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Thinking Minds: Nurturing the Design of a Better Future

Guest Editors:
Tan Bee Hoon and Shameem Rafik Galea

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Editorial Statement

Pertanika is the official journal of Universiti Putra Malaysia. The abbreviation for *Pertanika* Journal of Social Sciences & Humanities is *Pertanika* J. Soc. Sci. Hum.

Pertanika Journal of

SOCIAL SCIENCES & HUMANITIES

Selected Papers from:
14th International Conference on Thinking (ICOT 2009)

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PREFACE

This Special Issue of the Pertanika Journal of Social Sciences and Humanities (JSSH) comprises 12 revised and extended manuscripts based on papers originally presented at the 14th International Conference on Thinking (ICOT 2009) hosted by Universiti Putra Malaysia at the Kuala Lumpur Convention Centre from 22-26 June 2009. Therefore, the theme of this collection follows that of ICOT 2009, that is, **Thinking Minds: Nurturing the Design of a Better Future**.

As the Pertanika JSSH is a research-based journal, the editorial process of this Special Issue began by selecting papers from the proceedings that present empirical research data. Presented papers that reached us after the publication of the conference proceedings, and hence not included in the proceedings, were also considered. From an initial list of 22 papers, only 12 are published. The remaining shortlisted papers were either published earlier elsewhere, or did not survive the review.

As much as ICOT 2009 is privileged to be the first Thinking conference held in Malaysia, this JSSH issue is as privileged to be the first separate Special Issue of Pertanika JSSH. The ability to think critically, reflectively, creatively and innovatively is the greatest asset for a better future, and the papers in this collection represent the untiring effort of researchers from various fields in nurturing thinking minds.

We are grateful to our Vice Chancellor Tan Sri Datuk Dr Nik Mustapha Raja Abdullah for his support for the 14th ICOT, and the ICOT 2009 Organising Committee in funding the printing cost of the Special Issue from the balance of the conference fund. The timely publication of the Special Issue would not have been possible without the full commitment of the UPM Press with Puan Kamariah Mohd Saidin as the head, and the strong support from the Pertanika Editorial Office especially the Managing Editor, Dr Nayan Kanwal, and his dedicated assistant, Ms Erica Kwan Lee Yin.

Last but not least, our heartfelt appreciation goes to all the ardent followers and paper contributors of ICOT 2009. May our collective passion continue to flourish in serving the common objective of nurturing thinking minds for a better future.

Guest Editors
October 2010

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Selected Articles from the 14th International Conference on Thinking (ICOT 2009)

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Teaching Thinking Skills at Institutions of Higher Learning: Lessons Learned

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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

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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	
1	Survey questionnaire (Prospective graduates)	Study 1	Study 2
		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 (%)
Knowledge					
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)
Skills					
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)
General					
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…. (L5I)*

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 where 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., Presseisen, 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

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Applying Cognitive Conceptual Approach in Developing Year 6 Pupils' Problem Solving Skills in Mathematics

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ABSTRACT

This study aimed to investigate the effect of the cognitive conceptual approach as compared to the heuristics approach in developing pupils' problem solving abilities. An experimental study was conducted with two classes of Year 6 pupils from two different primary schools. Both classes were measured based on the improvement they made on their mathematics achievement tests as well as their responses to a survey. A mathematics achievement test containing ten word problems was designed on the classification systems of Riley, Greeno, and Heller (1983) and Carpenter and Moser (1982). Both classes took the achievement test during the first week of school term as a pre-test and during the eighth week of the school term as a post-test. For the survey, the students were administered four subscales of the Fennema-Sherman Mathematics Attitudes Scale (1976) with the aim to measure changes in their attitudes toward mathematics as a result of the intervention. An independent t-test was run as an indicator for statistical significance at the 0.01 level. Pre-implementation results showed that both classes are comparable in terms of mathematics achievement. For the survey, the control group scored significantly higher than the experimental group in terms of self-confidence, motivation, and enjoyment towards the subject. However, at the post-test, a significant difference was found between the two groups with the experimental group reporting significantly higher scores on the mathematics achievement test as well as the four subscales of the survey.

Keywords: Cognitive acceleration, conceptual knowledge, schema, problem solving

INTRODUCTION

The introduction of 'Thinking Schools Learning Nation' in Singapore in 1997 has placed a greater emphasis on developing thinking among our pupils. As such, to promote greater thinking among Singapore's pupils at the primary school level, there has been increased emphasis on problem solving that are of real life contexts (Gravmeijer, 1994) in the teaching and learning of mathematics.

In Singapore, the teaching of mathematics problem solving in schools is guided by the thematic topics found in textbooks. The word problems typically found at the end of chapters or topics in the prescribed textbooks are primarily designed based on the exercise paradigm (Skovsmose, 2001), where students mainly practice the procedural or algorithmic skills related to the chapter or topic. Riding on the belief that "practice makes perfect", teachers assume that pupils would "learn enough" of these mathematical knowledge by rote as long as they scored well for their examinations even if they have not understood what they have learnt or

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practiced (Adey and Shayer, 2002). A pupil who can only apply an appropriately remembered rule of thumb or heuristic to the solution of a problem without knowing why the rule works only has instrumental understanding (Skemp, 1987) and the acquisition of such knowledge type sometimes lead to a regurgitation of steps in familiar problems.

Therefore, to help pupils become better problem solvers, teachers could help pupils think creatively, reflectively and critically (Richhart, 2002). In fact, teachers should first help their pupils understand what and why they are learning before they can expect them to apply what they have learnt. At the same time, teachers would need to scaffold the problem solving process and address the issues and difficulties faced by pupils, especially in the area of conceptual understanding.

This paper presents a study which aims at providing a curriculum framework for cognitive acceleration to develop pupils' problem solving abilities, particularly in the acquiring of conceptual knowledge. The first part of this paper summarizes the literature review of cognitive acceleration, including an emphasis on schema instruction as well as the core concepts of conceptual knowledge. The second part presents the design and the implementation, while the final part discusses the results of the intervention in the study.

LITERATURE REVIEW

The term cognitive acceleration is based on the theoretical premise that pupils' thinking and ability to learn can be strengthened and developed through systematic training (Demetriou et al., 1992). For the past two decades, there has been a growing development of curriculum design that aimed to accelerate cognitive development in primary school education (Adey and Shayer, 2002). The major goal of these programs was the fostering of pupils' abilities to think effectively and thus increase their general problem solving ability and academic achievement (Adey and Shayer, 1995).

There are three main hypotheses pertaining to cognitive acceleration. The first hypothesis is backed up by several theorists on the central cognitive mechanisms process in the brain (Baddeley, 1990, Pascual-Leone, 1976) whom all believed that there is some kind of general intelligence which operates across all contexts. From the cognitive psychology point of view, since all cognition should be context-dependent (Anderson et al., 1996), educationists should operate on the basis that there is some general cognitive function which can be influenced by the way teachers design their curriculum and this would improve pupils' cognitive abilities. In addition, curriculum materials must also be designed to pitch at a suitable level to challenge cognitive ability of the pupils so that through their active engagement, they can arrive at some form of conclusions together.

The second hypothesis states that a person's cognitive ability develops with age. According to Piaget and Inhelder (1974), a child develops intellectually through the different stages, from sensory-motor stage to formal operational stage. Recognizing these stages and their characteristics can guide teachers to design a curriculum that can develop pupils' cognitive abilities appropriately by leading them from one stage of development to the next.

The third hypothesis states that cognitive development can be influenced by the environment. According to Piaget and Inhelder (1976), cognitive development is seen as a process of balancing and adaptation between how a child sees the world around him and the effects the world has on the child. When the experience the child encounters is coherent with his views, he assimilates in the new experience. But when the experience is contrary to his views, he will change his views to better understand the environment around him. Drawing on these works, the idea is to create an environment that will help stimulate the intellectual mind of our pupils.

Therefore, within the school setting, the development of concrete operational thinking, as characterized by Piaget and Inhelder, can be

accelerated in children with a curriculum which provides well-managed cognitive conflict and structured opportunities for social construction, including the encouragement of metacognition.

Based on the above three hypotheses, Adey, Shayer and Yates (1995) conceptualized the six pillars of the cognitive acceleration framework, namely concrete preparation, cognitive conflict, social construction, metacognition, schema theory, and bridging.

Concrete Preparation

Formal operations operate only on a situation that has first been described by the subject in terms of descriptive concrete models. Thus, concrete preparation involves establishing that pupils are familiar with the technical vocabulary, and framework in which a problem situation is set. For example, in getting pupils to do word problems, teachers should go through the language constructs so that pupils are clear what the problems mean.

