

## Teaching Thinking Skills at Institutions of Higher Learning: Lessons Learned

**Rajendran Nagappan**

*Universiti Pendidikan Sultan Idris,  
35900 Tanjung Malim, Perak, Malaysia  
E-mail: nsrajendran@hotmail.com*

### ABSTRACT

Graduates are increasingly expected to perform multiple and varied tasks which require them to be critical enough to analyze problems, be creative enough to look for alternatives, and be practical enough to identify the most workable solution(s). The kind of roles and responsibilities one is expected to perform are ever increasing. This expectation has brought about the need to teach thinking skills, more specifically, higher-order thinking skills to students. As a result, the teaching of thinking skills has increasingly gained attention from educators, in general, in the last few decades. In Malaysia, official attempts started in the early 1990s to teach thinking skills in schools and teacher education colleges. With far-reaching implications brought about by the knowledge economy the need to teach thinking skills has become even more evident, significant, and urgent. This paper will discuss the issues, challenges, and prospects in teaching thinking skills at institutions of higher learning. It will be based on formal attempts made at a selected institution of higher-learning. This paper would also dwell on the teaching and learning practices in relation to preparing future graduates to improve their thinking capabilities and also to teach higher-order thinking skills to others. Data for this paper would be drawn from research conducted on infusing thinking skills into the university curriculum (Rajendran, 2004) and perceptions of students taking a course on thinking skills (Rajendran, 2007). This paper would also offer recommendations to better improve the teaching of higher-order thinking skills to future graduates at institutions of higher-learning.

**Keywords:** Thinking, teaching thinking, higher-education, content- instruction

### INTRODUCTION

Employers and educators are generally in agreement that students need to increase their problem solving and critical thinking skills. National government policy as well as employers are demanding that education, no matter in what discipline or at which level, ought to enable graduates to think 'smarter' than was the case in the past (Pithers, 2000). This position has received new impetus when national development is tied up with education outcomes and because the pace of globalization with

increased economic competition is unrelenting. One effect of this change is that secondary and tertiary education graduates now more often find themselves in workplaces where they are exposed to large-scale social, technological, and social change.

Helping students become effective thinkers is increasingly recognized as a primary goal of education. Rapid expansion of knowledge points to the importance of curriculum and instruction that empower students to locate and process knowledge rather than simply memorize facts. Graduates are expected to learn not only

---

Received: 11 May 2010

Accepted: 14 October 2010

the content and methods of a discipline, but also to develop 'generic' abilities which can be deployed flexibly in a wide range of work and life contexts (Pithers, 2000).

The ability to think critically and to solve problems has been a concern of philosophers, educators, and psychologists for many centuries. More recently, the idea that education and training should help students to develop the dispositions or attitudes deemed to be associated with critical thinking, as well as the ability to think well, has been connected with employers' alleged desires for school, university, and college graduates who are curious, critical, analytic reflective thinkers – problem-solvers who are quick to learn, as well as flexible and are able to add value to their organizations (Harvey et al., 1997).

The real question, however, is whether the education system on the whole had been receptive and had made the necessary changes to prepare students who are capable of performing the various tasks mentioned above. In this respect, it seems interesting and also puzzling to note, as Rajendran (2002) and Nickerson (1988) suggested, in spite of numerous vigorous attempts by various reformers to make thinking a primary focus of education and to effect whatever changes in educational practice would be in the interest of doing so, the educational system, as a whole, has been remarkably resistant to these efforts.

Focus of this paper will be to present and discuss the experiences of a undergraduate program in attempting to train teachers to teach higher-order thinking skills (Rajendran, 2004) and students' perceptions of their preparedness to teach thinking skills after having taken a course on thinking skills (Rajendran, 2007). Findings presented and discussed are part of two major studies reported elsewhere (Rajendran, 2004; 2007).

In the first study (Rajendran, 2004), among the issues investigated include whether trainee teachers were prepared in terms of subject matter knowledge and higher-order thinking skills to infuse higher-order thinking skills into content

instruction, and the extent to which teaching and learning at the university prepared trainee teachers to teach higher-order thinking skills. Whereas, for the second study (Rajendran, 2007), the main aim was to investigate whether a specially mounted course was effective in preparing prospective teachers to infuse higher-order thinking skills into their content instruction.

### LITERATURE REVIEW

Kember (1997), after reviewing the available published research evidence, suggests that teaching approaches in tertiary education may be influenced by interplay of factors. For example, one factor, curriculum design, is seen to influence university and college lecturers to focus on subject-matter content when teaching rather than on the development of critical thinking. It seems that lecturers are offered little help in clarifying what is encompassed in the notion of 'good thinking'. Thus they are not clear on what it is they are supposed to be helping students to develop. Ongoing confusion about these matters seems sometimes to lead to teaching approaches to problem-solving which are unlikely to develop more widely transferable, generalizable critical thinking abilities and dispositions.

