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Teaching Thinking Skills in Teacher Education

ABSTRACT: *The thinking skills policy in Malaysia is motivated by the aspiration of the 2020 Vision that was published in 1991. The vision states explicitly that Malaysia will become a fully developed nation by the year 2020. So, teaching the thinking skills has also been given a high priority in educational policy. However, many teachers are ill-equipped with the ability to teach thinking skills. Therefore, as the producer of current and future teacher, teacher education programme should emphasize thinking skills teaching. This study aimed at identifying the extent to which teacher educators provide an exemplary practice of thinking skills teaching to student teachers. Specifically, this study investigates whether teacher educators provide the opportunity to student teachers to engage in teaching and learning that emphasized the integration of thinking skills. This study was conducted at one teacher education programme in Malaysia. All final year student teacher (60) were selected as the samples. A set of questionnaire used as an instrument. Data were analyzed using Statistical Package for the Social Science and the findings were reported in the form of frequency and percentage. The findings indicate the lack integration of various forms of thinking skills in teaching and learning activities. The traditional approach of a one-way communication technique was more dominant compare to the teaching technique that promotes thinking skills. Hence, this study has several practical implications for teacher education programme for producing future teachers with the ability to implement thinking skills policy in schools.*

KEY WORDS: *Thinking skills, educational policy, teacher education, teacher educator, student-teacher, teaching and learning activities, and ability to implement thinking skills policy.*

INTRODUCTION

Present technological advances and the need to stay competitive in the globalisation era require skilled workers, who are able to think critically, to evaluate alternatives, and to meet complex challenges intelligently (Pithers, 2000). These fundamental changes in employment imply a rise in the demand for non-routine cognitive and interpersonal skills and a decline in the demand for routine cognitive and craft skills, physical labour, and repetitive physical tasks (OECD, 2012).

Therefore, policy-makers around the world strive to include the development of cognitive ability or thinking skills as an important education goal. According to A. Craft (2007), by the late 1990s, policy-makers in several countries, such as Australia, Canada, England, Hong Kong, China, Singapore, and the Middle East had announced policy initiatives focused

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on fostering students' thinking.

In Malaysia, which is the focus of this study, teaching thinking skills has been mandatory since 1993. The thinking skills policy in Malaysia is motivated by the aspiration of the 2020 Vision that was published in 1991. The Vision states explicitly that Malaysia will become a fully developed nation by the year 2020. In order to achieve the Vision, the country needs to develop a manpower with the capacity to solve problems, make decisions, think both creatively and critically, and be able to adapt and adjust to present or future situations (Mohamad, 1991). In relation to this, all teachers are required to teach thinking skills across the curriculum (CDC, 2002).

The successful implementation of thinking skills policy in education requires the thoughtful consideration of current instructional techniques and the commitment to an active student-centered learning environment (Limbach & Waugh, 2010). However, H. Rosnani & H. Suhailah (2003), who reviewed some studies related to thinking skills teaching in Malaysia, concluded that in most of the studies teachers were not prepared to teach thinking, and had a low sense of self-efficacy and little knowledge and skills in the area of thinking skills (Rosnani & Suhailah, 2003:56).

Teaching and learning in the classroom are still dominated by one-way communication teacher centered approach. Similarly, M. Rahil *et al*. (2004) argue that it is realised that many teachers are not fully capable of incorporating thinking skills in their teaching strategies (Rahil *et al*., 2004:24). The extent to which higher-order thinking skills are taught and assessed continues to be an area of debate, with many teachers and employers expressing concern that young people "cannot think" (Collin, 2014).

The issue of teachers ill-equipped for implementing teaching thinking skills policy has led to the questioning of the effectiveness of teacher education programmes. M. Lunenberg & F. Korthagen (2003) argue that one of the reasons is maybe their teacher educators taught them according to traditional methods (Lunenberg & Korthagen, 2003:30). This is based on the idea that "teachers teach as they are taught" (Blume, 1971). Teacher educators should model teaching approaches that are consistent with those we expect for teachers in school (Russell, 1997; Hoban, 2005; and Korthagen, Loughran & Lunenberg, 2005).

Therefore, in the context of teaching thinking skills policy, teacher educators should provide an exemplary practice of thinking skills teaching to the student teachers. K. Guilfoyle, M.L. Hamilton & S. Pinnegar (1997) claim that in teaching future teachers, teacher educators are committed to model the kind of work we expected from them (Guilfoyle, Hamilton & Pinnegar, 1997:183). It is important to provide student teachers with the opportunity to gain relevant experience, because it could help the student teachers to become familiar with the new ways of educational innovation (Griffin, 1999; Stromquist, 2002; and Russell, 2005).

