic University Malaysia (IIUM) and University Malaya (UM). Participants were chosen using purposive sampling with status of study (Year 1, Year 2, Year 3 and postgraduate) and field of study (psychology) as the determining factors.

Instruments

Four instruments were administered to participants. The researcher also included questions on participants' demographic profile such as gender, year of study and academic major. The instruments used were:

1. The adapted Critical Thinking Disposition Inventory (CTDI)

The Critical Thinking Disposition Inventory (CTDI) is adapted from the California Critical Thinking Dispositions Inventory (CCTDI). The original CCTDI consists of 75 Likert-type items measuring seven dispositions, namely truth-seeking, open-mindedness, analyticity, systematicity, inquisitiveness, self- confidence and maturity. The developers report an overall reliability, Cronbach alpha of 0.90 and scale reliability ranging from alpha 0.72 – 0.80 (Facione, 1990). The researcher however adapted the CCTDI and the inventory comprised of 70 items, with 10 items for each scale.

2. The adapted Student Perception of Approach to Teaching Inventory (ATI)

The Approaches to Teaching Inventory is an instrument designed to capture qualitative

differences in teachers' approaches to teaching. It has two scales, the Conceptual Change/ Student-Focused (CCSF) approach scale, and the Information Transmission/Teacher-Focused (ITTF) approach scale. Each scale contains eight items. Responses are sought on a five-point scale from rarely true to almost always true. Scale reliabilities (Cronbach's alphas) for the ITTF and CCSF scales are .73 and .75 respectively (Trigwell & Prosser, 2004).

3. The Revised Study Process Questionnaire (R-SPQ-2F)

The R-SPQ-2F consists of 20 items with two deep and surface factors each with 10 items Each of the subscales consisted of five items. Students complete the survey by responding to the written statements on a 5-point Likert scale ranging from 1 (this item is never or only rarely true of me) to 5 (this item is always or almost always true of me). Biggs et. al. (2002) reported Cronbach alpha coefficients of .62 for the Deep Motive subscale, .63 for the Deep Strategy subscale, .72 for the Surface Motive subscale, and .57 for the Surface Strategy subscale.

4. The Malaysian version of Critical Thinking Test (MCTT)

From the theoretical framework and literature in critical thinking, five constructs have been identified to measure the cognitive skills of critical thinking which were: analysis, inference, deduction, interpretation and argument evaluation. The test constructed consisted of 100 items with 20 items for each subscale. The response format used a true or false answer.

Data Analysis

The data was analysed using SPSS. Both descriptive and inferential analyses were done. Analysis for pilot study involved looking at the reliability and validity of research instruments. Reliability analysis used the Cronbach internal consistency reliabilility. Validity analysis was done by correlating MCTT with the Watson-Glaser Critical Thinking Appraisal (W-GCTA) Form B.

Hypotheses were tested using structural equation modeling (SEM). Goodness-of-fit of model will be analysed by SEM with AMOS programme (Arbuckle, 1999). The evaluation of the theoretical and the respecified model was based on analysis of goodness of fit of the models (theoretical and empirical) and on the extent to which the hypotheses about causal relations among the variables were confirmed. Models were all tested with standardized coefficients obtained from the maximum likelihood method of estimation.

Results

The full structural model was imposed to assess the predictive relationship among critical thinking dispositions, teaching approach, learning approach and critical thinking skills. The theory-based, hypothesized model consisted three predictor variables; (1) critical thinking dispositions which has five subscales of openness, systematicity, analyticity, truth-seeking and self-confidence, (2) two teaching approaches which were measured by the information-transmission/teacher-focused (ITTF) approach and the conceptual-change/student-focused (CCSF) approach, and (3) the surface learning approach which

consisted surface motive and surface strategy subscales, (4) the deep learning approach consisting deep motive and deep strategy. The criterion variable was critical thinking skills. Surface learning approach and deep learning approach are variables that can be considered mediator variables as they are both predictors and criterion variables.