There appears to be a dearth of published research which examines the development of critical thinking during degree-level courses (Pithers, 2000). Although a number of issues in the teaching of thinking skills to students of tertiary institutions continue to be debated, including how one defines 'good thinking', 'thinking well' or 'thinking smarter', there seems to be enough findings to assist those who attempt to infuse thinking into the higher-education curriculum.

In the Malaysian context, the teaching of thinking at institutions of higher-education is a recent development, and more importantly evaluation on the effectiveness of these initiatives is largely an unmapped territory. The teaching of thinking skills in schools, unlike the teaching of thinking skills at institutions of higher-education

which started much later, which was started in the 1990s had been evaluated by major studies (Rajendran, 1998a; Kartini, 1998).

Local universities have begun offering courses on thinking and teaching thinking in recent years, but more evidently after 1998. Universities, such as Universiti Putra Malaysia, University Malaya, Universiti Utara Malaysia, and more recently Universiti Pendidikan Sultan Idris have introduced these courses at the undergraduate level (Rajendran, 2008).

There seems to be no major studies which have attempted to investigate the teaching of thinking skills to prospective graduates of universities in Malaysia. There may have been attempts by individual lecturers at these institutions to gauge the effect of their individual efforts to infuse thinking skills into their programs. Unlike some major studies which have attempted to investigate the effectiveness of programs to train teachers to teach thinking skills in schools, there is certainly a need to have studies which investigate whether or not there are attempts being made to infuse thinking into the curricula at institutions of higher learning, and if there are, to investigate how effective they are in nurturing thinking minds of these prospective graduates. One of the studies which had attempted to investigate the infusion of thinking skills in the university program was undertaken by Rajendran (2004).

## METHODOLOGY

Methodology used to collect data employed both quantitative and qualitative data collection procedures. In the first study (Rajendran, 2004),

there were a total of 364 respondents who provided data through a survey questionnaire. Later, selected lecturers and prospective teachers were interviewed. Teaching and learning at selected lecture rooms were also observed. Relevant documents were also analyzed. In the second study (Rajendran, 2007) there were a total of 147 respondents who provided data through a survey questionnaire. Both these studies were carried out at Universiti Pendidikan Sultan Idris which has prospective graduates who are all in the education discipline.

## SOURCES OF DATA

Since this study's main objective was to investigate how the university undergraduate program was attempting to orientate prospective graduates in acquiring thinking skills and are prepared to teach thinking skills, the participants of the study were all from the university. However, they were from different programs.

Table 1 shows the sources of data for this study. Besides the survey questionnaires for both the studies, there were also interviews with lecturers (8), interviews with prospective graduates (9), and observations of teaching and learning (4) for the first study.

In the second study, the respondents (147) were the total number of students who took a course on thinking skills. They provided data for this study at the end of a semester.

## INSTRUMENT

Two sets of survey questionnaires, modified versions of the survey questionnaire developed

TABLE 1  
Sources of data

No.	Type	No. of times/ Respondents	
		Study 1	Study 2
1	Survey questionnaire (Prospective graduates)	364	147
2	Interviews (Lecturers)	8	-
3	Interviews (Prospective graduates)	9	-
4	Observation of teaching and learning	4	-

and used by Rajendran (1998a) were used for these studies. For the first study, there were a total of 40 items: knowledge component (8 items); pedagogical skills (9 items); attitude (11 items); and general items (12 items). For the second study, there were a total of 28 items: knowledge (6 items); pedagogical skills (5 items); and general items (17 items).

The instruments showed high reliability rates. For study 1, for example, test for reliability by using Cronbach alpha was carried out on each section of the instrument. Separate analyses for each dimension of the instrument gave the following figures: knowledge – Major subject (.8494), pedagogical skills to teach major subject (.8922), attitude to teach major subject (.6676), knowledge to teach thinking skills (.8882), pedagogical skills to teach thinking skills (.9170), and attitude to teach thinking skills (.7100). Analysis on the items on the section to elicit data on various aspects of teaching thinking had an alpha of .8624.

Interview protocol for lecturers and students were developed to collect data through interviews and to maintain consistency. However, for

the second study, separate analyses for each dimension of the instrument gave the following figures: knowledge (.7394), pedagogical skills (.8321), and general items on teaching thinking skills (.8310).