Highlighting the role of teacher educators in preparing future teacher for the implementation of thinking skills policy extends the research in this area from school into teacher education. Very little research focusing on teacher education so far. Many studies in this area focused on teachers' conception of thinking skills and the extent to which they were able to develop students' thinking. This is particularly important, because teacher education has an important role in the preparation of future teachers who being able to implement thinking skills teaching across the curriculum.

The objectives of this study are: (1) to identify the extent to which teacher educators providing an exemplary practice of thinking skills teaching; and (2) to identify the extent to which teacher educators infusing various forms of thinking skills in their teaching.

THINKING SKILLS

Defining Thinking Skills. There is no unified and agreed-upon definition of thinking skills. As K. Cotton (1991) stated that those who take an interest in this field of study soon realise that they cannot go tossing around these terms in a casual manner, since there are no universal agreements as to their meanings (Cotton, 1991:2). Similarly, L. Cuban (1984) asserts

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that defining thinking skills, reasoning, critical thought, and problem solving is troublesome for both social scientists and practitioners. Troublesome is a polite word: the area is a conceptual swamp (Cuban, 1984:676).

Therefore, L.B. Resnick (1987) suggests that it is easy to list the key features associated with the term. As such, a number of researchers provide lists, taxonomies, and descriptions about types of thinking skills that should be subject to instruction. These include problem solving, decision-making, creative thinking, and critical thinking (Siegal, 1984; Presseisen, 1986; Beyer, 1987; and Marzano *et al.*, 2000). These thinking skills are included in the "way of thinking" as one of the four categories in the 21st century skills frameworks (Binkley *et al.*, 2010).

Obviously, there are three main components of thinking skills that can be identified in the literature: micro-thinking skills, macro-thinking skills, and thinking quality. The first and the second are differentiated in terms of their complexity.

Micro Thinking skill. This is used to refer to thinking skills that are less complex than overarching problem-solving and decision-making strategies (Beyer, 1987; and Marzano *et al.*, 2000). As B.K. Beyer (1987) notes that each micro-thinking (core skill) operation consists of only a limited number of steps, procedures, and rules. These skills are relatively simple and straightforward (Beyer, 1987:31). B.K. Beyer (1987) referred to the cognitive domain of Bloom's Taxonomy as the best and most clearly defined list of micro-thinking skills.

The progressive levels of Bloom's revised taxonomy include remembering, understanding, applying, analysing, evaluating, and creating (Krathwohl, 2002). These basic skills are components of more complex strategies, such as problem solving and decision-making. In her three-stage model of cognition, B.Z. Presseisen (1986) uses the term "essential skills" to explain a range of basic thinking skills. The essential skills include qualifications, clarifications, relationships, transformations, and causation.

Similar to B.K. Beyer (1987), B.Z. Presseisen (1986) treats the essential skills as prerequisite tools for more complex strategies in problem solving and decision-making. R.J. Marzano *et al.* (2000) identify 21 "core thinking skills". Core thinking skills, when employed in certain arrays, will lead to the formation and use of more complex thinking skills such as problem solving and decision-making (*cf* Marzano *et al.*, 2000; and Beresford & Sloper, 2008).

Macro thinking skills. Macro-thinking skills are sometimes explained as thinking processes, are broader, greater in depth and breadth, and more complex. They may include a range of core skills, and evolve and adapt with other complex strategies. These include two common thinking terms in the literature: problem solving and decision-making.

Problem solving, as it is largely described in the psychological literature, refers to certain mental operations or processes that are needed to reach a specific goal (*cf* Skinner, 1953; Polya, 1957; and Newell & Simon, 1972). R.E. Mayer (1990) defines problem solving as cognitive processing directed at transforming a given situation when no obvious method of solution is available. This definition is widely accepted in the problem solving community (*cf* Mayer & Wittrock, 2006).

Grounded in these accepted meaning of problem solving, the PISA (Programme International Student Assessment), in 2012, definition of problem solving competency is an individual's capacity to engage in cognitive processing to understand and resolve problem situations, where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one's potential as a constructive and reflective citizen (OECD, 2010).

A number of prescriptive strategies have been developed for problem solving (*cf* Newell & Simon, 1972; Gagne, 1985; Bransford & Steain, 1986; Gick, 1986; and Klieme, 2004); and although these are numerous, many share a basic similarity in structure. Perhaps foremost is the IDEAL problem solver model proposed by J.D. Bransford & B.S. Steain (1986). It is this that is employed in Malaysia. The model emphasies five components of thinking that are applicable to a wide variety of situations. These IDEAL include: I = *Identify the problem*;

D = *Define the problem*; E = *Explore strategies*; A = *Act on ideas*; and L = *Look for effect*.

Decision-making, typically, involves selecting a single option from a set of alternatives based on a set of criteria (Greenbank, 2010). Decision-makers must choose from a set of alternatives, each of which has one or more consequences (Halpern, 1984). In the context of uncertainty condition, effective decision making involves the ability to recognize risk, formulate strategies for action, and coordinate with others in an effort to bring an incident under control quickly (Comfort & Wukich, 2013).