Cognitive Conflict

Building on the notion of reflective intelligence by Dewey (1963), this term is used to describe an event or observation that the pupil finds puzzling and discordant with his or her previous experience or understanding. Using Piagetian notions of equilibration being attained at a higher level of thinking when a child encounters a problem which cannot be solved with existing cognitive structures, the child goes through a process of either assimilation (they learn a new experience) or accommodation (they change the way they think to fit the new experience). Viewing knowledge itself as problematic, it is therefore not viewed as a fixed body of information, but rather one that is constructed by students themselves.

Social Construction

Drawing on the works of Vygotsky, the construction of knowledge and understanding is a social process. Understanding appears first in the social space, and then becomes internalized by individuals (Vygotsky, 1978). The process of task related oral discussion around new ideas, exploring them through group discussion, asking for explanations and justifications, are all important aspects of pupils' learning (Meloth and Deering, 1999). The notion of a Zone of Proximal Development (ZPD), which is the difference in level between what a child can achieve unaided and what she can achieve with the help of an adult or 'more able peer' also established the fact that learning should be matched in some manner with the child's developmental level. To avoid having the social process ending up as a mere discussion, pupils are trained to respond to others to make the conversation more substantive. Responses may come in either of the following:

a. Questioning: Posing a question to a fellow group member based on what was said; this also includes clarification as well.

b. Proofing: Demonstrating a practical example to substantiate what has been said, e.g. using numerals to show that area of 2 triangles = area of a square.

c. Compare and contrast: Consolidating what has been said by a few individuals and draw out the similar and different points.

d. Extensions: Either building on what someone has said or illustrating with an example to improve the clarity of what has been said.

e. Explanations: To improve the clarity of what was said or to give a reason for a judgment made.

Metacognition

Metacognition is a form of cognition. It involves both knowledge of cognitive processing (how we are thinking) and a conscious control and monitoring of that processing. It is a conscious reflection by a child on his or her own thinking processes. This means that it is a process that must take place *after* a thinking act since at the time when pupils are engaging in a problem-

solving activity, their consciousness must be devoted to that. Only then can they think back about the steps they took, and become aware how their own conceptualisation changed during the activity (Perkins and Saloman, 1989).

Effective metacognition during problem solving requires not only knowing what and when to monitor, but also how to monitor. Teaching pupils to be aware of their cognition and better monitoring of their problem solving actions should take place in the context of learning specific mathematics concepts and techniques. However it can be quite challenging as the development of metacognitive skills is difficult and often requires "unlearning" inappropriate metacognitive behaviors developed through previous experiences (Schoenfeld, 1985). For example, in Singapore, pupils are trained to write number sentences. However, midway into the mathematical workings, many pupils tend to forget what their previous numeral workings represent. Therefore, it is important to encourage our pupils to label and explain their workings as they proceed with their number sentences (see *Fig. 1* where labeling is in bold).

Schema Theory

Mathematical problem solving is a transfer challenge requiring children to develop schemas for recognizing novel problems as belonging to familiar problem types for which they know the solutions. According to schema construction theory, a major challenge in effecting mathematical problem solving is the development of schemas for grouping problems into types that require the same solution (Chi et al., 1981). The broader the schema, the greater the probability that individuals will recognize connections between familiar and novel problems and will know when to apply the solution methods they have learned.

Schemas are phrases or words that capture the essence of a concept, event or an experience (Marshall, 1995). They help capture both the pattern of relationships as well as their linkages to operations. Problem sums pose difficulties for many pupils because of the complexity of the solution process (Jonassen, 2003). They emphasises conceptual understanding, knowledge organization and pattern recognition,

Problem 1

In a class of 40 pupils, $\frac{1}{2}$ of the boys is equal to $\frac{3}{4}$ of the girls. How many more boys than girls are the in the class?

1 unit of boys is equivalent to 3 units of girls

$\frac{1}{2}$ of the **boys** is equal to $\frac{3}{4}$ of the **girls**

Method 1:

Making the units equivalent

$\frac{1}{2}$ Boys $\longrightarrow$ $\frac{3}{4}$ Girls

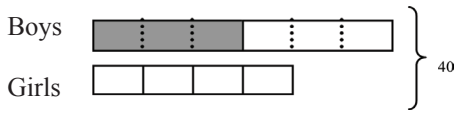
$\frac{3}{6}$ Boys $\longrightarrow$ $\frac{3}{4}$ Girls

10 Units $\longrightarrow$ 40

1 unit $\longrightarrow$ 4

2 units $\longrightarrow$ 8

Method 2:



10 units $\longrightarrow$ 40

1 unit $\longrightarrow$ 4

2 units $\longrightarrow$ 8

Fig. 1: Example of labeling number sentences in word problems

which are key elements of conceptual knowledge (Jitendra et al., 1999). During problem solving, all problem relevant knowledge is accessible only when the knowledge is adequately organised by a suitable cognitive structure or problem schemata (Chi et al., 1981). This will in turn facilitate problem representation, which translates words into a meaningful representation. According to Skemp (1987), he attributed three functions to the schema: (a) It serves to integrate what is already known. (b) It provides the framework for further learning. (c) It is the basis for understanding.

Coherent with the view of Piaget and Inhelder, Skemp (1987) said that "to understand something is to assimilate it into an appropriate schema" (Marshall, 1995, p.29). Using the word problem in *Fig. 2* as an example, pupils are taught the schema of 'repetition' as in this example where Nancy is repeated. Once they recognise this schema, they can make the units of Nancy the same by using the principle of common multiple and continue to solve the problem.

Problem 2

James had $\frac{3}{4}$ as many sweets as Nancy and Nancy had $\frac{1}{4}$ as many sweets as Tom.

If they have a total of 92 sweets altogether, how many sweets did James have?

Fig. 2: Example of a schema action in word problem

Developing Conceptual Knowledge

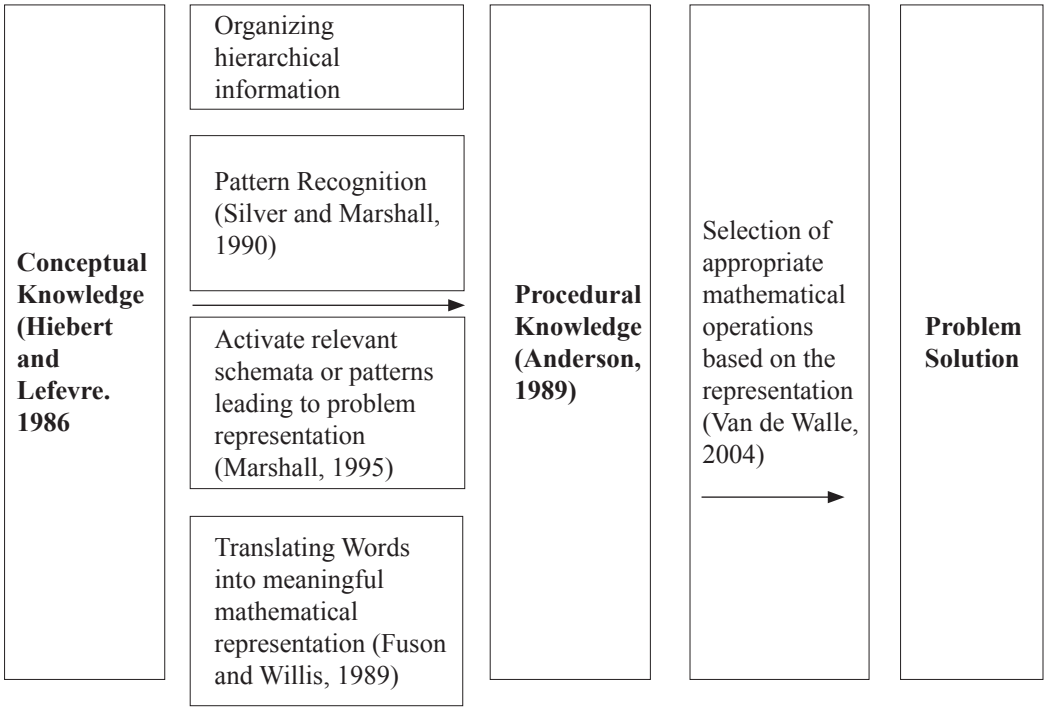


Fig. 3: Components of problem solving

Bridging

The explicit bridging to other contexts is the final link in this chain of developing, abstracting, and generalizing reasoning. Context should be extended to other non-routine problems to let pupils have a trial to see if they can apply what they had learnt in the process across the different topics and settings.