### ANALYSIS OF DATA

Descriptive and inferential statistics were used to analyze the quantitative data. The Statistical Package for Social Sciences (SPSS) Version 11 software was used to analyze the data for this study. Themes and categories in line with the focus of this study and research questions were developed to analyze and make meaning of the data obtained through interviews and observations.

Data-source triangulation was employed to validate the data obtained using qualitative methods. The data-source triangulation involved the comparison of data relating to the same phenomenon but deriving from different phases of the field-work or source. In this case, data-source triangulation was carried out on data obtained from lecturers from interviews,

TABLE 2  
Perspectives of prospective graduates about their knowledge, skills and general abilities

	1 F(%)	2 F(%)	3 F(%)	4 F(%)	5 F(%)
Knowing how to teach subject matter and thinking skills using the infusion approach	8(2.2)	44(12.1)	139(38.2)	145(39.8)	28(7.7)
Confident about using strategies and techniques which enable students to acquire thinking skills	4(1.1)	17(4.7)	103(28.3)	188(51.6)	52(14.3)
Confident about teaching thinking skills through the teaching of subject matter content	3(0.8)	21(5.8)	104(28.6)	192(52.7)	44(12.1)
Confident about evaluating the acquisition of thinking skills by students	4(1.1)	25(6.9)	126(34.6)	170(46.7)	39(10.7)

prospective teachers from interviews and prospective teachers from survey questionnaire.

## FINDINGS AND DISCUSSION

### *Knowledge and Pedagogical Skills to Teach Thinking Skills*

From a total of 364 respondents, 173 (47.5%) of the respondents indicated that they knew how to teach subject matter and thinking skills using the infusion approach as shown in Table 2. Slightly more than one-third (38.2%) of the respondents were unsure whether they knew how to teach subject matter and thinking skills using the infusion approach. Only 52 (14.3%) of the respondents did not agree that they knew how to teach subject matter and thinking skills using the infusion approach.

For the item on 'Confident about using strategies and techniques which enable students to acquire thinking skills', as shown in Table 2, a total of 240 (65.9%) of the respondents indicated that they were confident about using strategies and techniques which enable students to acquire thinking skills. However, a total of 103 (28.3%) respondents were still unsure whether they were confident about using strategies and techniques which enable students acquire thinking skills.

In the case of the item, 'Confident about teaching thinking skills through the teaching of subject matter content', a total of 236 (64.8%) of the respondents indicated that they were confident about teaching thinking skills through the teaching of subject matter content. However, a total of 104 (28.6%) respondents were still unsure whether they were confident about teaching thinking skills through the teaching of subject matter content.

More than half of the participants, 209 (57.4%) of the respondents indicated that they were confident about evaluating the acquisition of thinking skills by students. Once again, slightly more than one-third (34.6%) of the respondents were undecided on their confidence about evaluating the acquisition of thinking skills by students.

These items were included to investigate whether the teacher education program prepared the prospective teachers to infuse thinking skills in their teaching.

### *Knowledge to Teach Thinking Skills According to Different Majors*

One-Way ANOVA test analysis presented in Table 3 suggests that there is a significant difference ( $p=.000$ ) among students from the seven different majors (mathematics education, Malay literature, art education, Malay language, teaching of English as a second language, business management, and sports science) in terms of their knowledge to teach major subjects and thinking skills using infusion approach. This seems to suggest that there is a significant difference between the different majors in providing the necessary knowledge to prospective teachers to teach the respective major subjects and thinking skills using infusion approach.

### *Infusion Approach Ability to Teach Major Subject and Thinking Skills According to Different Majors*

The same scenario was found when prospective teachers were requested to state their perceptions on whether they are able to teach major subjects

TABLE 3  
Perceptions of prospective graduates from different majors on their knowledge of teaching major subjects and thinking skills using infusion approach

	Sum of squares	df	Mean square	F	Sig.
Between Groups	260.105	6	3.046	4.181	.000
Within Groups	18.277	357	.729		
Total	278.382	363			

and thinking skills using infusion approach. ANOVA test analysis presented in Table 4 suggests that there is a significant difference ( $p=.000$ ) between prospective graduates from the different majors in terms of their ability to teach major subject and thinking skills using the infusion approach.

*Ability to Involve Students Actively in Teaching and Learning According to Different Majors*

Respondents were also requested to state their perceptions about their ability to involve students actively in the teaching and learning processes when teaching thinking skills component. ANOVA test analysis presented in Table 5 suggests that there is a significant difference ( $p=.003$ ) between prospective teachers' perceptions about their ability to involve students actively in the teaching and learning processes when teaching thinking skills component which is certainly an important aspect when one tries to promote the acquisition of thinking skills amongst students.