In earlier work, L.K. Comfort (2007) identified four skills as essential to decision making under uncertainty: cognition, communication, coordination, and control. These skills are cumulative and each skill depends upon the preceding skill. Many decision-making models have been proposed in the literature (*cf* Cassidy & Kurfman, 1977; and Ehrenberg, Ehrenberg & Durfee, 1979).

All the models seem to share the same notion that decision-making consists of sub-processes; and although there are some differences in suggested steps, these models generally include the determination of goals, the search for alternatives, evaluation of alternatives, selection, and implementation.

Thinking Quality: Critical and Creative Thinking. S. Bailin (1998) stresses that thinking is not merely a description of how we think, but more importantly is how to think well. Although most individuals think, the problem lies in how effectively, efficiently, critically, and creatively one thinks (Schuable & Glaser, 1990).

According to R. Paul & L. Elder (2008), creativity masters a process of making or producing and criticality a process of assessing or judging. The very definition of the word "creative" implies a critical component (e.g. "having or showing imagination and artistic or intellectual inventiveness"). When engaged in high-quality thought, the mind must simultaneously produce and assess, both generate and judge the products it fabricates (Paul & Elder, 2008).

Therefore, it is important to note that critical and creative thinking are not two contrasting thinking processes, but complementary between each other (Ruggiero, 1994; Brophy, 1998; Dineen, Samuel & Livesey, 2005; and Facione, 2010). R. Dineen, E. Samuel & K. Livesey (2005), for example, pointed out that creativity requires both divergent/productive thinking, to ensure novelty, and convergent/reproductive thinking, to ensure appropriateness. Critical thinking saves creative thinking from pursuing novelty for its own sake and creative thinking prevents critical thinking from being merely reactive and negative (Ruggiero, 1994).

D.H. Cropley & A.J. Cropley (2005), who reviewed the importance of critical thinking, commented that without convergent thinking, the product of creativity may cause "surprise" in the beholder, but this is not enough, since surprise can be produced through "blind" variability: mere unregulated self-expression or doing things differently from the usual regardless of accuracy, meaning, sense, significance, or interestingness (Cropley & Cropley, 2005:4).

Critical and creative thinking are different from thinking strategies, because neither of the concepts is associated with any process such as problem solving or decision-making. Rather, critical and creative thinking have some sort of special characteristic that determines the quality of thinking. Critical and creative thinking are employed at various points of problem solving and decision-making. For example, Osborn's Creative Problem Solving model, in 1952, proposes a process that is directed toward the solution of a problem in unusual or unique ways.

In relation to this, R.J. Marzano *et al*. (2000) refer the term "critical and creative thinking" to the quality of thinking. They note that as we solve problem or make decisions, we do it more or less creatively, more or less critically (Marzano *et al*., 2000:17). Furthermore, creative and critical thinking are major tools in problem solving (*cf* Facione, 1990; Lewis & Smith, 1993; and Paul, Elder & Bartell, 1997).

R.B. Cattell & H.J. Butcher (1968) used the term "pseudo-creativity" to refer to creative thinking as a product that derives from nonconformity and blind rejection of what already exists. R.A. Finke, T.B. Ward & S.M. Smith (1992) argued that two broad processes,

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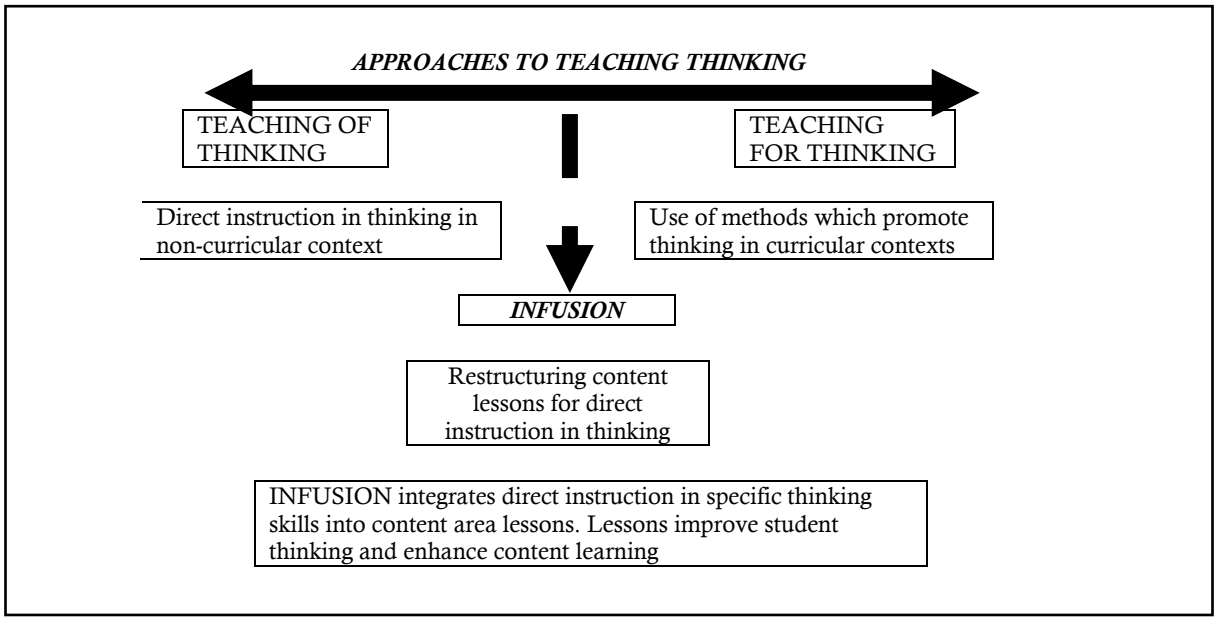

