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Infusing Thinking Skills in the Classroom: Perceptions of Undergraduates in China Public Universities

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Abstract

Preparing students to be able to think critically and analytically is a goal of higher education and also a quality sought by employers of university graduates. Nurturing thinking skills is considered as an important variable in the process of student learning for all nations, and China is not an exception. To activate and prompt students' thinking skills in a classroom, effective infusion of critical thinking skills could be the first step. Some studies merely evaluate thinking skills infusion/teaching from the instructors' perspectives. To date, there is no comprehensive attempt to investigate thinking skills infusion in classroom from students' perceptions in China. Therefore, providing a comprehensive angle of thinking skills infusion in the classroom is a starting point towards completing a bigger picture of the teaching and learning process. This exploratory study seeks to investigate students' perceptions of university instructors' infusion of critical thinking skills in their teaching through an evaluation questionnaire. A random sample of 132 undergraduate students completed this survey. A descriptive analysis on the data revealed that students positively confirmed the efforts of university instructors in infusing thinking skills in their courses. However, a question arises as to the issue of balancing between the infusing of LOTS (Lower-order thinking skills) and HOTS (Higher-order thinking skills) categories optimally so that university students are able to benefit from critical thinking skills training. The result suggests that the instructors should consider the ratio between LOTS and HOTS when they are preparing focused teaching programs of nurturing thinking skills in classroom. For instructors, especially new instructors, the result could help them to rethink on defining more refined learning outcomes according to the skill categories in accordance to

Bloom's taxonomy. In general, the study contributes to the knowledge on the literature on thinking skill infusion, and also to the more conscious realization of related pedagogical approaches that can be used to obtain task fulfilment of targeted goals of learning in the classroom.

Keywords: Critical thinking skills infusion, Higher-order thinking skills (HOTS), Lower-order thinking skills (LOTS), Perception

1. Introduction

As future human capital, university students need to equip themselves with critical thinking and problem solving skills as this is the focus of employers in hiring new people (Rodzalan & Saat, 2015). To deal with the new challenges and meet the new needs, university students were required to think analytically and critically. They must know how to organize, process and utilize knowledge more than merely remember them.

Thus, a tacit agreement exists that students' ability to think critically and analytically is a fundamental objective of higher education. Students are expected to process an unprecedented amount of information especially when they are university students who need to do assignments and self-directed learning. These require high-level thinking which involves the process of analysis, evaluation, reasonableness and reflection (Jeevanantham, 2005). In short, students in the process of their tertiary education are also preparing themselves for both academic study and work place needs in which application of thinking skills is extensively appreciated and practiced. Therefore, in higher education, the development of students' critical thinking skills has been strongly recommended by many scholars and educators (Nagappan, 2001).

At the policy level, there is a trend for adding critical thinking skills in curricula. For example, critical thinking skills have been clearly added in learning goals in educational policy in England in 1999 (Qualification and Curriculum Authority, 1999), in the latest Malaysia Higher Education Blueprint 2015-2025 (Ministry of Education Malaysia, 2015) and in China in 2001 (Ministry of Education, 2001). Chinese government and some Chinese educators have announced that it is highly important to innovate Chinese education to increase the focus on critical thinking (Dong, 2015).

To improve students' critical thinking skills in learning, instructors play an important role in fulfilling the desired learning outcomes in the classroom. This is apparent by the designing of pedagogical activities that stimulate and encourage students to develop their thinking skills (Curriculum Development Center, 1989).

Instructors' successful infusion of critical thinking skills is a good gauge of curricular achievement. However, there is only one-side picture of critical thinking skills infusion in classroom. Recently, the studies only focused on the investigation of critical thinking skills infusion in classroom from the instructors' views, but not from the students' perceptions (邹绍艳&高秀雪, 2015). What are students' perception on thinking skills infusion in classroom?