The full structural model of critical thinking in Figure 3 showed the model depicting direct relationships between all three exogenous variables, critical thinking dispositions (DISP), information-transmission/teacher-focused (ITTF5) and conceptual-change/student-focused (CCSF5) on critical thinking skills (MCTT), mediated by surface (SURF5) and deep (DEEP5) learning approaches. Results of the SEM showed that the model chi-square was statistically significant, χ^2 (70) = 101.73, $p < .05$. The statistic rejected the null hypothesis that there was no discrepancy between the sample and the population data. Hence, there was statistically significant difference between the full structural model and the observed data.

However, the root mean square error of approximation (RMSEA), which was 0.05 was found to be smaller than the acceptance value of 0.08. The index approximated the discrepancy that could be expected in the population; it estimated the good fit of the structural model of critical thinking to the population covariance matrix. The model also has adequate fit indices of a good model with CMIN/df = 1.75. The goodness-of-fit indices (Table 1) also showed acceptable values of GFI = .95, CFI = .93 and TLI = .91.

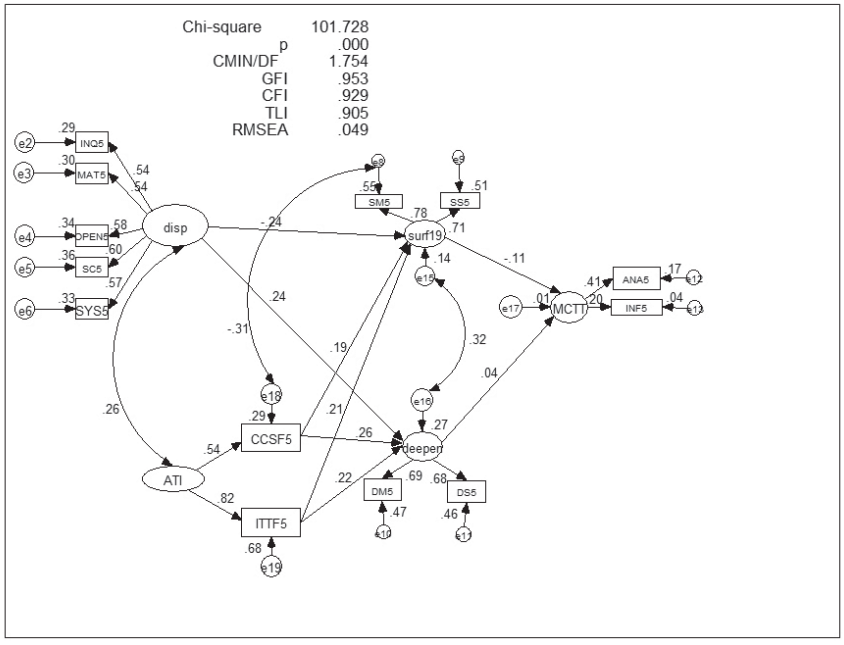

Figure 3: Structural model of critical thinking on direct and indirect relationship of dispositions, ITTF, CCSF, surface and deep approaches on thinking skills

The path coefficient between disposition and surface approach was statistically significant at .05 level (path coefficient = -.24, $p < .05$), and also significant between disposition and deep approach (path coefficient = .24, $p > .05$). However, the path coefficient between information-transmission and surface approach was statistically significant (path

coefficient = .21, p < .05), and between information-transmission and deep approach (path coefficient = .22, p < .05). Results also showed statistically significant path coefficient between conceptual-change and deep approach (path coefficient = .26, p < .05) and also significant between conceptual-change and surface approach (path coefficient = .19, p < .05). Finally, the path coefficients were not significant for surface approach and critical thinking skills (path coefficient = -.11, p > .05), and between deep approach and critical thinking skills (path coefficient = .04, p > .05). The results are summarized in Table 1.

Table 1

Goodness-of-fit indices of the structural model and standardized regression weights

	Recommended	Initial Model
Model chi-square	> 0.05	101.73*
CMIN/df	< 5.0	1.75
GFI	> 0.90	0.95
CFI	> 0.90	0.93
TLI	> 0.90	0.91
RMSEA	< 0.08	0.05

Standardized Regression Weights

DISP – SURF5	-0.24*
DISP – DEEP5	0.24*
ITTF5 – SURF5	0.21*
ITTF5 – DEEP5	0.22*
CCSF5 – SURF5	0.19*
CCSF5 – DEEP5	0.26*
SURF5 – MCCT	-0.11
DEEP5 – MCTT	0.04

* Statistically significant at p < .05

The indirect effect between critical thinking dispositions, surface approach and critical thinking skills was .026 which is not significant according to Hair et. al. (2006) who recommend the indirect effect to be more that .08 in order for it to be significant. The indirect effect between ITTF, surface approach and critical thinking skills was -.023, was also not significant. Finally the indirect effect was insignificant between CCSF, surface approach and critical thinking skills which was -.009. The indirect effects with deep approach as mediator were also not significant. The results of indirect effect are shown in Table 2.