Figure 1:
Approaches to Teaching Thinking
(Source: Swartz & Parks, 1994:9)

the creative (generating novelty) and critical (exploring/evaluating the novelty) working together, lead to the production of what J.S. Bruner (1986) called as "effective surprise".

The evaluation of the novelty from the point of view of criteria such as "workability" is now seen as an important part of the creative process (Csikszentmihalyi, 1999). As such, both of the concepts are employed in problem solving and decision-making. The creative element in problem solving, for example, distinguishes the solution of a problem in a routine manner and in more unusual ways.

As mentioned earlier in the attempt to clarify thinking skills, the utilisation of critical and creative thinking in problem solving and decision-making will create the product of high order thinking rather than low order thinking.

TEACHING THINKING SKILLS

Literature indicates that there are three common approaches to teaching thinking skills: (1) direct instruction on thinking skills in non-curricular contexts; (2) indirect approaches which promote thinking skills in content lessons; and (3) the infusion approach. R. Swartz & S. Parks (1994) illustrate the approaches in figure 1.

The teaching of thinking by direct instruction means that, in a time period designed for thinking instruction, students learn how to use explicit thinking strategies, commonly guided by the teacher (Swartz & Parks, 1994:8). Usually, the teaching of thinking occurs in separate, self-contained courses or programmes with specially designed materials, and is taught outside the standard curriculum. Examples of this approach include Martin Lipman's philosophy for children (Lipman, 1985); Feuerstein's IE or Instrumental Enrichment (Feuerstein, Hoffman & Miller, 1980); and Edward De Bono's CorT programme (De Bono, 1991).

Alternatively, the teaching for thinking involves employing methods to promote students' deep understanding of content (Swartz & Parks, 1994). While this approach enhances content-domain learning (Resnick, 1987) and eliminates the problem of scheduling extra courses (Martin, 1983), it has not been widely successful in transferring cognitive skills across the curriculum (Resnick, 1987; and Nickerson, Perkins & Smith, 1985). An innovative curriculum development project called *Thinking Through Geography* (Leat, 1998) is an example of this approach, and is

considered to be a rare success.

The approach adopted in Malaysia is a synthesis of both teaching of thinking and teaching for thinking (Swartz & Parks, 1994). This approach is closely linked with the National Philosophy of Education, which emphasises the development of knowledge, skills, and values in an integrated manner. Infusion lessons are taught across the curriculum. Infusion lessons comprise conventional subject teaching adapted to bring explicit emphasis on skilful thinking into this broader learning context. Classroom time is spent on both thinking skills and content. The teaching and learning activities are characterised by the new view of learning (Simon, van der Linden & Duffy, 2000), which differs from the traditional approach.

R. Swartz & S. Parks (1994) propose that in infusing thinking skills educators should involve students in four main activities, which involve the introduction, thinking actively, metacognition, and transfer. The first requirement in the infusion lesson is to "introduce thinking skills". Here, teachers introduce students to the thinking skills to be used and developed in the class. This is achieved by a discussion designed explicitly to demonstrate to the students themselves what they already know about the thinking skill being taught; show the students why this type of thinking is important; help them to understand the importance of the skills in their own experience; introduce the significance of engaging in this kind of skillful thinking; and help them reflect on the content they are learning (Swartz & Parks, 1994).

The second activity is the one centred on the infusion lesson, namely "thinking actively". This demands that the teacher uses a variety of teaching techniques to guide students through the practice of thinking. This is to be done as they learn concepts, facts, and skills in the appropriate subject. In this part of the lesson, teaching the content and teaching the thinking skills are combined. The primary role of the teachers/teacher educator in this phase of the infusion lesson is as a learning facilitator.