Thus, to ensure that thinking skills infusion is indeed practiced, it is necessary to evaluate the instructors' performance in teaching thinking skills from students' perceptions. To get a clearly picture of students' perception on thinking skills infusion, Bloom's taxonomy was applied to investigate the extent of the deliberate and explicit teaching of thinking skills in the classroom.

Higher education worldwide recognized the rapid changing of world and the changing needs

of students.To meet the needs, instructors should collaborate with the goal of creating better teaching strategies, remodeling of the curriculum, and constructing creative assessments for thinking skills (Rotherham & Willingham, 2009). Gehrett (2000) and McMahon (2009) noted that students seemed to gain a deeper understanding, definition, and application of critical thinking skills by way of immersed learning of these skills. Therefore, nurturing critical thinking skills, infusion of critical thinking skills is a recommended approach in teaching. Since the early years on the discussion on infusion of critical thinking skills in teaching, this issue has now been widely recognized as a challenge (Scherer, 2008). To ensure effectiveness of critical thinking skills infusion, students' perceptions cannot be neglected as they are the end-receivers.

Studies are rich in how assessing critical thinking, definitions of critical thinking/skills and theories on the development of good critical thinkers, but few studies exist on how students perceive critical thinking skills infusion in the classroom. Perceptions are not only related to what a person see or hear but also to what he or she knows, expects, or believes; accompanied at the same time by information on the respondent's physiological state(Schick & Vaughn, 2011). Thus, Alazzi (2008) noted that further researches could focus on whether the teachers have integrated critical thinking skills in teaching and to what extent the students have learned. Perception study is also seen as constructive, having an impact value on current pedagogical practices because of insights revealed from a systematic study on teaching and learning.

From this problem statement, the research questions that govern the direction of the study are as follows:

1. What are the perceptions of mainland China's tertiary students with regard to critical

thinking skills infusion as practiced by their classroom teachers?

2. How are critical thinking skills infusion distributed in terms of LOTS AND HOTS learning outcomes?

In the next section, related literature is reviewed to help support the central issues addressed in the research questions.

2. Literature Review

In university education, a stated policy is now entrenched that requires students to think analytically so as to go beyond the building of mere knowledge. However, there are past studies and published news that reported that most university graduates still lack thinking skills. For example, Professor Huang Yuanshen (黄源深) (2010) has reported that a large number of Chinese undergraduates merely listed information without logical organization and analysis in their academic work. A number of researchers have supported this finding on a lack of criticality in Chinese students' thoughts processes (孙有中, 2011a; 王强&国永荣, 2012). Thus, improving students' critical thinking skills is still relatively of concern in education, especially the infusion of critical thinking skills which is regarded as a key approach recommended to develop students' thinking skills in teaching. This approach is based on the natural infusion of information within the context of what is taught in content areas for the learning of skillful thinking (Swartz & Parks, 1994). Nurturing skillful thinking as an educational goal affirms the belief that growth in thinking is obtainable by all students. This goal also reflects confidence that all instructors can help students to become better thinkers regardless of the students' characteristics and background. The infusion approach differs from that of the discrete approach in learning. The former emphasizes the acquiring of thinking skills through everyday teaching while the latter, as the term implies, makes use of specific resources and techniques

to achieve a narrower goal. In other words, teach thinking skills draw on a broad range of subjects and at the same time seek to develop efficient teaching skills in curricular subjects, and encourage problem-solving (Taggart et al., 2005).

In this study, investigating 'infusion' approaches is the main focus. The infusion approaches were evaluated by students who reported their perspectives on the extent thinking skills infusion was present in classroom teaching. How is critical thinking defined? In early 1987, Scriven and Paul in a presentation at the 8th Annual International Conference on Critical Thinking and Education Reform, 1987, provided a comprehensive definition of critical thinking as:

> the intellectually disciplined process of actively and skilfully conceptualizing, applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (A definition used by the National Council for Excellence in Critical Thinking, 1987).