*Ability to Develop Individual Potential of Students According to Different Majors*

One other important aspect which needs to be given importance when teachers try to promote the acquisition of thinking skills by their students is teachers' ability to develop the individual potential of students when teaching thinking skills component.

ANOVA test analysis presented in Table 6 suggests that there is a significant difference ( $p=.003$ ) among prospective graduates on their perceptions of their ability to develop the individual potential of students when teaching thinking skills component according to different majors.

*Ability to Evaluate Progress of Students When Teaching Thinking Skills According to Different Majors*

On whether prospective graduates are able to evaluate the progress of students when teaching thinking skills component, ANOVA test analysis presented in Table 7 suggests that

TABLE 4  
Perceptions of prospective graduates from different majors on their knowledge of teaching major subjects and thinking skills using infusion approach

	Sum of squares	df	Mean square	F	Sig.
Between Groups	22.537	6	3.756	5.845	.000
Within Groups	229.419	357	.643		
Total	251.956	363			

TABLE 5  
Perceptions of prospective graduates from different majors on their ability to involve students actively in the teaching and learning process when teaching thinking skills component

	Sum of squares	df	Mean square	F	Sig.
Between Groups	14.543	6	2.424	3.342	.003
Within Groups	258.894	357	.725		
Total	273.437	363			

there is a significant difference ( $p=.002$ ) among prospective teachers on their perceptions of their ability to evaluate the progress of students when teaching thinking skills component according to different majors.

#### *Knowledge, Skills and General Ability to Teach Thinking Skills*

Table 8 provides data from undergraduate students who had taken a course on thinking skills. For the knowledge component, for example, majority (85.1 per cent) of them seem to agree that they knew how to use various strategies and techniques to teach thinking skills. After taking this course, majority (86.4 per cent) of the prospective graduates also agreed that they knew how to teach major subjects and thinking skills. The majority (87.1 per cent) of the prospective graduates also stated that they are able to involve students actively in the teaching and learning of thinking skills.

For the general aspects, a total of 90.5 per cent of the respondents stated that they knew about the various skills related to thinking skills. Even bigger percentage of respondents, 95.9 per cent of them agreed with the need to teach thinking skills to all students. For the item whether they have been exposed adequately to teach thinking skills, 81.6 per cent agreed that they had been exposed adequately. Interestingly, a total of 94.5 per cent of the respondents agreed that they had been exposed adequately to teach thinking skills through the thinking skills course prepared exclusively.

However, relatively a smaller percentage (75.5 per cent) of the respondents agreed that they are now able to do problem solving systematically and effectively. For the item on whether they are confident to teach thinking skills through the teaching of school subjects, 87.8 per cent indicated that they are confident. On whether they are confident of evaluating the acquisition of thinking skills by students, 82.3 per cent indicated that they are confident.

The specially mounted course on thinking skills seems to have contributed towards the differences found amongst prospective teachers

in terms of their knowledge, pedagogical skills, and also their general ability in relation to teaching thinking. For example, for the item 'I am confident of teaching thinking skills through the teaching of schools subject', in the first study a total of 64.8 per cent agreed that they were confident. However, in the second study, after having taken the course, 87.8 per cent indicated that they were confident. For the item, 'I am confident of evaluating the acquisition of thinking skills by students', in the first study only 57.4 per cent of the respondents agreed that they were confident. However, in the second study, for the same item a total of 82.3 per cent indicated that they were confident.

#### **ANALYTIC SUMMARY**

Of the 364 respondents in the first study from seven different majors, less than 50 percent (47.5%) have indicated that they fully agreed or agreed that they knew how to teach subject matter and thinking skills using the infusing approach. Slightly more than 50 per cent (57.4%) indicated that they were confident of evaluating the acquisition of thinking skills by students. What this suggests is that almost 50 per cent of the prospective graduates are either unsure or do not agree that they are capable of handling such tasks.

However, among the prospective graduates, 65.9 percent indicated that they agreed that they were confident about using strategies and techniques which enable students to acquire thinking skills. A total of 64.8 percent of respondents indicated that they agreed that they were confident about teaching thinking skills through the teaching of subject matter content. Although the scenario seemed to be better than the scenario discussed above, the fact remains that one-third of the prospective teachers in the program were unsure or incapable of carrying out the important tasks related to teaching thinking.