There are various techniques that are suggested for the effective teaching of thinking skills. In a critique of the traditional approach to teaching, R.J. Marzano *et al*. (2000) and A. Costa (2001) note that educators commonly provide so much information that students can comply with the learning objectives only by failing to think for themselves. They argue that transmission models of education compel teachers to instruct students what to do, when to do it, and even how to behave when they do it (Marzano *et al*., 2000; and Costa, 2001).

The infusion model is designed as a specific measure to free education from this instructor-led approach and to develop thinking skills by independent and individual learning, in which facilitation rather than instruction is a priority. Specific tools and methods designed to underpin this approach include *thinking map and graphic organiser* (Swartz & Parks, 1994); *high-order questioning* (Dillon, 1984; and Gall, 1984); *cooperative learning* (Slavin, 1981; Johnson & Johnson, 1982; and Hokaday, 1984); and *scaffolding* (Palinscar & Brown, 1989; and Rosenshine & Meister, 1992).

The third activity is focused on metacognitive or reflective thinking. This activity requires teachers to ask reflective questions designed to help students distance themselves from what they are thinking about, so that they can become aware of how they are thinking. Students map out their own thinking process explicitly, commenting on how easy or hard it was, how they might improve it, and whether this was a productive way to think about such issues. They are also encouraged to plan how they will do the same kind of thinking in the future.

There are three basic questions that can be used to structure this phase of the programme: (1) What kind of thinking did you engage in?; (2) How did you carry out this kind of thinking?; and (3) Is this an effective way to engage in this kind of thinking? However, during this third phase of the infusion lesson, teachers are also encouraged to think themselves about the thinking that the students have been doing. The teacher might also ask students how the thinking strategy developed in the lesson compares to their usual way of thinking.

The fourth activity in the final stage of the infusion lesson is application. Here, the teacher reinforces the thinking strategies by providing additional opportunities for students

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Table 1:
The Demographics (N = 60)

Demographics	% (f)
Sex:	
Male	36.7 (22)
Female	63.3 (38)
Age Range:	
20-23	40.0 (24)
24-27	51.6 (31)
28-31	8.4 (5)
Educational Background:	
Malaysia Higher Education Certificate	21.7 (13)
Diploma	18.3 (11)
Science Matriculation	58.3 (35)
Attended Programme Related to Thinking Skills:	
Yes	20.0 (12)
No	80.0 (48)

to engage in similar, but independent, thinking. R. Swartz & S. Parks (1994) stress that these processes emphasise thinking skill transfer and should be employed soon after the other three parts of the lesson. They should also be reinforced in other activities throughout the school year. They suggest two kinds of transfer that should be emphasised in practice: near and far transfer. Near transfer is described as the application of thinking activities to similar and related topics. Far transfer involves the application of thinking activities from other disciplines or in other forms of personal experience.

METHOD

The purpose of this study is to investigate the extent to which teacher. This study employed a survey method using a set of questionnaire as an instrument. The questionnaire focuses on the student teachers' views concerning: (1) the type of thinking skills infused in teaching; and (2) the extent to which teacher educators practicing thinking skills teaching. The questionnaire items for the types of thinking skills were constructed based on the taxonomy of thinking skills found in literature. These include macro-thinking skills (critical thinking, creative thinking, decision-making, problem solving); micro-thinking skills (six cognitive skills in Bloom's Taxonomy); and metacognition.

The questionnaire items regarding teacher educators' teaching practices consist of two different approaches. The first approach is the one-way communication or lecture, which is under the category of a teacher-centred approach. The second approach is based on a student-centred approach with a focus on the infusion of thinking skills teaching. There are four components: *first*, the infusion lesson approach – based on the infusion approach by R. Swartz & S. Parks (1994); *second*, teaching techniques; *third*, classroom environment; and *fourth*, assessment of thinking skills acquisition.

The samples were drawn from the final year student teachers at one teacher education programme in Malaysia. There were a total of 63 student teachers in semester seven and all of them were selected as samples. Only 60 questionnaires were returned to the researchers. The data from the questionnaire were analysed by using descriptive statistics to obtain the frequency and percentage. The demographic information of the respondents is shown in table 1.