Besides this definition, scholars, educators, philosophers, and many others have defined critical thinking skills based on varied fields. These various definitions of critical thinking are not necessarily incompatible with one another, they shared similar key words. Most of these definitions are focused on "skillful", "reasonable", "reasoning" and "logical" (Bailin et al., 1999; Sharon Bailin & Battersby, 2009; Fisher & Scriven, 1997; Lipman, 1987).

In learning and teaching, Bloom's taxonomy offers a hierarchical scale of learning skills (*Knowledge, Comprehension, Application, Analysis, Synthesis*, and *Evaluation*) which can be

connected to critical thinking skills. Blooms' taxonomy is one of the most widely used models of cognitive abilities and educational objectives in education, and even its severest critics agree that the model has enormous influence on learning and is an important step toward understanding the structure of learning outcomes (Kottke& Schuster, 1990). Based on Bloom's taxonomy, embedded critical thinking skills are often demarcated into two broad categories that of LOTS (Lower-order thinking skills) and HOTS (Higher-order thinking skills).Knowledge, comprehension and application are LOTS; analysis, synthesis, and evaluation are HOTS. The acquiring of (HOTS) is very emphasized in university curriculum, in which teachers have to guide students to develop a critical thinking system to aid the making of sound decisions, and solving of problems (Barak et al., 2007; Heong et al., 2011).

Infusion of thinking skills in HOTS in fact is not only emphasized at the tertiary education, but also in secondary education. Mahyuddin, Pihie, Elias and Konting (2004) had carried out a survey on 387 secondary school students which showed that teachers had incorporated critical thinking skills as well as convergent/divergent thinking skills in the teaching of their subjects. It provided evidence that vocational/technical and science and mathematics students had better perceptions of the teachers incorporating thinking skills in their subjects when compared to language students. The study suggests that in language teaching, especially in a comprehension classroom, thinking skills such as drawing inferences, making predictions, monitoring one's own understanding of written materials should be infused more emphatically (Mahyuddin, Pihie, Elias, & Konting, 2004).

The infusion of thinking skills in a subject is considered necessary to develop students' thinking (Sheha et al., 2010). One of the ultimate goals of promoting HOTS is the transfer of these

thinking skills across disciplines and domains (Leou et al., 2006; Zohar & Dori, 2003). Essentially, infusion and the promotion of critical thinking skills entail teaching students to use information and concepts that they have learnt in school to make decisions and solve problems effectively (Swartz et al., 1998). In effect, this learning would help to imbue life-long skills.

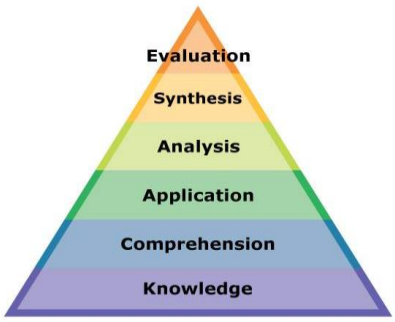
To date, the related studies only observed critical thinking skills infusion from the instructors' perspectives, the students' haven't been investigated in China. Form other studies, it is worrying that they shared similar results in finding an imbalance in the infusion of thinking skills at the LOTS and HOTS levels (Barak et al., 2007; King et al., 1988; Mahyuddin et al., 2004; Sheha et al., 2010). This is also evident in Sheha, Aziz and Mustapha's (2010) study, in which they found that the lecturers infuse mostly LOTS, especially the lowest level of critical thinking skills (*Knowledge*) in classroom teaching. Instructors/lecturers were observed to be inclined to enhance LOTS more than HOTS in classroom (Abdullah et al., 2003; R. Nagappan, 2001; Rosma et al., 2004; Sheha et al., 2010; Zohar, 1999). Barak et al. (2007), found that only 20% of teachers purposefully integrate teaching strategies targeted at promoting HOTS in science education. It is disturbing that teaching may fall short of preparing students to face an ever-changing and challenging world that requires critical/evaluative thinking (Ben-chaim et al., 2000). All of these researches showed a deliberation on the degree of promoting critical thinking skills in both LOTS and HOTS. The above readings provide the context for the present research and the next section elaborates on the literature that focuses on the theoretical framework used in the study.