Table 2

Indirect effect of critical thinking disposition, ITTF, CCSF, surface, deep and critical thinking skills

Path Coefficients	Criterion	Indirect Effects	
Disposition via Surface	Thinking Skills	-.24 x -.11	.026
ITTF via Surface	Thinking Skills	.21 x -.11	-.023
CCSF via Surface	Thinking Skills	.19 x -.11	-.021
Disposition via Deep	Thinking Skills	.24 x .04 -	.009
ITTF via Deep	Thinking Skills	.22 x .04	-.009
CSF via Deep	Thinking Skills	.26 x .04	-.010

The SMC-R^2 showed that disposition, information-transmission and conceptual-change contributed 14% of the variance in surface approach. The same predictors contributed 27% of the variance in deep approach. However, disposition, information-transmission, conceptual-change, surface approach and deep approach explained nearly none of the variance in critical thinking skills.

Based on the results of full structural model of critical thinking skills, a respecified model was tested. Although the full structural model of critical thinking showed that all goodness-of-fit indices fulfilled the recommended values, the interpretation of interrelationships between variables did not explain students' critical thinking skills. Thus, the full structural model was lacking in explaining the good fit of the model with the theory. All the predictor variables did not contribute significantly in influencing critical thinking skills. The role of learning approaches as mediator variable also failed to mediate the relationship between predictors and critical thinking skills. In other words, based on the results we cannot establish what are the variables that predict, contribute and explain how critical thinking skills are developed among university students.

In conclusion, although this model showed acceptable and good fit between the model and the data, it does not explain well the contribution of predictors on critical thinking skills. The zero variance as indicated by squared multiple correlation did not explain the variance in critical thinking skills. Furthermore, the path coefficients of predictor variables namely, surface and deep approaches were not significant. The path coefficients were only significant between predictor variables (disposition, ITTF, CCSF) with surface and deep learning approaches. Therefore, the model needed to be respecified.

The respecified model (Figure 4) proposed that critical thinking dispositions are part of learning outcomes that resulted from the teaching and learning process. The competing model still supported Biggs' (1993) model that student learning is a continuous process. Critical thinking is a continuous process whereby students must first receive the appropriate teaching approach, followed by learning approaches that will then influence the critical thinking dispositions and critical thinking skills.

Results of the SEM showed that the model chi-square was statistically significant, χ^2 (66) = 70.58, $p < .05$. The statistic rejected the null hypothesis that there was no discrepancy between the sample and the population data. Hence, there was statistically significant discrepancy between the hypothesized model and the observed data.

However, the root mean square error of approximation (RMSEA), which was 0.03 was found to be smaller than the acceptance value of 0.08. The index approximated the discrepancy that could be expected in the population; it estimated the good fit of the revised model to the population covariance matrix. The model also has adequate fit indices of a good model with CMIN/df = 1.36. The goodness-of-fit indices also showed acceptable values of GFI = .97, CFI = .97 and TLI = .96. The result of the respecified model is shown in Figure Table 4.