Mathematical problem solving is an extremely complex form of human endeavor that involves much more than the simple recall of facts or the application of well-learned procedures (Lester, 1983). Looking at *Fig. 3*, there are two components that are essential to solving mathematical problems. One is the conceptual knowledge (why and the what) - the facts, concepts and principles, which comprised of individual pieces of information and the relationships between these pieces of information (Hiebert and Lefevre, 1986). The other is the procedural knowledge (how), heuristics in particular, that are used to recall and construct information while solving the problem. This includes both a familiarity with the symbol representation system of mathematics and knowledge of rules and procedures for solving exercises in mathematics.

An important aspect of domain specific concept knowledge is problem comprehension and representation, which involves translating the text of the problem into a semantic representation on the basis of an understanding of the problem structure. While procedural knowledge may or may not be learned meaningfully, conceptual knowledge must be learned with meaning. Procedural knowledge learned without meaning is similar to instrumental understanding, a type of understanding named by Mellin-Olsen (1991) and described by Skemp (1976) as "rules without reason." As such, although procedural knowledge is also important, it is extremely limited unless it is connected to a conceptual knowledge base (Hegarty et al., 1995). Using the word problem in *Fig. 4* as an example:

Without looking at the context, pupils will tend to add $\frac{1}{4} + \frac{2}{3} = \frac{2}{3}$ without realizing that they are related to different bases (orange and apples).

Successful problem solving requires a substantial amount of qualitative and conceptual reasoning (Marshall, 1995). Good problem solvers do not rush to apply a formula or an equation. Instead, they try to understand the problem situation and they consider alternative representations and relations based on the problem statements. Only then are they satisfied that they understand the situation and all problem statements in it in a qualitative way.

PURPOSE OF THE STUDY

Rationale

In some Singapore classrooms, when word problems are presented in the classroom setting as teaching examples, teachers would generally go through the conceptual phase quickly, and almost immediately to the procedural phase by working at the solution (Teong et al., 2004). The conceptual phase appears to be implicit to the teacher, and not often made explicit to the students. Consequently, the emphasis on procedural knowledge accounted for pupils' lack of planning and understanding when they approach a non-routine word problem. They read the questions quickly, do not spend time in understanding and thinking about the concepts, and work towards the solution immediately. Such procedural knowledge learned without meaning is similar to instrumental understanding, a type of understanding described by Skemp (1976) as "rules without reason."

There are a total of 38 apples and oranges in a bag. After $\frac{1}{4}$ of the apples and $\frac{2}{3}$ of the orange are removed, there are 21 apples and oranges left behind. How many oranges are there at first?

Fig. 4: Example of contextual understanding in word problems

In the use of manipulatives as an alternative approach to improving conceptual understanding, teachers often demonstrate the way these manipulatives are to be used and pupils are left with little freedom to give meanings to the experiences in ways that make sense to them; the way the materials are to be used is prescribed. (Cobb et al., 1992). This is based on the belief that mathematics is "out there" and that models "show" the conceptual understanding. However, given the nature of problem solving, learning should be more constructive in nature and pupils should be given greater opportunity to construct their own knowledge.

Building on the previous studies of Hiebert and Lefevre (1986), conceptual knowledge is important to help pupils solve problems successfully. Yet, the underlying challenge is not an issue of what conceptual knowledge is but how teachers can help their pupils construct conceptual knowledge effectively. In looking at successful problem solving, Kantowski (1975) found evidence that although conceptual knowledge is related to success in problem solving, it depended a lot on pupils' cognitive abilities as well. In addition, metacognition has long been linked to successful mathematical problem solving and improvement in the learning of Mathematics (Biggs, 1987; Wittrock, 1986).

SIGNIFICANCE OF THE STUDY

Therefore, this study extends the literature of conceptual knowledge by developing a cognitive conceptual approach; one which makes use of the cognitive acceleration framework to help pupils construct their conceptual knowledge in a constructivist manner. As the intervention would also place a greater emphasis on metacognition, the teacher can also help her pupils to become more aware of their own thinking. At the same time, the study would also examine the attitudes of the pupils towards mathematics and investigate if the new approach could help improve their attitudes towards the subject. If students' attitudes could be improved, research shows this would possibly improve their achievement. As noted by Mager (1968), favorable attitudes toward academic areas will maximize the likelihood that students will remember what they have learned and learn willingly.

RESEARCH PROBLEM

The key research problem is to investigate the effect of the cognitive conceptual approach compared to the heuristics approach to develop pupils' problem solving abilities. To address the research problem, the following specific research questions are:

1. Is there a significant difference in the increase in pupils' mathematics achievement between the cognitive conceptual group and the heuristics group?
2. Is there a significant difference in the increase in pupils' attitude towards mathematics between the cognitive conceptual group and the heuristics group?

In this study, there are two hypotheses tested at 0.01 significance level. The first null hypothesis is that the experimental class would not experience a more significant improvement in their mathematics achievement as compared to the control class. The second null hypothesis is that the experimental class would not experience a more significant gain in their attitude towards Mathematics as compared to the control class.

METHOD

Subjects

Two classes from two government primary schools participated in the study. The control group was an intact class of mixed ability from school A and consisted of 36 pupils. The experiment group is another mixed ability class who comes from school B and consisted of 40 pupils. Both the schools' principals gave permission for their classes to be part of the study.

The two teachers teaching the control and experimental classes were both female and had

the same years of teaching experiences. They were of the same age and graduated with a non-Mathematics degree.

Measures

Two types of instruments were used to measure the effect of the cognitive conceptual approach compared to the heuristics approach in the classes, namely mathematics achievement tests and survey questionnaires. The mathematics achievement test, where both pre and post tests are both identical, consist of ten word problems with a maximum score of forty marks. Each of these problems is non-routine in nature and contained multiple numeric and narrative information that is presented in a mixture of mathematical forms (*see* Annex A). Based upon the classification systems of Riley, Greeno, and Heller (1983) and Carpenter and Moser (1982), there are four types of word problems classes. The first type consists of ***change*** (CH) problems which involve an exchange of quantity. The second type consists of ***equalize*** (EQ) problems, which are a variant of the change problems and usually have the phrases "must give away" or "must get". The third problem type consists of the ***combine*** (CB) problems with two specific subtypes. The combine problems require joining and separating sets, but not by any action explicitly indicated in the word problem. The fourth problem type consists of the ***compare*** (CP) problems. To assess the validity and reliability of this test, the items in the mathematics achievement tests have also been sent to Dr Koh Teh Hong[1] and Mr Zuhairi[2] for expert opinion. For this study, an independent t-test is used to measure if the improvement made by the two groups is significant when we measure their progress made from the pre-test to the post-test.

Four of the seven subscales of the Fennema-Sherman Mathematics Attitudes Scales (1976) were used as part of the questionnaire to be administered at the beginning and the end of the eight week intervention (*see* Annex B). The four subscales used in the survey include the following: self confidence, value, motivation, and enjoyment. Each subscale contains four items that were scored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The procedures described by the authors of the instrument were used to analyze the responses: negatively worded items were reverse-scored before analysis so that a 1 represents a strongly agree response and a 5 represents a strongly disagree response. Thus, a high mean on a scale represents a positive attitude toward mathematics. Responses that were left blank were assigned a value of three, a neutral response. The survey was administered by the Head-of-Department (Mathematics) during the first week of the school term (pre-survey) and during the 8th week of the school term (post-survey). All administrations of the surveys were administered during a regularly scheduled class meeting. The duration of the survey was fifteen minutes.

The surveys were administered in their individual classes to minimise location threat and interaction effect as the two schools were very far apart. To validate the questionnaire for use among local students, the survey was also piloted separately at school C to a class of 35 primary six pupils. The Cronbach alpha coefficient (a) was calculated for each of the four dimensions to check for internal consistency. The coefficients are shown below.

According to Kerlinger and Lee (2000), a value of 0.6 or higher is acceptable and indicates the reliability of the scale used. Hence, all the four dimensions are assumed to be sufficiently reliable. Similarly, an independent t-test would be used to measure if there was any significant difference among the control and experiment classes when the study measured their improvement made from the pre-survey to the post-survey based on the four dimensions.