What seems to be more worrisome is that significant differences were found among students from different majors in terms of: knowing how to teach major subject and thinking

TABLE 6  
Perceptions of prospective graduates from different majors of their ability to develop the individual potentials of students when teaching thinking skills component

	Sum of squares	df	Mean square	F	Sig.
Between Groups	15.859	6	2.643	3.381	.003
Within Groups	279.116	357	.782		
Total	294.975	363			

TABLE 7  
Perceptions of prospective graduates from different majors on their ability to evaluate the progress of students when teaching thinking skills component

	Sum of squares	df	Mean square	F	Sig.
Between Groups	16.587	6	2.765	3.571	.002
Within Groups	276.402	357	.774		
Total	292.989	363			

TABLE 8  
Perceptions of prospective graduates about their knowledge, skills and general ability after taking a course on thinking skills

	1 F (%)	2 F (%)	3 F (%)	4 F (%)	5 F (%)
<b>Knowledge</b>					
I know how to use various strategies and techniques to teach thinking skills	0(0)	0(0)	22(15)	83(56.5)	42(28.6)
I know how to teach my major subject and thinking skills	0(0)	0(0)	20(13.6)	89(60.5)	38(25.9)
<b>Skills</b>					
I am able to involve students actively in the teaching and learning of thinking skills	0(0)	1(0.7)	17(11.6)	98(66.7)	30(20.4)
<b>General</b>					
I know about the various skills related to thinking skills	0(0)	0(0)	14(9.5)	85(57.8)	48(32.7)
I agree with the need to teach thinking skills to all students	0(0)	1(0.7)	5(3.4)	54(36.7)	87(59.2)
I have been exposed adequately to teach thinking skills	1(0.7)	1(0.7)	25(17)	65(44.2)	55(37.4)
I have been exposed to teach thinking skills through the thinking skills course (LAK2013)	0(0)	1(0.7)	4(2.7)	50(34)	89(60.5)
I am able to do problem solving systematically and effectively	1(0.7)	1(0.7)	34(23.1)	84(57.1)	27(18.4)
I am confident of teaching thinking skills through the teaching of schools subject	0(0)	0(0)	17(11.6)	71(48.3)	58(39.5)
I am confident of evaluating the acquisition of thinking skills by students	0(0)	0(0)	25(17)	70(47.6)	51(34.7)

skills using infusion approach; being able to teach major subject and thinking skills using infusion approach; being able to involve students actively in the teaching and learning processes when teaching thinking skills component; being able to develop the individual potential of students when teaching thinking skills component; and being able to evaluate the progress of students when teaching thinking skills component.

What these findings suggest is that there are components of teaching thinking skills in certain teacher education programs, and there are also initiatives by lecturers to include the teaching of thinking skills through the various school subjects in their lectures and activities prepared for prospective teachers. While this may be so for certain programs, it certainly seems not the case for other disciplines.

Besides, the nature of the subjects themselves may be providing the supporting discourse for the teaching and learning of thinking skills more than others. For example, as Block (1993) suggested, language abilities and thinking competencies shape each other. The languages may have an advantage as compared to other disciplines. Although each discipline has its own idiosyncrasies, there may be certain characteristics of the discipline which may or may not be providing the support for the teaching of thinking skills. However, this needs to be researched.

Data obtained through interviews with lecturers and students seem to provide evidence to better understand the situation where prospective teachers are ill-prepared to teach thinking through the teaching of various subjects. One lecturer (L1R) suggested that “Yes teach. It is very appropriate. We do not pay serious attention to the teaching of thinking. It is like an add-on. ...to me it should be the core”. He (L1R) also felt that in the teaching of art education, everyone expects the acquisition of thinking skills to take place at the studios, when in fact it should be the responsibility of every lecturer and, ideally, should be happening in all lecture rooms.

Another lecturer (L2M) agreed that it is important to teach thinking skills to prospective graduates. He also felt that when prospective graduates enroll themselves at universities, “it is the duty of the university to expose them to thinking skills, techniques of thinking, how to provide the knowledge on the techniques of teaching students, and how they can motivate students to think”.

However, this particular lecturer (L2M) was not sure whether there was infusion of thinking skills when she delivered her lectures or when she gave assignments to students. However, she believed that when she prepared questions for the TESL program, she checked those questions to ensure that they required higher-order thinking skills of students who answered those questions. Even in that, she thought that there was no element of thinking skills. In her opinion, “Most of the questions are of the recall level and there are no application or evaluation questions”.

The other thing is that she was not sure whether lecturers even realize the cognitive levels of questions they ask.

*Delivering lecture and assignments, I am not sure but when we create questions, in the TESL program, we used to check the questions. So, the questions which are given, there is no thinking skills. Most questions are of the recall type, no application, no evaluation. And I feel, I am not sure whether the lecturer is aware not aware. (L2M)*

In comparison with other subjects and through her discussions with students, this lecturer (L2M) seems to believe that similar situations existed for other subjects as well.