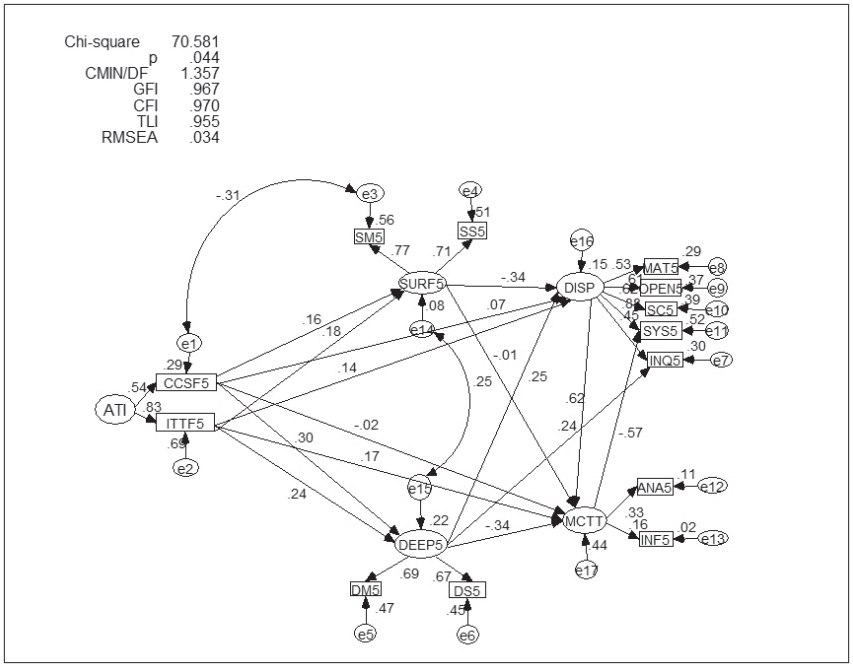

Figure 4: The respecified model of critical thinking

The standardized regression weights of the competing model were free from offending estimates. Results showed that there were statistically significant path coefficients between information transmission (ITTF) and surface approach (path coefficient = .18, $p < .05$), and between ITTF and deep approach with path coefficient .24, $p < .05$. The path coefficient was also statistically significant between CCSF and deep approach (path coefficient = .30, $p < .05$), but not significant between CCSF and surface approach (path coefficient = .16, $p > .05$). The path coefficient between information-transmission (ITTF5) and disposition was not statistically significant at .05 level (path coefficient = .14, $p > .05$). The path coefficient between conceptual-change (CCSF5) and disposition was also not statistically significant (path coefficient = .07, $p > .05$). Results also showed no significant path coefficient between ITTF and critical thinking skills (path coefficient = .17, $p > .05$) and between CCSF and critical thinking skills (path coefficient = -.02, $p > 05$).

Table 4: Goodness-of-fit indices of the hypothesized model and standardized regression weights

	Recommended	Initial	Competing
Model chi-square	> 0.05	101.73*	70.58*
CMIN/df	< 5.0	1.75	1.36
GFI	> 0.90	0.95	0.97
CFI	> 0.90	0.93	0.97
TLI	> 0.90	0.91	0.96
RMSEA	< 0.08	0.05	0.03

Standardized Regression Weights	Initial	Competing
ITTF5 – DISP	-	0.14
CCSF5 - DISP	-	0.07
SURF - DISP	-0.24*	-0.34*
DEEP - DISP	0.24*	0.25*
ITTF5 – SURF	0.21*	0.18*
ITTF5 – DEEP	0.22*	0.24*
ITTF5 – MCTT	-	0.17
CCSF5 – SURF	0.19*	0.16
CCSF5 – DEEP	0.26*	0.30*
CCSF5 – MCTT	-	-0.02
SURF – MCCT	-0.11	-0.01
DEEP – MCTT	0.04	-0.34
DISP – MCTT		0.62*

* Statistically significant at $p < .05$

Results also showed statistically significant path coefficients between surface approach and disposition (path coefficient = -.34, $p < .05$), and between deep approach and disposition (path coefficient = .25, $p < .05$). Results showed that there were no statistically significant path coefficients between deep approach and critical thinking skills (path coefficient = -.34, $p > .05$), and between surface approach with critical thinking skills (path coefficient = -.01, $p > .05$).

The indirect effect between ITTF, surface approach and critical thinking skills was -.002. The indirect effect between CCSF, surface approach and critical thinking skills was also -.002. Surface approach was not significantly mediating between ITTF and disposition (-.061) and between CCSF and disposition (-.054). However, deep approach significantly mediated between ITTF and critical thinking skills (-.082) and between CCSF and critical thinking skills (-.102). Finally the indirect effect was insignificant between ITTF, deep approach and disposition (.045) and between CCSF, deep and disposition (.040). The results of indirect effects are shown in Table 5.