TREATMENT

Pupils were pre-tested the mathematics achievement test that consist of topics such as fractions, ratio, percentage, and whole numbers. The period of intervention was eight weeks and

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TABLE 1
Internal consistency of Fennema-Sherman Mathematics Attitudes

Dimensions	Cronbach alpha coefficient (a)
Self Confidence	0.883
Value	0.634
Enjoyment	0.852
Motivation	0.823

the number of Mathematics periods was held constant for both the control and experimental groups. The Head-of-Department carried out lesson observation and observation notes were recorded during the eight weeks for scoring fidelity of treatment implementation. Finally, pupils were post tested on the same measures.

Control Group

Within the control group, a prescribed set of problem-solution rules were taught. The teacher approached the problems according to the sequence in which the topics were presented. There was no attempt to broaden pupils' schemas for these problems. Control class instruction provided more practice in applying problem-solution rules and involved a greater emphasis on computational requirements. The mode of instruction was explicit and relied on word examples, guided practice and homework, relying heavily on textbooks and workbooks, as well as the heuristics booklet covering the nine heuristics approach.

Experimental Group

The methodological design of a weekly lesson adopted the six pillars scheme of cognitive acceleration with a dual emphasis on cognitive and conceptual development as shown in *Fig. 5*.

Concrete Preparation and Schema Theory – Laying the Foundation

The teacher began the class by teaching pupils some of the basic algorithmic skills in preparation for the problem formulation. At the same time, the teacher also introduced to pupils the terms of the problem including the context and helped them identify some of the key schemas found in the problem statement. The teacher also took this time to lay the ground rules for the group discussion at the second stage.

Building Conceptual Knowledge through Social Construction

As pupils proceeded in groups to discuss their solutions for the second stage, many would attempt to apply their experiential intelligence (previous experiences and prior knowledge) to solve the problem, but could not. As cognitive dissonance occurred, pupils are engaged in reflective thinking to resolve the cognitive conflict within them. As everyone was involved in clarifying and questioning each other in an attempt to analyze the word problem as a group, they collectively helped build a deeper conceptual understanding of the problem. The groups presented their views again to the class and also responded to questions raised by other group.

Assessing Construction of Ideas within the Group

As they worked within the construction zone, as described by Vygotsky (1978), the teacher would move among the groups and help scaffold the problem to facilitate discussion when necessary. At the same time, she would assess the progress of the pupils' discussion using a set of rubrics (Annex C).

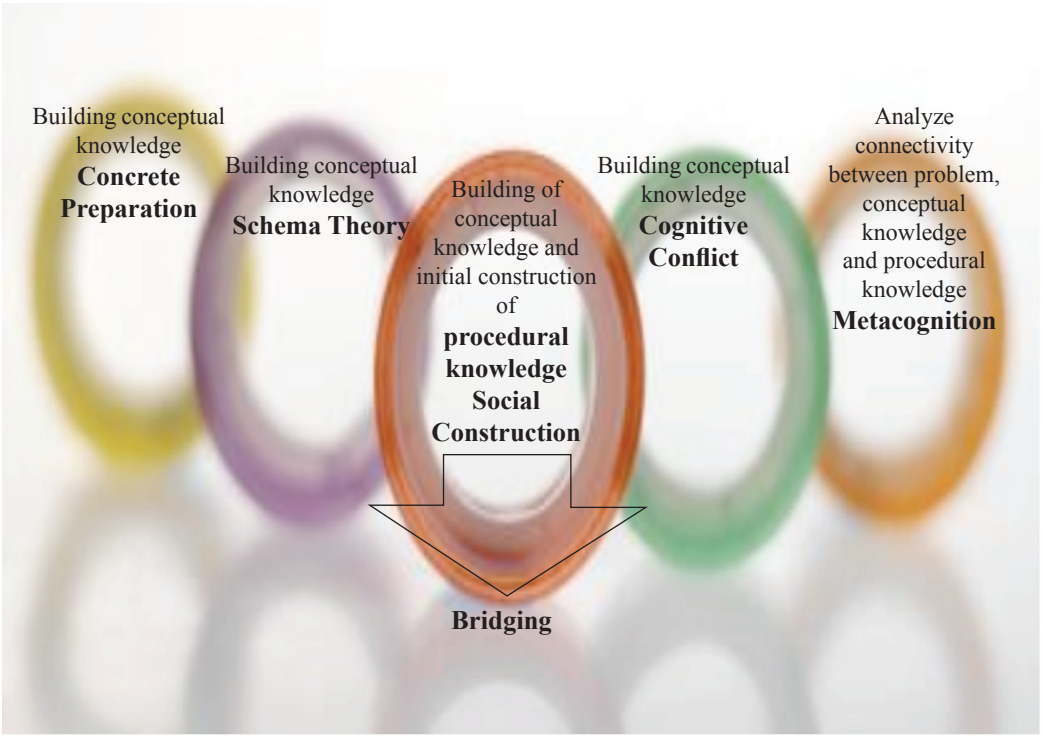

Fig. 5: The Cognitive Conceptual Model

Metacognition

As the pupils entered into the social construction phase, they tended to *monitor* their thoughts more consciously in an attempt to make themselves understood by others within the group. What was often neglected was to help them *evaluate* on what has been done because very often, pupils tend to forget how they had arrived at the answers.

Therefore, instead of giving pupils questions and asking for their solutions, pupils were given problems with worked solutions attached which were incorrect in terms of conceptual representation. As such, pupils needed to evaluate and find out where the mistakes were and offered an alternative solution. This motivated them to adopt a more holistic approach towards analyzing the problem. Please refer to Appendix A for a sample of pupils' responses to the given task.

RESULTS

Analysis of Mathematics Achievement Pre Test

A pre-test was administered to both the control group and the average ability experimental group. Both were comparable as shown by the lack of significant main effects on the pre-test. Table 2 shows the results of the t-test. Thus, in terms of their preparedness for the course, the two groups were considered to be comparable prior the study.

Although both the control and experimental groups improved in their post tests when compared against their pre-tests, the difference gained by the two groups between the pre

TABLE 2
Analysis of pre and post mathematics achievement test

	Control		Experimental		Independent t-test	
Mean	S.D.	Mean	S.D.	Mean	t-value	p-value
Pre-test	8.17	5.15	9.58	4.88	1.22	.225
Post-test	11.49	5.28	35.65	4.89	20.72***	.000
Gain (Post – Pre)	3.32	4.28	26.08	5.76	19.38***	.000

(All figures are round off to 2 decimal places)
p< 0.01***

and post-test was significantly higher for the experimental group compared to the control group (t =19.38, df = 74, p-value = .000 <.05).

ANALYSIS OF PRE QUESTIONNAIRE SURVEY

Self Confidence

Prior to the study, the pre-survey results showed that the difference between the control and experimental group is not significant (t-score = –2.488, df = 74, p-value = .015> .01). Therefore, the control group and the experimental group are comparable in terms of their level of self confidence toward the subject.

Value

In terms of measuring the dimension of 'value' in the survey, the control group and the experimental group are comparable as shown by the lack of significant main effects on the pre-survey. A t-test indicated that the difference between the mean scores of the control group (M = 15.58, S.D. = 2.92) and the experiment group (M = 16.03, S.D. = 3.44) on the pre-survey was not statistically significant (t = 0.600, df = 74, p-value = .55 > .05). Thus, the two groups were considered to be comparable in the way they value the subject of Mathematics.

Enjoyment

With a higher mean score exhibited by the control group in the pre-survey under the dimension of enjoyment, a t-test indicated that the difference between the control and experimental group is significant (t-score = –3.998, df = 74, p-value = .000> .01). Pupils in the control group generally enjoyed the subject of Mathematics more than their peers in the experimental group.

Motivation

Before the intervention, there is no significant difference in the level of motivation towards the subject between the two groups (t-score = –2.315, df = 74, p-value = .023> .01). Therefore, the control group and the experimental group are comparable in terms of their level of self confidence toward the subject.