*Don't see many reasons, when I discuss with students, for example, students who are doing assignments for history. They interview, about personality, write about that personality, where is thinking there? What they are doing is that they conduct the interview and*

*write it up. Next, for geography, I see them doing questionnaire to ask whether such things are taking place. One thing they learn to do is to do questionnaire. About environment, about how many times the garbage is collected? So, a thing like this, to me is a lot about looking for information (L2M)*

This, in her opinion (L2M), was because there was no specific course in the teacher education program which prepares students to teach thinking. She proposed that the teaching of thinking should be incorporated into the subject or major.

This seems to be supported by another lecturer (L5I) who teaches Malay Language and is not sure whether the prospective graduates are taught higher-order thinking skills. He suggested that, "When we teach them, the attention we pay to thinking skills is less because there are a lot of thinking skills". He also suggested that, "When they come to higher-order thinking skills, I do not know whether they (students) are given this or not".

Another lecturer (L8H) was of the opinion that the teaching of thinking skills is not seen explicitly and in her/his opinion is because, "Actually, the possibility is that during our planning of our synopsis (of courses) in the beginning, possibly it was not mentioned, the infusion of higher-order thinking skills in this case".

Interestingly, this also seemed to be the stand of a prospective graduate (S3S) who participated in this study. She suggested that "On the whole, in my opinion, there is very little (in the program). Yes. Little". This particular prospective graduate (S3S) believed that this was brought about by the fact that attention was mostly being paid to specialization in the respective subjects and the pedagogy to teach the subject. In her opinion, thinking skills were emphasized in the pedagogy course. Although there was a course on strategic thinking, in her opinion, teaching of thinking skills was not taught in that course. She concluded by

saying that, "the outcome is that we do not see it (thinking skills) yet".

This was also supported by another student (S5M) who participated in this study. He suggested that, "Ya, I feel that it (is) definitely not enough. I do not feel confident and I am not confident about applying it to teach students at the school level". This, he attributed partly to the lecturers, who, in his opinion, were themselves partially prepared. He suggested that, "For me, I feel what I went through and experienced, I feel that among the lecturers, I feel it is fifty, fifty" (S5M).

On the contrary, another respondent (S2S) in this study believed that there was at least about 80 percent of thinking skills being infused, especially in the major subject. He believed that, "Either in school or here at the university, thinking skills are being infused indirectly, but it is there".

At least two lecturers (L5I, L3N) in this study seemed to believe that these prospective graduates were not able to follow the teaching of thinking. In the opinion of one of the lecturers, "most of the mathematics students are not so creative, because of that they can't think". Another lecturer suggested that, "From my experience, I see the under-graduates whom I teach, their experience in schools. This thing never happened".

Another lecturer (L1R) was of the opinion that the prospective graduates were not capable of understanding the thinking skills, and more importantly he was unsure whether these teachers were capable of realizing what they were learning. He suggested that, "Actually I am very confident this thing will take place. Only thing is that, these teachers do not understand. Whether they understand or not what happens to them".

In relation to this, a prospective teacher (S7Z) too seemed to support the notion that prospective graduates, especially those fresh ones from schools with higher school certificates (STPM), are unable to acquire and teach thinking skills. One lecturer's (L5I) feelings probably explain very well the current scenario in preparing prospective graduates in thinking

skills. In his opinion, there was a suggestion to include the teaching of thinking as a course in the program. However, it was rejected. The outcome is that the prospective graduates' knowledge and skills about thinking skills is low.

*The reason, last time it was proposed that thinking skills is taught as a subject. But, it seems that at the level of basic education course, it was not accepted, but was rejected.... (L51)*

The outcome of this situation is that they leave the university without acquiring thinking skills and also not being confident enough to teach these skills to others. Findings from the investigation on students' perceptions on whether they have benefited from the specially mounted course on thinking skills, however, seem to suggest that it has helped them to be able to do problem solving systematically and effectively (75.5 per cent), they have been exposed to teach thinking skills through the thinking course (94.5 per cent), they knew about various thinking skills (90.5 per cent), and were confident about teaching thinking skills through the teaching of school subjects (87.8 per cent).

These findings seem to suggest that the specially mounted course has helped prospective graduates in acquiring thinking skills and being more confident to teach these skills to others. The contents of the course include important aspects of thinking skills such as theories supporting the teaching and learning of thinking skills, different types and categories of thinking skills, approaches, strategies and techniques to teach thinking skills, and assessing the acquisition of thinking skills by students. Besides lectures, various other methods, such as, group work, projects, presentations, writing critique are used in the delivery.

As such, there is an urgent need to have all those involved in teacher education to pay serious attention towards improving the teacher education programs in relation to preparing them to teach thinking skills. Besides the pre-service programs, there is also an urgent need to mount programs to assist those teachers in schools to

incorporate the teaching of thinking skills into their content instruction.