Table 5

Indirect effect of ITTF, CCSF, surface, deep, disposition and critical thinking skills

Path Coefficients	Criterion	Indirect Effects
ITTF via Surface	Thinking Skills	.18 x -.01 -.002
CCSF via Surface	Thinking Skills	.16 x -.01 -.002
ITTF via Surface	Disposition	.18 x -.34 -.061
CCSF via Surface	Disposition	.16 x -.34 -.054
ITTF via Deep	Thinking Skills	.24 x -.34 -.082
CCSF via Deep	Thinking Skills	.30 x -.34 -.102
ITTF via Surface	Disposition	.18 x .25 .045
CCSF via Surface	Disposition	.16 x .25 .040
Surface via DISP	Thinking Skills	-.34 x .62 .211
Deep via DISP	Thinking Skills	.25 x .62 .155

The squared multiple correlation or R-squared (SMC-R^2) showed that transmission-information and conceptual-change contributed 22% of the variance in deep approach while the same predictors explained about 8% in the variance of surface approach. Finally, all the variables of information-transmission, conceptual-change, surface approach and deep approach explained only 15% of the variance in disposition and 44% variance in critical thinking skills. In conclusion, based on the goodness-of-fit indices and parameter estimates, the competing model of critical thinking skill was better compared to the hypothesized model.

Discussion

The results of the respecified model showed that there was no significant relationship between teaching approaches and critical thinking skills as shown in Figure 5.10. The information-transmission (ITTF) approach was not related with critical thinking skills. Critical thinking skills also were not influenced by conceptual-change/student-focused approach (CCSF).

Additional results in the respecified model indicate that teaching approaches also have no significant relationship with critical thinking dispositions. The information-transmission (ITTF) approach was not related with critical thinking dispositions. Critical thinking dispositions also were not influenced by conceptual-change/student-focused approach (CCSF). Therefore, it can be concluded that teaching approaches have no influence and do not predict both critical thinking dispositions and critical thinking skills. However, when we analyze the path estimates among all the variables, the highest estimate although not significant can be observed between information-transmission (ITTF) approach and critical thinking skills. Perhaps if the variance is increased with the sample, the relationship would be significant. This is an indication that information-transmission (ITTF) approach is one teaching approach that may contribute to critical thinking skills. When we analyzed the squared multiple correlation (SMC) also, the results showed higher values in critical thinking skills (.33) compared to critical thinking dispositions (.20). This implies that teaching strategy contributes more towards critical thinking skills than in

encouraging critical thinking dispositions. This can be supported by the fact that critical thinking disposition is a student outcome based on attitudes which Salomon (1994) defined as a relatively stable behaviour.

Learning approaches were significantly related to critical thinking dispositions but not significantly related with critical thinking skills. Both surface and deep approaches to learning were significantly related with critical thinking dispositions. Surface approach is negatively related with critical thinking dispositions, meaning that the more students preferred surface approach the lower their critical thinking dispositions. On the other hand, deep approach is positively related with critical thinking dispositions, meaning that the more students employ deep approach the higher their critical thinking dispositions. This is consistent with findings that showed students' learning approaches were related to learning outcomes. Those students adopting deep approaches to learning were associated with higher quality learning outcomes (Prosser & Millar, 1989; Trigwell & Prosser, 1991; van Rossum & Schenk, 1984). Evidence from previous research also showed that surface learning approach leads to lower quality learning outcomes (Marton & Saljo, 1997; van Rossum & Schenk, 1984; Ramsden, 1992; Prosser & Millar, 1989). These findings suggest that to encourage critical thinking dispositions among university students, students themselves should employ more deep approach in their learning.

The results showed that only deep approach to learning mediated the relationship between both ITTF and CCSF teaching approach and critical thinking dispositions. Deep approach also mediated the relationship between ITTF and CCSF with critical thinking skills. This means that critical thinking dispositions and critical thinking skills can be enhanced with the right teaching approaches if deep approach is employed in learning. The findings of this study are consistent with previous studies which found significant relationship between teachers' teaching approaches and students' learning approaches (Gow & Kember, 1993; Trigwell, Prosser & Waterhouse, 1999; Gibbs & Coffey, 2004).

Results of the current study also are consistent with findings that showed students' learning approaches were related to learning outcomes. Teachers' teaching approaches affect how students approach their learning and this in turn affects learning outcomes (Biggs, 1993; van Rossum & Schenk, 1984).