ANALYSIS OF POST QUESTIONNAIRE SURVEY

Self Confidence

After the intervention, the results showed otherwise. The post survey showed that there is a significant difference in the level of self confidence between the control group and the experimental group (p-value = .001< .01). With a higher mean score (M= 14.09) for the experimental group and a significant difference in the gain between the two groups (t-score = 4.116, df = 74, p-value = .000< .01), pupils in the experimental group actually felt more confident towards the subject than those in the control group. However, the F-test results also showed that this effect might not be solely due

TABLE 3
Analysis of pre and post questionnaire survey

	Control group		Experimental group		Independent t-test	
	Mean	S.D.	Mean	S.D.	t-value	p-value
Self Confidence						
Pre	11.67	2.26	10.15	2.97	–2.49	.015
Post	11.47	3.03	14.05	3.49	3.42***	.001
Gain^	–0.19	3.37	3.90	5.04	4.12***	.000
Value						
Pre	15.58	2.92	16.03	3.44	0.60	.550
Post	14.83	3.94	16.80	3.31	2.36**	.021
Gain^	–0.75	4.79	0.78	4.83	0.23	.172
Enjoyment						
Pre	15.69	2.35	12.98	3.42	–3.99***	.000
Post	14.25	3.49	16.73	3.52	3.07***	.003
Gain^	–1.44	4.29	3.75	4.21	5.33***	.000
Motivation						
Pre	15.17	2.66	13.53	3.43	–2.32	.023
Post	14.86	3.82	16.75	3.38	2.29**	.025
Gain^	–0.31	4.38	3.23	5.14	3.23***	.002

(All figures are round off to 2 decimal places)
^Gain = Post – Pre $p < 0.01$*** , $p < 0.05$*

TABLE 4
Test of between-subjects effects

	Group			Treatment		
	Mean sq	F-value	Sig.	Mean sq	F-value	Sig.
Self Confidence	10.67	1.20	0.275	130.09	14.63	0.000
Value	54.95	4.70	0.032	0.01	0.00	0.982
Enjoyment	0.57	0.05	0.817	50.36	4.78	0.030
Motivation	0.58	0.05	0.821	80.75	7.20	0.008

to the intervention alone as the two classes were significantly different at first (F-value = 1.20, significance level at 0.835).

Value

Post- survey results also showed that there is a significant difference in the level of self confidence in the post survey between the control group and the experimental group (t-score = 2.363, df = 74, p–value = .021). However, the difference in gain is not significant when the control group is compared against the experimental group (t-score = 0.225, df = 74, p-value = .172> .05). Although the mean score for the experimental group improved slightly, pupils from both groups believe that Mathematics is important despite the intervention. The real frustration of the pupils is always struggling to understand the subject better and apply what has been taught despite knowing its importance.

Enjoyment

After the intervention, the post survey showed that there is a significant difference in the level of enjoyment between the control group and the experimental group (t-score = 3.071, df = 74, p-value = .003< .01). With a higher mean score (M= 16.73, S.D. = 3.52) for the experimental group and a significant difference in the gain between the two groups (t-score = 5.329, df = 74, p-value = .000< .01), pupils in the experimental group actually enjoyed the subject more than those in the control group. Again, the F-test results also showed that this effect may not be solely due to the intervention alone as there is interaction between the two classes as shown by their significant difference in the beginning. (F-value = 0.05, significance level at 0.817).

Motivation

Under the last dimension of motivation, only the experimental classes experienced an improvement in their motivation towards the subject of Mathematics. Although the difference in the level of motivation at the post survey is only significant at the 95% confidence interval (t-score = 2.288, df = 74, p-value = .025< .05), there is a significant difference in gain in the dimension of enjoyment at the 99% confidence interval when the control group is compared against the average ability experimental (EA) group (t-score = 3.233, df = 74, p-value = .002< .01). Again, the F-test results also showed that this effect may not be solely due to the intervention alone as the two classes are significantly different at first (F-value = 0.05, significance level at 0.821).

DISCUSSION

The present study built on the previous studies of Hiebert and Lefevre (1986) on conceptual knowledge and Adey and Shayer (1995) on cognitive acceleration. By designing a framework (*Fig. 5*) with a dual emphasis to help pupils construct conceptual knowledge through the use of their cognitive abilities, the work was extended. Based on the understanding that schema construction is the key to constructing conceptual knowledge, the study demonstrated how pupils could construct this knowledge in a constructivist manner so that it could be internalised by the pupils (Vygotsky, 1978). In eliciting from her pupils, the experimental class teacher was also consciously improving her questioning techniques so that she can guide them effectively to construct their own knowledge. At the same time, the holistic approach towards analyzing and interpreting the given information also help pupils to consciously monitor their own metacognition, and in turn improved their problem solving abilities (Perkins and Saloman, 1989).

On the basis of the performance in the word problems test, the results supported the hypothesis, with the experimental class's scores significantly higher than the control class (p< 0.000). With the focus on the conceptual understanding of problems, metacognitive activity was displayed more prominently and pupils have begun to understand that the reasoning behind the process was just as

important as the final answer. From the interview, the teacher had also observed that there were fewer incidences of pupils playing blindly and more importantly, erroneously, with the given numbers. From the solutions of the pupils in the experimental class, the pupils also appeared to have developed a repertoire of semantic schemes to deal with particular categories of non-routine problem sums. This is very encouraging as the weaker pupils were previously reluctant to attempt challenging problems and would prefer to wait for solutions from teachers. In addition, the teacher also noticed that her pupils in the experimental class had also noticed a reduction in the amount of time taken for them to solve a word problem.

Most of the dimensions in the survey results also supported the hypothesis except on the dimension of how pupils generally valued the subject of Mathematics. This is because pupils from both the control and experimental classes generally viewed Mathematics as an important subject and it is useful to them in their daily lives. It is also very encouraging to know that pupils generally want to do well in the subject, which probably explains why pupils can actually become more confident towards the subject if they can apply effectively what they had learnt and experienced success. According to Mager (1968), favorable attitudes toward school subjects will maximize the likelihood that students will remember what they have learned, willingly learn more about the subject, and use what they have learned.

Contrary to many beliefs about pupil resistance, pupils were generally very open to learning new approaches. The challenge is mainly to make the learning effective for them. In order to help her pupils to develop their conceptual understanding, the teacher mentioned in her interview that she tried to scaffold the problem solving process by not leading the pupils into the procedural and mechanical aspects immediately. In return, her pupils also learnt to appreciate the reasons behind why certain constructs are presented in a particular manner. Through these processes, their self confidence toward the subject naturally increased with greater understanding. The increase in confidence also meant that pupils were generally less anxious towards the learning of mathematics after the intervention period. Although a high level of anxiety can mean that pupils know Mathematics is an important subject and are keen to learn it well, such high level of anxiousness in the long run can be detrimental to learning. Therefore, by helping the pupils to improve in solving word problems, which is a challenge for most primary pupils, pupils will become more confident and improved in their performance. Quite naturally, this would be translated to a higher level of enjoyment towards the subject.

An improvement in pupil motivation towards the subject could also mean that the intrinsic value of learning Mathematics is better appreciated with this holistic and constructivist approach to approaching word problems, as pupils are encouraged to think more actively and critically. The dual emphasis on cognitive and conceptual understanding helped pupils to analyse critically and make sense the underlying meaning of each construct. Because of the success experienced by the pupils in the experimental group, they pupils believe that by trying hard, they can improve in their Mathematics grades. This positive attitude, where pupils are more than willing to put in effort to achieve good grades, gives reasons for the teacher to be optimistic for the future.

CONCLUSION

The major purpose of the present study was to test the hypothesis that the experimental class that is trained using the cognitive conceptual approach would experienced a more significant improvement both in their word problems test and attitude survey as compared to the control class who relies more on the heuristics approach. With respect to theories of cognition and problem solving, the present results are consistent with the assumption that a dual emphasis on cognition and conceptual development can improve

pupils' problem solving abilities. Given the relationship between conceptual knowledge for problem representation and solution accuracy, the attempt was to use a constructivist approach to construct such knowledge. Beyond the academic achievement, the significant gain in the self-confidence, enjoyment, and motivation of the pupils toward the subject also supported the fact that knowledge is best constructed by the students themselves when they are given a chance to make meaning with the knowledge imparted (Vygotsky, 1978) although this effect might be due to other factors as well.

REFERENCES

Adey, P. S., Shayer, M. and Yates, C. (1995). *Thinking Science: Student and Teachers' Materials for the CASE intervention* (2nd Ed.). London: Nelson 3rd ed.published 2001, Nelson Thornes.

Adey, P. and Shayer, M. (2002). *Learning Intelligence: Cognitive Acceleration Across the Curriculum from 5 to 15 Years*. Buckingham: Open University Press.

Anderson, J.R. (1989). A theory of the origins of human knowledge. *Artificial intelligence*, *40*, 313 – 351.

Anderson, J. R., Reder, L. M. and Simon, H. A. (1996). Situated learning and education. *Educational Researcher*, *25*, 5-11.

Baddeley, A. (1990). *Human Memory: Theory and Practice*. London: Lawrence Erlbaum.

Biggs, J. (1987). *The Process of Learning*. Sydney: Prentice Hall.