For the pre-service teacher education program at teacher education institutes and universities, there needs to be serious and comprehensive approaches to include the teaching of thinking skills to prospective teachers. Findings of these studies reported here may be of assistance in guiding those attempts. There needs to be efforts to improve the infusion of teaching thinking skills through content instruction and also through specially mounted courses, as was seen in this case here.

## CONCLUSION

There are clear evidences that the teacher education program investigated is attempting to infuse the teaching of higher-order thinking skills into its program with the aim of preparing teachers who will be able to teach this component effectively in classrooms. However, there are, as has been discussed above, a number of aspects involving the teaching of thinking that need serious and immediate attention. Among other things, it was found that less than 50 percent of the prospective teachers agreed that they knew how to teach subject matter and thinking skills using the infusion approach. What is of serious concern is that more than one-third of the students were unsure or not confident about using thinking skills, both for their own use and also to teach those skills. Significant differences were also found between different programs in preparing prospective teachers to teach thinking skills. This includes significant differences in preparing teachers to teach subject matter knowledge and thinking skills using the infusion approach, being able to involve students actively in the teaching and learning processes, and being able to evaluate the progress of students when teaching the thinking skills component.

However, it was gratifying to find that the respondents who are prospective graduates, after having taken a specially-mounted course on thinking, have indicated that they have benefited from taking this course. Except for

the item on whether they are able to do problem solving systematically and effectively where a total of about 25 per cent of them were either unsure or were not confident, for the rest of the items less than 15 per cent of the respondents were either unsure or were not confident of the different aspects of acquiring thinking skills and teaching those skills. With this, one could say that introducing a course on thinking skills is certainly a good move in the right direction.

Based on the findings of this research, it seems very important that there has to be a comprehensive review of the teacher education program and there has to be more explicit, systematic, and continuous efforts to infuse the teaching of higher-order thinking skills into the curricula of higher education.

Infusing the curriculum with higher-level thinking and with appropriate assessments, however, will require an expansion of college teaching services. The need for this type of assistance seems especially critical at colleges and universities due to the professors' lack of formal training on how to teach (Haas and Keeley, 1998). Faculty with advanced degrees has expended considerably more effort mastering the methods of acquiring knowledge than mastering the methods of teaching that knowledge (Brown and Meuti, 1999). This deficiency in academic training has far-reaching consequences because students learn to "think, write, and speak in critical ways by watching respected leaders" model these behaviors (Brookfield, 1997).

It is my belief that most of us have strategies and techniques for helping students to master the various types of higher-level thinking. Now we need to make a more concerted effort to integrate thinking habits with factual content. We need to focus on these attitudes and behaviors and model them in all of our courses if our students are going to develop a disposition to think critically, reflectively, and inquisitively in a wide variety of situations. I believe that infusion of higher-level

thinking across the curricula has great potential for reshaping higher education. It may eventually change the meaning of "higher education" from extended years of formal learning to a lifelong habit of "higher-level thinking."

## REFERENCES

- Adams, M. J. (1989). Thinking skills curricula: Their promise and progress. *Educational Psychologists*, 24(1), 25-77.
- Block, C. C. (1993). *Teaching the Language Arts: Expanding Thinking Through Student-Centered Instruction*. Boston: Allyn and Bacon.
- Brookfield, S.D. (1997). Assessing critical thinking. *New Directions for Adult and Continuing Education*, 75, 17-29.
- Brown, M. Neil. and Michael D. Meuti. (1999). Teaching how to teach critical thinking. *College Student Journal*, 33, 162-70.
- Costa, A. (1985). *Teacher Behaviours that Promote Student Thinking in Developing Minds*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Curriculum Development Center. (1993). *Kemahiran Berfikir: Konsep, Model dan Strategi Pengajaran dan Pembelajaran*. Kuala Lumpur: Ministry of Education, Malaysia.
- Geertsen, H. Reed. (2003). Rethinking thinking about higher-level thinking. *Teaching Sociology*, 31(1), 1-19.
- Haas, P. F. and Stuart M. K. (1998). Coping with faculty resistance to teaching critical thinking. *College Teaching*, 46, 63- 70.
- Harvey, L., Moon, S., Geall, V. and Bower, R. (1997). *Graduates' Work : Organizational Change and Students' Attitudes*. Birmingham : Centre for Research into Quality, University of Central England.
- Jabatan Perdana Menteri. (2001). *Outline Perspective Plan 3 (2001 -2010)*. Kuala Lumpur: Government Printers.