Based on all the results of indirect effects, the most influential teaching approach is CCSF in increasing critical thinking skills. This finding is consistent with the review by McKeachie (1970) who concluded that difference of teaching methodology in student-centred classes rather that instructor-centered classes promote higher level retention and thinking (e.g. Gibson, 1985; Suksringarm, 1976; Fishbein, 1975; Smith, 1977). This is further affirmed by findings that showed the student-centred orientation is more consistent with the development of students' thinking (Kember, 1997). Tsui (1999) and Trigwell et. al. (1999) also agreed that instructional techniques similar to the student-centred approach focused on what students are doing and results showed that this type of teaching influenced critical thinking. Thus, a combination of the right teaching approach and learning approach will encourage critical thinking dispositions and skills.

Conclusion

Two significant predictors of critical thinking dispositions and skills have been identified: teaching approaches and learning approaches. Learning approaches played an important role as a mediator in the relationship between teaching approaches, critical thinking dispositions and critical thinking skills. How students perceived their lecturers' teaching approaches influence the learning approaches that they employed. How students approach their learning, whether adopting surface approach or deep approach on the other hand, influence their critical thinking dispositions and skills. Students who employed deep approach and perceived teaching as student-focused scored higher in critical thinking dispositions and skills. Surface approach learners on the other hand are negatively related to critical thinking dispositions.

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20. TEACHERS' ACCEPTANCE TOWARDS TECHNOLOGY SCALE VALIDATION

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Introduction

Computers are great invention that are used across discipline and education is one of the discipline that inculcate the use of computers through its' teaching and learning process. The use of technology in education is not something which is new but the usage of ICT in education has made a tremendous impact in the educational settings. Computer in education is regarded as a new innovation not in-term of the computer itself but the integration of computer in teaching and learning as well as administration. Being a new innovation, computers need to be accepted by teachers. In Roger's Diffusion of Innovation Theory (1960), for new innovation to be adopted, it must go through five stages of Innovation-Decision Process namely; Knowledge, Persuasion, Decision, Implementation and Confirmation. However this study will not address the acceptance of technology using Roger's theory but applying Davis's Technology Acceptance Model-TAM (1989). TAM posits that technology will be accepted (use) if it is perceived to be useful and requires less effort to use it (ease of use).

In ensuring that computers are accepted and implemented in school, the Ministry has formulated three policies as guideline for schools to implement the use of computers. The first policy states that ICT is for all students. This policy emphasize on the ICT as enabler to bridge the digital gap in the schools. The second policy emphasizes the role of ICT as teaching and learning tool, as part of the subject and as a subject by itself. Apart from the common radio and television as teaching technology, computers were given due attention as tools to gather information, keeping the information and disseminating the information. The third policy emphasizes on the use of ICT in administering the school through automate and mechanise work processes such as students profile, teachers profile, and examination marks and results (Fong Chan Mae, 2004).

While computers have been made available in most of the schools, little research is done to study on teachers' perception towards technology and how anxious they are when dealing with computers using TAM. A study by Ngah and Masood (2006) discussed on the issues relating to the diffusion and integration of ICT in classroom while Alias and Zainuddin (2005) studied the adoption of Learning Management System based on Concern Based Adoption Model. In Malaysia TAM has been used to study computers acceptance by small and medium sized company (Jantan, T.Ramayah & Chin, 2001), Internet shopping behaviour , and receptiveness of E-banking by Malaysian consumers (Koay, 2002). Fok (2001) incorporates self-efficacy in researching Internet acceptance among Malaysian while Ramayah, Dahalan and Mohamad and Siron (2002) incorporates gender, income and level of education into TAM in studying technology usage of managers in SME's in Malaysia.

Since the adoption of computers by teachers somewhat "force to" by the authority through the implementation of ICT Policy, teachers were not given a chance to express their feelings whether computers will give relative advantage to them and whether they are ready to use it. Teachers may find computers as added burden instead of being useful and even if it is useful, it may not necessarily easy for them to use.