2.1 Theoretical Framework

For this investigation, thinking skills are framed in traditional terms which correspond with Bloom's taxonomy (1956). Bloom's taxonomy is widely used today as an educational planning tool for all levels of teaching (Faculty Development and Instructional Design Center, 2010). By extension, this framework also applies to the teaching of tertiary level teaching and learning as well (Yan & Chan, 2015). According to Bloom's taxonomy, thinking skills fall into six sub levels and/or skills: *Knowledge*, *Comprehension*, *Application*, *Analysis*, *Synthesis* and *Evaluation*. In this taxonomy, skills involving *Analysis*, *Evaluation* and *Synthesis* (creation of new knowledge) are defined as HOTS, involving the learning of complex judgmental skills such as critical thinking and problem solving and the rest of the skills are defined as LOTS: *Knowledge*, *Comprehension* and *Application*(Higher-order thinking, n.d.). Bloom's taxonomy provides the overarching framework used in this investigation of infusion thinking skills across classroom teaching. Bloom's taxonomy is a major underpinning for the theoretical foundation of the study as it is able to explain the phenomenon of thinking skills and the thinking process. This taxonomy provides a continuum of six levels of thinking skills, ordered from LOTS to HOTS.

Figure 1:

Bloom's taxonomy of learning goals



As figure 1 shows, the lowest level, *Knowledge* level requires the remembering of facts and

data. Students could be asked questions related to *who, when, where*. *Comprehension* level requires the demonstration of understanding of learned information. Students could be asked to explain, paraphrase, compare and contrast. *Application* level could ask students to take a concept and apply it in a new or hypothetical situation. The upper level, *Analysis* requires learners to break something into component parts, classify, categorize and analyze. *Synthesis*, developing from *Analysis*, demands processing of decomposed elements comprehensively, and recombining them into a whole as required. The last level is *Evaluation*, which requires learners to judge/evaluate evidences based on established arguments. Students could be asked to assess, comment, predict and evaluate. Bloom's (1956) taxonomy offers an accessible guide for instructors to scaffold well-designed teaching items which integrate both LOTS and HOTS, and in turn, offers a measure to gauge the effectiveness of critical thinking skills infusion.

3. Methodology

In the study, a questionnaire was adapted from *"Student Perceptions of Critical Thinking in Instruction Course Evaluation Form"* published by the Foundation for Critical Thinking (Foundation for Critical Thinking, 2007). It uses a unidimensional scale of measurement and is able to elicit evidences of how students perceive thinking skills, especially HOTS, as fostering classroom instruction (Foundation for Critical Thinking, 2007) (Appendix A).

To resolve ambiguity and to facilitate understanding, some of the questions were revised from the original statements prior to administration. For example, the original question: "To what extent did your instructor explain what critical thinking is (in a way that you could understand)? appears complicated in syntactical arrangement and was therefore simplified and rephrased as 'My instructor explains what critical thinking is (in a way that I could understand), so that it is

concise and straightforward as a declarative statement to elicit a scaled response. Then, a five-point Likert scale was devised with values that are as follow: *strongly disagree, disagrees, neither, agree, strongly agree,* which replaced a two point value (low to high score) that encompasses a range of 5 options (1 -5). The items were further categorized according to different thinking skills based on Bloom's taxonomy, no item fell into *Knowledge*.

Following the ground work, a pilot study of the questionnaire was conducted on a group of undergraduates (N=30) from a public Chinese university. To test the reliability of the questionnaire, the Cronbach Alpha measure was obtained through SPSS 21(see table 1).