RESULTS AND DISCUSSION

Firts, **Teacher Educators Practice in Teaching Thinking Skills.** *Theory Classes:* Table 2 shows that the most frequently applied strategy during theory classes was one way communication (76.7%). The other remaining strategies that focused on thinking skills, namely the infusion approach, teaching techniques, and the assessment, were below satisfactory in practice. This is evident when a

Table 2:
Teacher Educators' Teaching Practice that Promote Thinking in Theory Classes

Please read each statement carefully, reflect upon the teacher educators' practice in their teaching	S and N	STS	F and A
*Used one-way communication – lecture **	0.0 (0)	23.3 (14)	76.7 (46)
Infusion lesson approach:			
Introduced thinking skill in lesson	73.3 (44)	20.0 (12)	6.7 (4)
Collaborative engagement in thinking tasks	18.3 (11)	53.3 (32)	28.3 (17)
Demanded student teachers to plan their thinking	56.7 (34)	38.3 (23)	5.0 (3)
Demanded student teachers to describe their thinking processes	80.0 (48)	20.0 (12)	0.0 (0)
Demanded student teachers to evaluate their thinking	36.7 (22)	50.0 (30)	13.3 (8)
Applied thinking skills on taught topic	61.7 (37)	28.3 (17)	10.0 (6)
Applied thinking skills beyond taught topic	71.7 (43)	21.7 (13)	6.6 (4)
Mean percentage	**57.0**	**33.0**	**10.0**
Teaching techniques:			
Asked high-order questioning – go beyond simple recall	21.7 (13)	65.0 (39)	13.3 (8)
Used probing techniques to help student teachers think more deeply about their answer	61.7 (37)	25.0 (15)	13.3 (8)
Allowed waiting time for students response	48.3 (29)	31.7 (19)	20.0 (12)
Encouraged active participation from students	20.0 (12)	55.0 (33)	25.0 (15)
Used thinking map to clarify and organise skilful thinking	85.0 (51)	15.0 (9)	0.0 (0)
Required students work together in group	13.3 (8)	60.0 (36)	26.7 (16)
Used variety of teaching aids that encouraging thinking	78.3 (47)	15.0 (9)	6.7 (4)
Lecturer acted as a facilitator of learning	68.3 (41)	26.7 (16)	5.0 (3)
Mean percentage	**49.5**	**36.7**	**13.8**
Managing classroom environment that motivating student thinking:			
Accepted 'odd' response given by student teachers	11.7 (7)	28.3 (17)	60.0 (36)
Open minded and student teachers are treated fairly	10.0 (6)	26.7 (16)	63.3 (38)
Student teachers free to express opinion	13.3 (8)	25.0 (15)	61.7 (37)
Promoted intrinsic motivation for thinking	86.7 (52)	6.7 (4)	6.7 (4)
Promoted extrinsic motivation for thinking	81.7 (49)	10.0 (6)	8.3 (5)
Mean percentage	**40.7**	**19.3**	**40.0**
Evaluated students improvement in thinking skills	76.7 (46)	13.3 (8)	10.0 (6)
Overall Mean percentage	**52.3**	**29.9**	**17.8**

Notes: S and N = Seldom and Never; STS = Sometimes; F and A = Frequent and Always.

low mean percentage of the student teachers (10%) experienced an infusion lesson approach employed by their teacher educators.

Similarly, a mean percentage of 13.8% indicated that the teacher educators did not practise the teaching technique that is important for thinking skills teaching. The student teachers also felt that teacher educators were not concerned with assessing the improvement of thinking skills, with low mean percentage of 10%. However, the efforts to provide a classroom environment that could enhance thinking is higher than the rest of the variables, with 40% of student teachers identifying this as frequent practice. The overall percentage of 17.8% indicates that very low concern was placed on the teaching of thinking skills in theory classes.

Practical Classes. The concern about thinking skills was found to be more dominant in the workshops. This is evident from table 3, which illustrates that when the student teachers observed their lecturers employing an infusion lesson approach, the mean percentage was 58% compared to only 10% in theory classes. The student teachers also felt the management of the environment during the teaching and learning process encouraged student teachers' thinking, with the mean percentage of 65.

However, in terms of teaching techniques, the student teachers appeared to have different views, with almost an equal mean percentage indicating that these techniques were seldom (30.5%), sometimes (33.7%), and frequently

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Table 3:
Teacher Educators' Teaching Practice that Promote Thinking in Practical Classes