- Kartini Baharom. (1998). Critical thinking skills, dispositions and classroom practices of history teachers in Malaysian secondary schools. Unpublished Doctoral Dissertation, Manchester University, United Kingdom.
- Kember, D. (1997). A reconceptualization of the research into university academics' conceptions of teaching. *Learning and Instruction*, 7, 255-275.
- Maritn, D. (1989). Restructuring teacher education programs for higher-order thinking skills. *Journal of Teacher Education*, May 1989, 40(3), 2-8.
- Marzano, R., Brandt, R. S., Hughes, C. S., Jones, B. F., Pesseisen, B. Z., Rankin, S. C. and Suhor, C. (1988). *Dimensions of Thinking: A Framework for Curriculum and Instruction*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Mahathir Mohamed. (1991). *Malaysia: The Way Forward*. Kuala Lumpur, Malaysia: Center for Economic Research & Services, Malaysian Business Council.
- Nickerson, R. S. (1988). On improving thinking through instruction. *Review of Research in Education*, 15, 3-57.
- Onosko, J. J. and Newmann, F. M. (1994). Creating more thoughtful learning environments. In J. N. Mangieri and C.C. Block (Eds.), *Creating powerful thinking in teachers and students: Diverse perspectives*. Fort Worth: Harcourt Brace College Publishers.
- Perkins, D. N. (1993). Teaching for understanding. *American Educator*, 17, 28 – 35.
- Pithers, R. T. (2000). Critical thinking in education: A review. *Educational Research*, 42(3), 237-249.
- Prawat, R. (1991). The value of ideas: The immersion approach to the development of thinking. *Educational Researcher*, 20(2), 3-10.
- Rajendran, N. (1998a). Teaching higher-order thinking skills in language classrooms: The need for transformation of teaching practice. Unpublished doctoral dissertation, Michigan State University, East Lansing. MI: Michigan State University.
- Rajendran, N. (1998b). Teaching higher-order thinking skills in language classrooms in Malaysia: The teachers' dilemmas. *Inaugural Conference of the Malaysian Educational Research Association*, April 28-30, Penang, Malaysia.
- Rajendran, N. (2000). Teaching higher-order thinking skills in classrooms: Learning from the experiences of Malaysia. Paper presented at the *Thinking Qualities Initiative Conference Hong Kong 2000*, June 23-24, Hong Kong Baptist University.
- Rajendran, N. (2001a). Language teaching and the enhancement of higher-order thinking skills. In W. Renandya and N.R. Sunga (Eds.), *Language curriculum and instruction in multicultural societies*. Singapore: SEAMEO Regional Language Centre.
- Rajendran, N. (2001b). Teaching higher-order thinking skills in Malaysia. *Journal of Southeast Asian Education*, 2(1), 42-65.
- Rajendran, N. (2002). Restructuring teacher education programs to teach higher-order thinking skills. *Conference proceedings of The Inaugural UPSI International Teacher Education Conference*, May 6-8, 2002. Universiti Pendidikan Sultan Idris.
- Rajendran, N. (2004). *Infusing higher-order thinking skills into the teacher education program: A case study of university pendidikan sultan idris*. Tanjong Malim, Malaysia: Universiti Pendidikan Sultan Idris.
- Rajendran, N. (2007). Teaching higher-order thinking skills at institutions of higher-learning: Lessons to be learned from a formal initiative. Paper presented at the *Conference on Teaching and Learning in Higher Education 2007 (CTLHE07)*, December 5-7, 2007, Seremban, Malaysia.
- Rajendran, N.S. (2008). *Teaching and Acquiring Higher-Order Thinking Skills: Theory and Practice*. Tanjong Malim, Malaysia: Universiti Pendidikan Sultan Idris Publishers.
- Resnick, L. B. and Klopfer, L.W. (Eds.). (1989). *Toward the Thinking Curriculum: Current Cognitive Research*. Alexandria, VA: Association for Supervision and Curriculum Development.

- Sternberg, R. and Martin, M. (1988). When teaching thinking does not work, what goes wrong? *Teachers College Record*, 89(4), 555-578.
- Swartz, R. and Parks, S. (1994). *Infusing Critical and Creative Thinking into Content Instruction*. California: Critical Thinking Press.
- Teacher Education Division. (1994a). *Kemahiran Berfikir Secara Kritis dan Kreatif dan Kemahiran Belajar (Sukatan Pelajaran KPA Lima Semester)*. Kuala Lumpur: Ministry of Education, Malaysia.
- Teacher Education Division. (1994b). *Model Pengajaran dan Pembelajaran Kemahiran Berfikir*. Kuala Lumpur: Ministry of Education, Malaysia