Table 1

Reliability Statistics of Students' Perceptions

Questionnaire	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Student's Perceptions of Thinking Skills in Instruction	.92	.92	20

Based on the 20 items of the questionnaire, table 1 displays a Cronbach's alpha index of .92, which indicates high reliability, and thus acceptable for use. Additionally, the noun form of 'lecturer' in the questionnaire was changed to the plural form to emphasize clearly the generic group coverage as a perception. With these changes and the obtaining of a credible reliability index, the questionnaire was administered to the participants of the study.

3.1 Samples

The 132 participants were randomly selected from three universities (Hebei Normal University, Hebei Medical University and Hebei University) in Hebei province of China. The participants

were sophomores who had enrolled in four departments (Computer and network information security, Electrical engineering and automatization, Nursing, English) for the third semester of 2019/2020. Forty-five were from the Department of Computer and network information security ofHebei Normal University (34%), 10 were from the Department of Electrical Engineering and Automatization of Hebei Normal University (8%), another 23 were from the Department of Nursing of Hebei Medical University (17%) and 54 were from the English Department ofHebei University (41 %) (see table 2).

Table 2

Demographic Information of Participants

Variables		No	Percentage
Departments	Computer and Network Information Security	45	34%
	Electrical Engineering and Automatization	10	8%
	Nursing	23	17%
	English	54	41%
Total:	132	100%	

3.2 Data Descriptions

As mentioned, the questionnaire contains 20 items accompanied by a five-point Likert scale. Table 3 displays the overall results, which clearly shows that a reasonably high percentage of 72.9% of students had agree/strongly agreed that thinking skills were clearly infused in the classroom teaching. Only a small percentage of 3.37% disagreed with this notion. This result shows that the students had a dominantly strong perception of their instructors imparting thinking skills to them.

Table 3

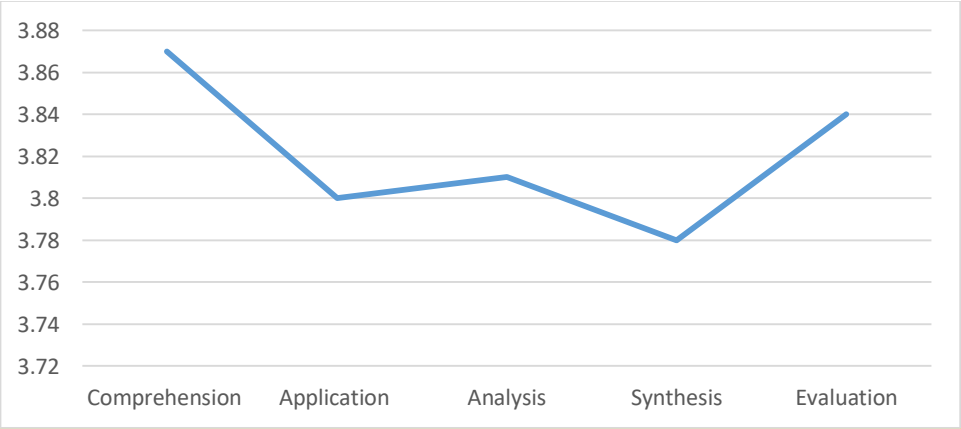
Frequency of Responses for Students' Perception in Questionnaire (N=132)

Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
0.57%	3.37%	24.16%	56.52%	15.38%

Figure 2 below shows the means of students' perception on infusion of thinking skills in instruction according to the component skills using Bloom's taxonomy. The highest mean value (M=3.87) referred to the thinking skills of *Comprehension*. *Evaluation* also received quite a high mean value (M=3.84). *Application* had a mean of3.80. *Analysis* showed a mean figure of3.81 while *Synthesis* received the lowest rating with a mean of 3.78. Based on the mean value of each component skills in Bloom's taxonomy, the overall mean of the questionnaire was obtained (M=3.82). A more discrete display of the mean figures is illustrated in the figure below when the calibrations are given a .02 difference in the values indicated along the x- axis.