Carpenter, T. P. and Moser, J. M. (1982). *Addition and Subtraction: A Cognitive Perspective*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Chi, M. T. H., Feltovich, P. and Glaser, R.(1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science*, *5*, 121- 152.

Cobb, P., Yackel, E. and Wood, T.(1992). A constructivist alternative to the representational view of mind in mathematical education. *Journal for Research in Mathematics Education*, *23*(1), 2 – 33.

Demetriou, A., Efklides, A. and Gustafsson, J. (1992). *Training, Cognitive Change, and Individual Differences*: *Neo-Piagetian Theories of Cognitive Development*. New York: Routledge.

Dewey, J. (1963). *Experience and education*. New York: Collier Erlwanger, S. (1973). Benny's perception of rules and answers in IPI mathematics. *Journal of mathematical behaviour*, *1*(2), 1 – 26.

Fennema, E. and Sherman, J. A. (1976). Fennema – Sherman Mathematics Attitudes Scales: Instrument designed to ensure attitudes towards the learning of mathematics by males and females. *JSAS Catalog of Selected Documents in Psychology*, *6*(1), 3b.

Fuson, K. C. and Willis, G. B. (1989). Second graders' use of schematic drawing in solving addition and subtraction word problems. *Journal of Educational Psychology*, *81*, 514 – 520.

Gravemeijer, K. P. E. (1994). *Developing Realistic Mathematics Education.* Utrecht, Netherlands: Freudenthal Institute.

Hegarty, M., Mayer, R. E. and Monk, C. A. (1995). Comprehension of arithmetic word problems: A comparison of successful and unsuccessful problem solvers. *Journal of Educational Psychology*, *87*, 18 – 32.

Hiebert, J. and Lefevre, P. (1986). Conceptual and procedural knowledge in mathematics: An introductory analysis. In J. Hiebert (Ed.), *Conceptual and procedural knowledge: The case of Mathematics*. Hillsdale, NY: Erlbaum.

Kantowski, E. L. (1975). Processes involved in mathematical problem solving (Doctoral dissertation, University of Geogia, 1974). *Dissertation Abstracts International, 36,* 273A.

Kelly, G. A. (1955). *A Theory of Personality*: *The Psychology of Personal Constructs*. New York: Norton library.

Kerlinger, F. N. and Lee, H. B. (2000). *Foundations of Behavioral Research* (4th Ed.). Wadsworth Thompson Learning, USA.

Jitendra, A. K., Hoff, K. and Beck, M. M. (1999). Teaching middle school students with learning disabilities to solve word problems using a schema-based approach. *Remedial and special education*, *20*, 50 – 64.

Jonassen, D. H. (2003). Designing research-based instruction for story problems. *Educational Psychology Review*, *15*, 267 – 296.

Lester, F. K. (1983). *Trends and issues in mathematical problem solving research*. In R.Lesh and M. Landau (Eds.), Orlando, FL: Academic Press.

Lucangelo, D., Coi, G. and Bosco, P. (1997). Metacognitive awareness in good and poor math problem solvers. *Learning Disabilities Research and Practice*, *12*, 209 – 212.

Mager, Robert F. (1968). *Developing Attitude toward Learning*. Belmont, California: Fearon Publishers.

Marshall, S. P. (1995). *Schemas in Problem Solving*. New York: Cambridge University Press.

Mellin-Olsen, S. (1991). *Mathematical Knowledge: Its Growth Through Teaching*. Dordrecht, The Nethelands: Kluwer.

Meloth, M. and Deering, P. (1999). The role of the teacher in promoting cognitive processing during collaborative learning. In A. O'Donnell and A. King (Eds.), *Cognitive perspectives on peer learning*. Mahwah, NJ: Larence Erlbaum Associates.

Pascual-Leone, J. (1976). On learning and development, Piagetian style. *Canadian Psychological Review*, *17*(4), 270 – 97.

Perkins, D. (1995). *Outsmarting IQ: The Emerging Science of learnable Intelligence.* New York: Free Press.

Perkins, D.N. and Saloman, G. (1989). Are cognitive skills context bound? *Educational Researcher*, *18*(1), 16 – 25.

Piaget, J. and Inhelder, B.(1974). *The Child's Construction of Quantities*. London: Routledge.

Piaget, J. and Inhelder, B.(1976). *The Child's Conception of Space*. London: Routledge & Kegan Paul.

Polya, G. (1988). *How to Solve It – A New Aspect of Mathematical Model*. NJ: Princeton University Press.

Riley, M., Greeno, J. and Heller, J. (1983). Development of children's problem-solving ability in arithmetic. In H. Ginsburg (Ed.), *The development of mathematical thinking* (pp. 153-196). New York: Academic Press.

Ritchart, R. (2002). *Intellectual Character: What it is, Why it Matters, and How to Get it*. San Francisco: Jossey- Bass, A Wiley Comp.

Schoenfeld, A. H. (1985). *Mathematical Problem Solving*. Orlando: Academic Press.

Sigel, I. A. (1981). Social experience in the development of representational thought: Distancing theory. *New Directions in Piagetian Theory and Practice.* Hillsdale, NY: Lawrence Elbaum.

Silver, E. A. and Marshall, S. P. (1990). Mathematical and scientific problem solving: Findings, issues, and instructional implications. In B.F. Jones and L.Idol (Eds.), *Dimensions of thinking and cognitive instruction*. Hillsdale, NY: Erlbaum

Simon, H. A. (1975). Learning with understanding. Mathematics Education Report: ERIC information analysis center for science, mathematics and environmental studies, The Ohio State University.

Skemp. R. R. (1976). Relational understanding and instrumental understanding., *Mathematics Teaching*, *77*, 20-26.

Skemp, R. R. (1987). *The Psychology of Learning Mathematics*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Skovsmose, O. (2001). Landscapes of investigation. In L. Haggarty (Ed.), *Teaching Mathematics in secondary schools: A reader*. London: Routledge Falmer.

Teong, Sk, Hedberg, J. G. and Ho K. F. (2004). *Mathematical Problem Solving: Enhancing the Repertoire of Strategies in the Primary Classroom. First Report.* Singapore: Centre for Research in Pedagogy and Practice, Nanyang Technological University.

Van de Walle, J. A. (2004). *Elementary and Middle School Mathematics: Teaching Developmentally* (5th Edn.). Boston: Ally & Bacon.

Vygotsky, L. S. (1978). *Mind in Society*. Edited by M.Cole, V.John Steiner, S.Scribner and E. Souberman. Cambridge, Mass: Harvard University Press.

Wittrock, M. (1986). *Handbook of Research on Teaching*. New York: Macmillan.

ANNEX A

MATHEMATICS ACHIEVEMENT TEST

Name: _____ ( ) Marks: ____/40
Class: Primary 6 – ( ) Duration: 1h 30min

Answer all questions. Show your workings clearly.

1. Diane spent $\frac{2}{3}$ of her money on some magazines. She spent 14 of the remaining money on a box of colour pencils.

(a) What fraction of her money was left? (2m)

(b) Given that the box of colour pencils cost $8, find the sum of money Diane had at first. (2m)

2. Ezra had $150 more than Keng Wee. Ezra spent $\frac{3}{4}$ of his money and Keng Wee spent $\frac{4}{7}$ of his money. In the end, Keng Wee and Ezra had the same amount of money left. Find the amount of money Keng Wee had at first. (4m)

3. Mary had $\frac{3}{4}$ as many stickers as Dennis and $\frac{1}{2}$ as many stickers as Roy. If they have a total of 169 stickers altogether, how many more stickers did Roy have than Dennis? (4m)

4. Janet has $\frac{1}{4}$ as many marbles as Kumar. After Kumar gave Janet 8 marbles, Janet now has $\frac{1}{3}$ as many marbles as Kumar. How many marbles did Janet have in the end? (4m)

5. In a class, there are 75% as many boys as girls. After 14 girls and 14 boys left the class, there are now 40% as many boys as girls. How many pupils are there in the class in the end? (4m)

6. Mrs Chen spent $36 on some plates and 75% of her remaining money on some cups. If she had $\frac{1}{6}$ of her total money left, how much money did she have at first? (4m)

7. 30% of Calvin's stickers is equal to 25% of Brian's stickers. If Brian has 24 more stickers than Calvin, what is the total number of stickers Calvin and Brian have? (4m)

8. Ramesh has 50% more cards as Arun and 60% less cards than Jody. If they have a total of 150 cards, how many cards does Jody have? (4m)