Please read each statement carefully, reflect upon your lecturers' practice during theory classes and circle your response.	**S and N**	**STS**	**F and A**
*One-way communication**	71.7 (43)	25.0 (15)	3.3 (2)
Infusion lesson approach:			
Introduced thinking skill in lesson	65.0 (39)	20.0 (12)	15.0 (9)
Collaborative engagement in thinking tasks	3.3 (2)	28.3 (17)	68.3 (41)
Demanded student teachers to plan their thinking	31.7 (19)	41.7 (25)	26.6 (16)
Demanded student teachers to describe their thinking processes	6.7 (4)	21.7 (13)	71.7 (43)
Demanded student teachers to evaluate their thinking	5.0 (3)	18.3 (11)	76.7 (46)
Applied thinking skills on taught topic	6.7 (4)	13.3 (8)	80.0 (48)
Applied thinking skills beyond taught topic	13.3 (8)	18.3 (11)	68.3 (41)
Mean percentage	**17.9**	**23.1**	**58.0**
Teaching teachniques:			
Asked high-order questioning – go beyond simple recall	35.0 (21)	48.3 (29)	16.7 (10)
Used probing techniques to help student teachers think more deeply about their answer	38.3 (23)	50.0 (30)	11.7 (7)
Allowed waiting time for students response	38.3 (23)	51.7 (31)	10.0 (6)
Encouraged active participation from students	0.0 (0)	10.0 (6)	90.0 (54)
Used thinking map to clarify and organise skilful thinking	86.7 (52)	13.3 (8)	0.0 (0)
Required students work together in group	0.0 (0)	6.7 (4)	93.3 (56)
Used variety of teaching aids that encouraging thinking	15.0 (9)	56.7 (34)	28.3 (17)
Mean percentage	**30.5**	**33.7**	**35.8**
Managing classroom environment that motivating student thinking:			
Lecturer acted as a facilitator of learning	6.7 (4)	16.7 (10)	76.7 (46)
Accepted 'odd' response given by student teachers	6.7 (4)	11.7 (7)	81.7 (49)
Open minded and student teachers are treated fairly	3.3 (2)	13.3 (8)	83.4 (50)
Student teachers free to express opinion	1.7 (1)	11.7 (7)	86.7 (52)
Promoted intrinsic motivation for thinking	28.3 (17)	65.0 (39)	6.7 (4)
Promoted extrinsic motivation for thinking	5.0 (3)	40.0 (24)	55.0 (33)
Mean percentage	**8.6**	**26.4**	**65.0**
Evaluated students improvement in thinking skills	78.3 (47)	13.3 (8)	8.3 (5)
Overall Mean percentage	**21.8**	**27.0**	**51.2**

Notes: S and N = Seldom and Never; STS = Sometimes; F and A = Frequent and Always.

(35.8%) applied. Similar to theory classes, a high percentage (78.3%) of student teachers felt the improvement of thinking was not given serious attention.

Second, **Integrating the Various Form of Thinking Skills.** *Theory classes.* Very low percentages of student teachers admitted that the teaching and learning activities emphasised macro thinking skills, as shown in table 4. The focus on critical thinking recorded the lowest percentage (5.0%). This was followed by creative thinking (6.6%), decision making (13.3%), and problem solving (20.0%). For micro thinking skills, the focus was limited to the lowest cognitive level, such as recall of information (75.0%) and comprehension level (53.3%).

In contrast, low percentages were recorded for evaluation skills (11.7%), synthesis skills (15.0%), analysis skills (21.7%), and application skills (43.4%). The mean percentage of 36% of frequent practice indicates that micro thinking skills were not given serious attention. Similarly, the focus on metacognition or reflective thinking was not encouraging. A high percentage of student teachers (85%) observed that teaching and learning activities "seldom and never" emphasised reflective thinking during theory classes.

Practical classes. Table 5 indicates better practice of thinking skills during workshop activities. For macro thinking skills, the student teachers were required to a make decision (81.7%), solve a problem (80.0%), and think creatively (75.0%). The respondents also

Table 4:
Frequency of Integrating the Various Form of Thinking Skills (Theory)

Thinking skills	To what extent do you think your lecturers emphasised the following thinking skills in their teaching?	Seldom & Never	Sometimes	Frequent & Always
Macro thinking skills	Required students solve problem by considering all possible solution (problem solving skills)	31.7 (19)	48.3 (29)	(20.0) 12
	Require students to make decision by considering all possible alternatives and their consequences (decision making)	36.7 (22)	50.0 (30)	13.3 (8)
	Require students to generate new ideas (creative thinking)	66.7 (40)	26.7 (16)	6.6 (4)
	Require students to judge the accuracy and validity information. (critical thinking)	65.0 (39)	30.0 (18)	5 (3)
	Mean percentage	**50.0**	**38.8**	**11.2**
Micro thinking skills	Require student to recall or recognises information (recall)	15.0 (9)	10.0 (6)	75.0 (45)
	Required students to translate and comprehends, or interprets information (comprehension)	20.0 (12)	26.7 (16)	53.3 (32)
	Require student to select, transfers, and uses data and principles to complete a problem or task with a minimum of direction (application)	18.3 (11)	38.3 (23)	43.3 (26)
	Require student to distinguish, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question (analysis)	56.7 (34)	21.7 (13)	21.6 (13)
	Require student to originate, integrate, and combine ideas into a product, plan or proposal (synthesis)	65.0 (39)	20.0 (12)	15.0 (9)
	Require student to appraise, assess, or critique on a basis of specific standards and criteria (evaluation)	73.3 (44)	15.0 (9)	11.7 (7)
	Mean percentage	**41.3**	**22.0**	**36.7**
Meta cognition	Require students to make reflection	68.3 (41)	18.3 (11)	13.3 (8)
	Overall Mean percentage	**47.0**	**27.7**	**25.3**

always engaged in tasks that required them to synthesise (70.0%), apply (66.7%), evaluate (65.0%), and analyse information (61.7%). They were also required to reflect on their thinking processes (66.7%). However, the focus on critical thinking was limited as 68.5% of respondents selected "seldom and never".