Figure 2

The means of students' perceptions on infusion of thinking skills according to Bloom's Taxonomy (N=132)



When arranged in a hierarchy from the highest to the lowest value, the information is as follows:

Table 4

Hierarchy of Perception Values for the Infusion of Thinking Skills in Teaching

Component	Mean	Thinking skill
1. My instructors teach me to think to understand the content.	3.87	Comprehension
2. My instructors explain what critical thinking is (in a way that I could understand).		
4. My instructors' teaching clarifies the reason why I am doing what I am doing.		
7. My instructors' teaching can help me learn how to understand the key organizing concepts in the subject.		
3. My instructors' teaching encourages critical thinking in the learning process.	3.84	Evaluation
14. My instructors' teaching enables me to think more accurately when discussing or answering questions.		
15. My instructors' teaching enables me to think more deeply when discussing or answering questions.		
16. My instructors' teaching enables me to think more logically when discussing or answering questions.		
17. My instructors' teaching enables me to think more ethically when discussing or answering questions.		
20. My instructors' teaching encourages me to think for myself using reasoning to make relevant decisions.		
8. My instructors' teaching can help me learn how to identify the most basic assumptions in the subject.	3.81	Analysis
9. My instructors' teaching can help me learn how to make inferences justified by data or information related to the subject.		
10. My instructors' teaching can help me learn how to distinguish assumptions, inferences, and implications.		
13. My instructors' teaching enables me to think clearly when discussing or answering questions.		
18. My instructors' teaching can help me learn how to distinguish what I know from what I don't know.		
6. My instructors' teaching helps me learn how to find information on my own that are relevant to answering questions about the subject.	3.8	Application
11. My instructors' teaching can help me learn how to think rationally about the subject.		
12. My instructors' teaching can help me learn how to ask questions that experts in the subject routinely ask.		
5. My instructors' teaching helps me to form precise questions, statements of problem at any given time during the instruction.	3.78	Synthesis
19. My instructors' teaching helps me to give critical comments when I disagree with a point of view.		

The data above showed that the infusion of *Comprehension* (LOTS) took the highest mean value compared to the other thinking skills in the two categories. To rate the infusion of thinking skills for *Comprehension*, the questionnaire items emphasized the main concept of "understanding". "Understanding" is a typical basic thinking skill in *Comprehension*, which can help students to grasp and demonstrate facts and ideas (Bloom & Krathwohl, 1956; Ritchhart & Perkins, 2008). The questionnaire items showed the majority of students agreed that the instructors conveyed the concepts of critical thinking skills by helping students understand how assignments and tasks are to be done. Clearly, the majority of students agreed that *Comprehension* skill was infused in the classroom instruction by way of helping students "understand" the activities that need to be carried out. This is where teachers had chosen to concentrate on the infusion of thinking skills which is unsurprising manifested as successful completion of assignments as a core activity in classroom instruction. Obviously, this aspect of invoking thinking skills is explicitly emphasized.

The mean value in *Application* was lower than *Comprehension* and thisgives further testimony to the notion that usually in LOTS, emphasis is given mostly to the *Comprehension* level (Sheha et al., 2010). To rate infusion of thinking skills in *Application*, the items focused on the students' perception of the instructors helping them to use learned knowledge in new concrete situations. The result showed that students received encouragement from their instructors through activities such as helping them to find information on their own that are relevant to answer questions about the subject, to learn how to ask questions that experts in the subject routinely ask, and to think rationally about the subject. The mean score indicated that *Application* is less attended to in LOTS instruction. This is another level in LOTS instruction that certainly can be given more attention on the cultivation of independent learning for tertiary

students.