9. In a train that was heading for Lido Town, the number of adults was $\frac{4}{5}$ the number of children. Halfway, the train stopped at Clamore Station and 40 children got off the train and another 40 adults had got onto the train. There were then 100% more adults than children. How many adults were there in the train in the end? (4m)

10. In an enrichment class, $\frac{1}{3}$ are boys and the rest are girls. After 3 girls and 3 boys had left the class, there were $\frac{2}{5}$ as many boys as girls remaining in the class. How many pupils are there in the class in the end? (4m)

Classification of Problems

Question	Classification	Question	Classification
1	Combine	6	Combine
2	Equalize	7	Equalize
3	Compare	8	Compare
4	Change	9	Change
5	Change	10	Change

Based on Riley, Greeno and Heller (1983) and Carpenter and Moser (1982)

ANNEX B

Mathematics Attitudes Survey

Name: _____ ( ) Class: Primary 6 – ( )
School: _____

Read each question below carefully. Circle 1, 2, 3, 4 or 5 to indicate the extent you agree with the statement by using the following scale:

1. **Strongly Disagree**
2. **Disagree**
3. **Neutral**
4. **Agree**
5. **Strongly Agree**

1.	Doing mathematics problem sums make me feel nervous	1	2	3	4	5
2.	Mathematics is important in everyday life	1	2	3	4	5
3.	I enjoy studying math in school	1	2	3	4	5
4.	I am willing to learn more than the required amount of mathematics	1	2	3	4	5
5.	I am able to solve Mathematics problems without too much difficulty	1	2	3	4	5
6.	Doing well in Mathematics is not important for my future	1	2	3	4	5
7.	Mathematics is dull and boring	1	2	3	4	5
8.	I would like to avoid using mathematics in in my future studies	1	2	3	4	5
9.	I think I can handle difficult Mathematics problems	1	2	3	4	5
10.	I study Mathematics because I know how useful it is	1	2	3	4	5
11.	I am happier in a Mathematics class than in any other class	1	2	3	4	5
12.	I plan to take as much Mathematics as I can during my education	1	2	3	4	5
13.	I can get good grades in Mathematics	1	2	3	4	5
14.	I don't expect to use much Mathematics when I get out of school	1	2	3	4	5
15.	Taking Mathematics is a waste of time	1	2	3	4	5
16.	I see mathematics as something I won't use very often when I get out of high school	1	2	3	4	5

Adapted from Fennema, E. and Sherman, J.A. (1976). Fennema – Sherman Mathematics Attitudes Scales: Instrument designed to ensure attitudes towards the learning of mathematics by males and females. *JSAS Catalog of Selected Documents in Psychology*, *6*(1), 3b.

ANNEX C

Five categories of thinking behaviors checklist

	Category	Characteristics	Tick
A	Explanation	A child explains: - his idea/action - another child's idea/action - his/her idea of explanation -his/another child's misunderstanding/difficulty	
B	Compare & Contrast	A child either: - summarizes what was said by a few individuals - draws out coherent views - highlights main ideas which are different	
C	Proofing	A child uses additional data to back up a statement that was made.	
D	Extensions	A child makes an extension when he: - makes various suggestions about solving a problem - Builds on each other's idea or use several sources of information to solve a problem; - highlights main ideas which are different - agrees that a problem is not solvable and give reason/s to back it up.	
F	Questioning	A child asks questions to the teacher or another child to clarify task/ activity/ problem/ ideas.	

APPENDIX A

Excerpts of pupils' response from metacognition assessment

Students' Responses to question 2

Student A: Ron should have 125% because Ben is 100%. Ben was not repeated twice and Joe should be 100%. The repeated name units must be the same. The repeated name should be 60% because Joe have 100%"

Student B: Ron is 25% more than Ben. Ron is repeated twice. Ben must be 100%. The repeated name must have the same units. 'And' refer to Ron, not Ben. Ron is 40% lesser than Joe. Joe must be 100%. How to make Ron have the same units? Use the lowest common multiply of the units that have at first."

Student C: Lesser needs to '-'minus and after than is a person that is have 100%. Ron is comparing with Ben so Ron is 125% because more means + and Ben is 100% because he is the one that Ben is comparing with. comparing --> means that person 100%.

Student D: 100%, Ron has 25% more so 100% + 25% = Ron's cards.

Student E: You should have put 125% for Ron as he has 25% more than Ben. Do not minus off 25% from 100% unless the qn says that Ron has 25% lesser than Ben. But now the qn says that Ron has 25% more than Ben so you should add 25% to 100% hence it is all wrong.

Student F: Ron should be 125% as it is 25% more than Ben so Ben is 100%. Joe is 100%, Ron is 40% lesser than Joe so Ron is 60%.

Student G: First of all, the qn said that Ron has 25% more cards than Ben. Secondly, and 40% lesser cards than Joe means that Ron has 40% lesser cards than Joe. Actually, Ron is a repeated identity not Ben.

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The Acquisition of Logical Thinking Abilities among Rural Secondary Students of Sabah

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ABSTRACT

The science curriculum in Malaysia emphasizes the acquisition of scientific skills, thinking skills, and the inculcation of scientific attitudes and noble values. Besides that, the acquisition of scientific and technological knowledge and its application to the natural phenomena and students' daily experiences are also equally emphasized. The purpose of this study was to gauge the acquisition of logical thinking abilities, namely, conservational reasoning, proportional reasoning, controlling variables, combinatorial reasoning, probabilistic reasoning, and correlational reasoning among Form 4 students in the Interior Division of Sabah, Malaysia. This study was also aimed to ascertain if there is any significant difference in students' acquisition of logical thinking abilities based on students' gender and science achievement at lower secondary level. This was a non-experimental quantitative research and sample survey method was used to collect data. In this study, samples were selected by using a two-stage cluster random sampling technique. Independent sample *t*-test and one-way ANOVA were used to test the stated null hypotheses at a predetermined significance level, $\alpha = .05$. Research findings showed that rural secondary students' acquisition of logical thinking abilities was low. The average item mean for all the subscales, except conservational reasoning, were lower than the overall average item mean. This research also surprisingly revealed that up to 98 percent of the respondents were categorized at the concrete operational stage whereas only 2 percent were categorized at the transitional stage. This study also found no significant difference in the mean of logical thinking abilities, except conservational reasoning, based on students' gender, but a significant difference based on students' science achievement at lower secondary level was found. These research findings bring some meaningful implications to those who are involved directly or indirectly in the development and implementation of secondary science curriculum, especially at the rural secondary schools of Sabah, Malaysia.

Keywords: Combinatorial reasoning, conservational reasoning, controlling variables, correlational reasoning, logical thinking abilities, probabilistic reasoning, proportional reasoning

BACKGROUND OF THE STUDY

The development of thinking abilities is well-discussed in the world of education. Cohen (1980) stated that the higher the ability of a person to think in an abstract way, the higher the ability of the person will function effectively in the society. Hence, the improvement of formal reasoning and thinking abilities among students is one of the aims of science education at all levels of schooling.

Cognitive Development Theory, a well-known theory proposed by Jean Piaget has

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conceptualized four different stages in the cognitive development of a person i.e. sensory motor (0 - 2 years), preoperational (2 - 7 years), concrete operational (7 - 11 years), and formal operational (11 - 16 years). The main difference among these stages of cognitive development is the mode of thinking involved. Children at formal operational stage can think logically about abstract propositions and test hypotheses systematically. At the same time, they become concerned with the hypothetical, the future, and ideological problems. Researchers (e.g., Inhelder and Piaget, 1958; Lawson, 1982b: 1985; Linn, 1982) had identified five different modes of formal operational reasoning i.e., proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning, and combinatorial reasoning which are determinants of students' success in advanced science and mathematics courses at secondary level (Wilson and Wilson, 1984).

PROBLEM STATEMENT

The fundamental function of the schooling system in the United States of America was outlined by the Educational Policies Commission in 1961. The Commission stressed the importance of logical thinking abilities in education as stipulated by the following statement:

> *The purpose which runs through and strengthens all other educational purposes - the common thread of education is the development of the ability to think. (Renner and Philips, 1980, p.193)*

Renner and Philips (1980) strongly believed that students should be given opportunities to develop their thinking abilities as a base for intellectual development. In relation to this, Lawson (1985) stressed that schooling system is not meant for the teaching of facts and concepts which are specific to a particular knowledge domain but more importantly to assist students in acquiring thinking skills.