Overall, the student teachers' perceived that the integration of thinking skills was more dominant in practical classes compared to theory classes. This is evident when majority of the student teachers' felt that one-way communication was frequently adopted by teacher educators during theory classes. In an one-way communication approach, the teacher educator role is more as knowledge transmitters and facilitators.

As knowledge transmitters, the teacher educators focused on imparting knowledge with minimal student participation (Caine & Caine, 1995). This is in line with the result of studies on the implementation of thinking policy in schools, where teaching and learning are dominated by teachers (Baharun, 1998; Rajendran, 1998; and Rahil *et al.,* 2004). In the context of teacher education, L. Darling-Hammond *et al*. (2005) argues that teacher education is still dominated by the knowledge transmission approach.

In contrast to the knowledge transmission approach, teacher educators' roles as facilitators of learning provide an environment that is conducive to thinking activities. Through a variety of student-centred teaching methods, such as higher-order questioning, problem-based learning, and discussion, students engaged actively in thinking activities (Dillon, 1984; and Palinscar & Brown, 1989).

However, the results of this study indicate only a small percentage of teacher educators employed teaching techniques that promote students' thinking. The absence of the

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Table 5:
Frequency of Integrating the Various Form of Thinking Skills (Practical Classes)

Thinking skills	To what extent do you think your lecturers emphasised the following thinking skills in their teaching?	S and N	STS	F and A
Macro thinking skills	Required students solve problem by considering all possible solution (Problem solving)	5.0 (3)	15.0 (9)	80.0 (48)
	Require students to make decision by considering all possible alternatives and their consequences (decision making)	3.3 (2)	15.0 (9)	81.7 (49)
	Require students to generate new ideas (creative thinking)	5.0 (9)	10.0 (6)	75.0 (45)
	Require students to judge the accuracy and validity information. (critical thinking)	68.3 (41)	21.7 (13)	10.0 (6)
	Mean percentage	**22.9**	**15.4**	**61.7**
Micro thinking skills	Require student to recall or recognises information (recall)	20.0 (12)	28.3 (17)	51.7 (31)
	Required students to translate and comprehends, or interprets information (comprehension)	20.0 (12)	48.3 (29)	31.7 (19)
	Require student to select, transfers, and uses data and principles to complete a problem or task with a minimum of direction (application)	15.0 (9)	18.3 (11)	66.7 (40)
	Require student to distinguish, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question (analysis)	15.0 (9)	23.3 (14)	61.7 (37)
	Require student to originate, integrate, and combine ideas into a product, plan or proposal (synthesis)	10.0 (6)	20.0 (12)	70.0 (42)
	Require student to appraise, assess, or critique on a basis of specific standards and criteria (evaluation)	10.0 (6)	25.0 (15)	65.0 (39)
	Mean percentage	**15.0**	**27.2**	**57.8**
Meta cognition	Require students to make reflection (metacognition)	5.0 (3)	28.3 (17)	66.7 (40)
	Overall Mean percentage	**17.0**	**24.0**	**59.0**

Notes: S and N = Seldom and Never; STS = Sometimes; F and A = Frequent and Always.

exemplary practice in teaching thinking skills will prevent the student teachers opportunity to experience thinking activity in teaching and learning. As a consequence, the student teachers may not familiar with the teaching strategies for thinking skills (Parker & Hess, 2001).

This study also indicate that there were very limited emphasised given to infuse various form of thinking skills in teaching and learning activities. This is particularly true in theory classes. As a consequence, student teachers may not expose to the various types of thinking skills that can be integrated in teaching.

According to A. Lieberman & D.R. Wood (2003), it is important for teacher to be given a relevant opportunity to engage in activities that relevant to what they need to be practised in school. Therefore, the missing of various forms of thinking skills not only prevented them to expose to the various different types of thinking, but also show that thinking skills as not compulsory or important.

CONCLUSION

Thinking skills policy demands the teacher educators to provide an exemplary practice of thinking skills teaching to their student teachers. This new vision of teaching differs significantly from views framing conventional teaching approaches. In order to move toward this new vision, teacher educators need to change their teaching approaches from traditional into constructivist approaches with an emphasised on students' thinking development.

However, the results of this study clearly indicate that teaching thinking skills has not spread yet into teacher education. This should be given serious attention since teacher education is the provider of current and future teachers. Such lacking of focus on current education needs would continue the problem related to the ill-equipped teacher to implement thinking policy.[1]

[1]***Statement:*** Herewith, we have declared that this paper is our original work; so, it is not product of plagiarism and not yet be reviewed as well as be published by other scholarly journals.

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