As for *Analysis, Synthesis* and *Evaluation* which are HOTS, the results indicated that students did have ample chance to practice these thinking skills during classroom teaching and learning. The result showed that the majority of students could distinctly perceive the infusion of the instructors' guidance of these levels of thinking skills, such as thinking clearly when discussing or answering questions, distinguishing what one knows from what one does not know, and identifying the most basic assumptions in the subject.

4. Results and Discussion

The results of the present study provide evidence of the infusion of thinking skills in the classroom on the part of the teachers who appeared to have taken on the role responsibly. The result generally concurred with two prior studies which applied the same instrument. In the review of literature, only two studies applied the same evaluation form (*Student Perceptions of Critical Thinking in Instruction Course Evaluation Form*). The first was Carlson's (2011) study. The present study and Carlson's (2011) study both revealed that the majority of students agreed that instructors imparted the job of infusing thinking skills in the instruction. Both studies achieved similar overall mean values of around 3.84.

The two studies confirmed that students believed quite firmly that thinking skills were incorporated by instructors in the classroom. In addition, Carlson's (2011) study showed that as students advanced from freshmen to senior status, the aggregate students' perception scores rose. There was also a general agreement between the students' perceptions and the instructor's perceptions, suggesting that the enhancement of students' perceptions is subject to the efforts

of the instructors. Carlson's study in 2013 also applied the questionnaire to test whether students' perceptions of critical thinking instruction correlated with the instructors' perceptions of critical thinking instruction in the course on pedagogy. However, the findings did not support a significant correlation between students' perceptions and instructors' perceptions on this matter.

This particular study did not attempt to compare student and instructor perceptions. Rather, it was more interested in comparing students' perceptions with regard to LOTS and HOTS division within Bloom's framework. To show the differences in perceptions, mean scores were calculated according to the two divisions revealing means scores of 3.84 for LOTS and 3.81 for HOTS. The figures suggest a near balance in terms of infusion of thinking skills for both categorizations. This leads to the inquiry of whether instruction should place more emphasis on the infusion of thinking skills at HOTS level as they obviously are more complex and perhaps more valued as students become more mature in their cognitive skills. If this is the case, then instructors could devote more emphasis on the infusion of thinking skills in this category of skills so that they can become 'better' performers in such skill processing. Within the Likert scale use, a curricular aim could be to achieve a perception score of 4.0 and above as a recognition of the higher value placed on the cognitive maturity of HOTS.

The results indicated that students perceived that infusion of skills was most obvious in the teaching of *Comprehension* compared to other thinking skills, the mean scores for the infusion of LOTS especially *Comprehension* were also very close in value for the other skills of *Evaluation, Analysis* and *Application* (HOTS). *Synthesis* which is ranked the most complex according to Bloom's taxonomy had the lowest mean score. This could possibly mean that

instructors took more efforts on promoting *Comprehension* skill rather than the other skills. Seen from the perspective of HOTS and LOTS categorization, with *Comprehension* and *Application* falling into LOTS, it would appear that lecturers concentrated on the infusion of thinking skills at this level, though not neglecting the HOTS domain. This observation was also shared by Sheha, Aziz and Mustapha (2010) where they commented that when lecturers infuse LOTS, mostly, the emphasis is on *Comprehension* skill.

The findings of this study also lend support to some other recent studies (Abdullah, Marimuthu, & Liau, 2003; Nagappan, 2001; Zohar, 1999) that showed that teachers are still lacking in posing higher order questions to their students. Teachers were observed to elicit questions which were mainly targeted at the lower-order level of thinking skills (Rajendran Nagappan, 2001; Rosma et al., 2004). Sheha et al. (2010) carried out a study on infusion of thinking skills in English language instruction in the first semester of the Diploma of Science program in a Malaysian university. The result revealed that both LOTS and HOTS were given equal priority in the teaching objectives, but the course content and the scheme of work had more elements related to the area of LOTS. Their study also used audio recordings to investigate the infusion of thinking skills in the classroom. The data collected showed that questions and tasks posed at the lower order thinking level amounted to 59%, whereas higher order thinking level questions were only allocated 41%.