Technology Acceptance Model

TAM, although originated in Information Studies field, has been widely tested in other areas. Previous research using TAM focuses more on measuring the attitude of users towards technology and the actual usage of the technology (Fusilier & Durlabhji, 2005; Schaper & Pervan, 2004). Spacey, Goulding and Murray (2004) studied the correlation between positive attitude and actual use of ICT among librarians. Positive attitude of the librarian has strong correlation with actual use of the Internet and intention to use the Internet. Money (2004) concluded that TAM can be used as a foundation to measure users' acceptance of and actual use of new system, in his case the Knowledge Management System

Havelka (2003) on the other hand stated that students from both Management Information System major and Business major have the same positive attitude level towards technology indicating subject specialization does not influence students perception on the ease of use and the usefulness of technology.

Other study uses TAM in the context of social influence in technology acceptance. Social influences that generate a feeling of compliance to use the new system, seems to have negative influence on users' attitude toward use of the new system. However, when social influences generate a feeling of internalization and identification on the part of the user, they have a positive influence on the attitude toward the acceptance of the new system (Malhotra & Galleta, 1999). Saade and Kira (2006) had in their research added affect and anxiety as other variables that impacted perceived usefulness and perceived ease of use of undergraduate students using web-based learning program.

The basic concept underlying User Acceptance Model are individuals reactions towards technology, how they perceived that the technology is beneficial to them and how easy can they use the technology. If individual reacted positively to the new technology, chances are they will use the technology but if their reactions are negative, they may avoid the technology. These positive or negative reactions created and intention to use or not to use the technology which later become the moderating factor in determining the actual use or no use of the technology.

Method

Participants

The population was student-teachers, pursuing Bachelor of Education at IIUM. These students are in-service teachers who were from various urban and rural schools (based on their last posting) with more than 2 years teaching experience. Questionnaires were distributed to all 406 students in semester 1, 2006/2007 which include both in-service

and pre-service cohort, thus employing sampling of convenient procedure. These students were enrolled to various programs namely; Teaching English as Second Language, Teaching Arabic as Second Language, Moral Education, Counselling and Educational Management. A total of 328 responses were returned. These responses were then subjected to data screening to eliminate incomplete data and 318 questionnaires deemed to be valid to be analyzed. Of the total 318 completed and valid responses, only 222 responses were analyzed as sample to the population leaving out 90 responses representing pre-service teachers. The sample is deemed adequate based on the general rule of 5 respondents per item (Hair, et.al., 1998) and based on the 21 items in the questionnaire, a sample of 105 is required for the study.

Measures

A pool of 21 items was selected from an instrument adopted and adapted from a research done by Kiraz and Ozdemir in 2006. Each item, suggestive of a specific dimension, to which the teacher indicates his or her response on a 7-point response scale, represents an indicator. Each indicator was worded in a manner to capture the meaning attached to one of the three dimensions, the underlying factors that explained the pattern of responses. Theoretically, the latent factor for the first five items was perceived usefulness, the subsequent indicators assessed the ease of use dimension and the next questions assessed the anxiety dimension.

The questionnaire was divided into two parts, Part A (variables on usefulness, ease of use, relative advantage and axiety) and Part B (demographic). Kiraz and Ozdemir (2006) uses the items to measure the relationship between educational ideologies and TAM of Pre-service teachers at Middle East Technical University, Turkey. Respondents were asked to indicate their agreement or disagreement on a 7 –point Likert scale with 1= strongly disagree to 7 = strongly agree.

To further establish the psychometric value of the teachers' acceptance of technology, the questionnaires were subjected to content-related validation. To content-validate the items, the instrument was administered to a purposive sample of 10 "judges" comprising of 5 lecturers and 5 PhD candidates. These judges were requested to validate and comment on whether the items would correspond to the underlying dimensions. Based on these comments, the items were reworded and included in the present study.

Data Analysis

To verify and validate the survey questionnaire, a confirmatory factor analysis (CFA) was conducted on the hypothesized three-factor structure model using Analysis of Moment Structure (AMOS; Arbuckle, 1989) model-fitting program. The program adopted maximum likelihood estimation to generate estimates in the full-fledged measurement model. Goodness of fit of the estimated model was evaluated using not only the Chi-square but also multiple descriptive indices. The present study reported the goodness-of fit index (GFI), comparative fit index (CFI), Tucker-Lewis Index (TLI) and root mean square of error approximation (RMSEA).