It is worthy to consider ways of striking a better balance when developing thinking skills at both LOTS and HOTS levels as too much or too little support of either category may hinder rather than support their development (King et al., 1988) especially at the tertiary level.

5. Conclusion

One of the current threads in curriculum reform is the increasing attention accorded to critical thinking. To remain competitive, developing critical thinking skills has become a core feature in a curriculum. It is crucial that students be equipped with adequate or more than adequate thinking skills in order to function and cope successfully in a highly technical society that is undergoing rapid changes, with high demands on being innovative and having self-independence in task completion.

As evidenced in this study, a major issue is to achieve a more sensitive balancing of infusing thinking skills according to educational level attainment. It would indeed be worrying if stakeholders, especially planners and teachers, fall short of their roles as effective custodians and practitioners in the active and appropriate promotion of infusing thinking skills across the curriculum.

6. Implications for Further Study

The findings could have some implications. Firstly, policy makers for tertiary education could rethink their strategies on planning of infusion of thinking skills in classroom instruction especially in terms of arriving at a pragmatic balance in infusion of thinking skills between LOTS and HOTS. Additionally, the balance could also take into consideration the level of student progression with regard to their advancement from stages of learning from year to year. At the tertiary level, the balance could be skewed more in favor of HOTS as they progress in their semesters.

Another implication is that discipline of study may matter in the way infusion of thinking skills

is imparted. More investigation could be carried along interdisciplinary lines to realize differences in pedagogic approaches in infusion of thinking skills. Teachers themselves could also consciously reflect on their approaches in the teaching of thinking skills and document their experiences as part of action research in the classroom. Such findings can lead to improvements in teaching styles of infusing thinking skills in LOTS as well as in HOTS.

Finally, as we move further into technological advancement, infusion of thinking skills could be captured in scenarios that are played out with the use of videos clips. Visual displays of role play will help to reinforce the learning and teaching of thinking skills which can also be calibrated along the lines of teamwork as in real life situations to prepare students for the work world.

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Appendix A

Thinking Skills Questionnaire (adapted from Paul & Elder, 2007)

Thinking Skills	Statement
Comprehension	1. My instructors teach me to think to understand the content.
	2. My instructors explain what critical thinking is (in a way that I could understand).
	4. My instructors' teaching clarifies the reason why I am doing what I am doing.
	7. My instructors' teaching can help me learn how to understand the key organizing concepts in the subject.
Application	6. My instructors' teaching helps me learn how to find information on my own that are relevant to answering questions about the subject.
	11. My instructors' teaching can help me learn how to think rationally about the subject.
	12. My instructors' teaching can help me learn how to ask questions that experts in the subject routinely ask.
Analysis	8. My instructors' teaching can help me learn how to identify the most basic assumptions in the subject.
	9. My instructors' teaching can help me learn how to make inferences justified by data or information related to the subject.
	10. My instructors' teaching can help me learn how to distinguish assumptions, inferences, and implications.
	13. My instructors' teaching enables me to think clearly when discussing or answering questions.
	18. My instructors' teaching can help me learn how to distinguish what I know from what I don't know.
Synthesis	5. My instructors' teaching helps me to form precise questions, statements of problem at any given time during the instruction.
	19. My instructors' teaching helps me to give critical comments when I disagree with a point of view.
Evaluation	3. My instructors' teaching encourages critical thinking in the learning process.
	14. My instructors' teaching enables me to think more accurately when discussing or answering questions.
	15. My instructors' teaching enables me to think more deeply when discussing or answering questions.
	16. My instructors' teaching enables me to think more logically when discussing or answering questions.
	17. My instructors' teaching enables me to think more ethically when discussing or answering questions.
	20. My instructors' teaching encourages me to think for myself using reasoning to make relevant decisions.