As stipulated in the Integrated Curriculum for Secondary School (ICSS) science curriculum, the aims of the science curriculum in Malaysia are to provide students with the knowledge and skills in the science and technology and enable them to solve problems and make decisions in everyday life based on scientific attitudes and noble values. Via the science curriculum, it is hoped that students will be able to acquire scientific skills (i.e., science process skills and science manipulative skills), thinking skills (i.e., creative and critical thinking skills), and apply knowledge and skills in a creative and critical manner for problem solving and decision-making (*Pusat Perkembangan Kurikulum, Kementerian Pelajaran Malaysia*, 2001).

Based on the Cognitive Development Theory proposed by Jean Piaget, Malaysian Form 4 students are at the formal operational stage whereby they can think logically about abstract propositions and test hypotheses systematically. At the same time, they also become concerned with the hypothetical, the future and ideological problems. As pointed out by Wilson and Wilson (1984), formal operational reasoning was determinant of students' success in advanced science and mathematics courses at secondary level.

Previous researchers (e.g., DeLuca, 1981; Hernandez, Marek and Renner, 1984; Howe and Shayer, 1981; Meehan, 1984; Shemesh, 1990) had found a significant difference in logical thinking abilities between male and female students. Male students have shown better performance in Piagetian formal reasoning tasks as compared to their counterparts. However, other researchers did not find any significant difference (e.g., Keig and Rubba, 1993; Michael Liau, 1982; Roadrangka, 1995). On the other hand, previous researches (e.g., Bitner, 1991; Roadrangka, 1995; Siti Hawa Munji, 1998) suggested that formal reasoning abilities are closely related to science achievement.

However, there are not many researches conducted to gauge secondary students' logical thinking abilities, especially in the Malaysian rural secondary schools context. Hence, due to

the scarcity of research in this area, the main aim of this study is to gauge the logical thinking abilities among Form 4 students in the Interior Division of Sabah, Malaysia. This study is also aimed to identify if there is any significant difference in rural students' logical thinking abilities based on their gender and science achievement at lower secondary level.

RESEARCH OBJECTIVES

The objectives of this study are:

1. To gauge the logical thinking abilities among Form 4 students in the Interior Division of Sabah, Malaysia.
2. To investigate if there is any significant difference in rural secondary students' logical thinking abilities based on their gender and science achievement at lower secondary level.

RESEARCH HYPOTHESES

This study was guided by the following hypotheses:

Ho_1: There is no significant difference in the acquisition of logical thinking abilities based on students' gender.

Ho_2: There is no significant difference in the acquisition of logical thinking abilities based on students' science achievement at lower secondary level.

RESEARCH DESIGN

This was a non-experimental quantitative research and a sample survey method was used to collect data. The samples were selected by using a two-stage cluster random sampling technique. Univariate analysis which includes independent sample t-test and One-way Analysis of Variance (ANOVA) were used to test the stated null hypotheses at a predetermined significance level of .05.

CONTEXT OF THE STUDY

This study was conducted in 18 Form 4 classes from nine secondary schools in the Interior Division of Sabah, Malaysia. The distribution of schools and Form 4 classes according to four districts in the Interior Division of Sabah, Malaysia is shown in Table 1.

POPULATION AND SAMPLING

The population of this study was Form 4 students, from 22 secondary schools in the Interior Division of Sabah, who took the Integrated Curriculum for Secondary School (ICSS) Science as one of their compulsory learning subjects in school. Population size is approximately 3,500 students. The average age of the population is 16 years old. Sample size of this study was determined based on the formula suggested by Krejcie and Morgan (1970) and power analysis (Miles and Shevlin, 2001). Krejcie and Morgan suggested that for a

TABLE 1
Distribution of schools and Form 4 classes according to four districts in the interior division of Sabah, Malaysia

District	No. of schools	No. of Form 4 classes
Tambunan	2	4
Keningau	4	8
Tenom	2	4
Nabawan	1	2
Total	9	18

population between 3,000 and 3,500, a minimum sample size of 341-346 is acceptable. Thus, the sample size of this study is adequate compared to Krejcie and Morgan's recommendation.

To be specific, two-stage cluster random sampling was used to identify schools and Form 4 classes to be involved in this study. At stage one, systematic sampling was used to identify nine secondary schools from four districts in the Interior Division of Sabah, Malaysia. Once the schools have been chosen, simple random sampling method was used to select any two Form 4 classes from each chosen school by using the random number table. All the students in the chosen classes were automatically taken as samples of the study. The combination of sampling techniques is to ensure the representativeness of the samples used in the study.

RESEARCH INSTRUMENT

Group Assessment of Logical Thinking (GALT) is a paper-and-pencil test which consists of 21 items to measure students' logical thinking abilities. The distribution of items according to six different modes of logical thinking abilities is shown in Table 2.

Instrument used in this study is a modified and translated Malay version from the instruments i.e. 'Group Assessment of Logical Thinking' (GALT) (Roadrangka et al., 1983) and 'Test of Logical Thinking' (TOLT) (Tobin and Capie, 1981). These instruments were developed to measure students' modes of Piagetian cognitive reasoning abilities i.e. conservational reasoning, proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning, and combinatorial reasoning.

Double-multiple-choice response format for alternatives and justifications of answers were used in this instrument. Students were posed with a problem and asked to choose the best answer, from 2 to 5 possible answers available, for each problem. Following that, students were asked to choose the best justification for the chosen answer from a list of 2 to 5 possible justifications. On the other hand, pictorial presentation was used to enhance students' better understanding of the items (Roadrangka et al., 1983).

Validity and Reliability of the Instrument

The researcher had examined all the items in the original GALT and TOLT instrument and found that most of the items were suitable to be used in the Malaysian context. Efforts have been devoted to ensure the content and face validity of the modified and translated version of the instrument. In this matter, all the items were translated into Malay language so that the respondents can understand the items and choose their best answers and justifications without any semantic distortion. The Cronbach's alpha reliability coefficient of the instrument was found at .52 which is considered moderate for its use in the study.

TABLE 2
Distribution of GALT items according to six different modes of logical thinking

Subscales	Item	No. of items
Conservational reasoning	1,2,3,4	4
Proportional reasoning	5,6,7,8,9	5
Controlling variables	10,11,12	3
Probabilistic reasoning	13,14,15	3
Correlational reasoning	16,17,18	3
Combinatorial reasoning	19, 20, 21	3
Total		21

DATA COLLECTION

Before administering the instrument, formal permission from the school principals involved was sought and obtained. The instrument was then administered by the researcher. Students were gathered in the school hall and the instrument was administered to the students concurrently. The students were told about the nature of the instrument and how the instrument should be answered. The students were given ample time of approximately 2 hours to answer all the questions in the instrument.

DATA ANALYSIS

Students' answers on the instrument were checked and scored by the researcher to ensure consistency in the scoring. There were two answers for the first 18 items in the instrument. One point will be given for both correct answers. If only part of the answers is correct, zero point will be given. The last three items in the instrument were used to gauge students' combinatorial reasoning ability. One point will be awarded if all the correct combinations of answers are listed in the space provided. Likewise, zero point will be given if only part of the answers is correct. Possible minimum score for this instrument is zero whereas the maximum score can reach 21. According to Lawson (1995), students' performance in GALT instrument can be used to categorize students into empirical-inductive thinking pattern (score 0 to 15) or hypothetical-deductive thinking pattern (score 16 to 21). On the other hand, students can also be categorized into three levels of cognitive development i.e. concrete operational (score 0 to 8), transitional operational (score 9 to 15), and formal operational (score 16 to 21) stage.

Descriptive statistics which include measures of central tendency (mean, average item mean) and measures of variability (range, standard deviation, and average item standard deviation) were used to gauge the acquisition of logical thinking abilities among Form 4 students in the Interior Division of Sabah, Malaysia. After the assumptions of using parametric tests were met, univariate analysis such as independent sample *t*-test and one-way ANOVA were used to test the stated null hypotheses at a specified significance level, $\alpha = .05$.

Independent Sample t-Test

Independent sample *t*-test was used to determine if there is any significant difference in the acquisition of logical thinking abilities based on students' gender. Independent sample *t*-test was used to compare the overall mean of logical thinking abilities as well as the scale mean of logical thinking abilities i.e. conservational reasoning, proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning, and combinatorial reasoning.

One-way Analysis of Variance

One-way ANOVA was used to ascertain if there is any significant difference in the acquisition of logical thinking abilities based on students' science achievement at lower secondary level (low, medium, high). One-way ANOVA was used to compare the overall mean of logical thinking abilities as well as the scale mean of logical thinking abilities. If there is a significant difference, Post-Hoc multiple comparison test i.e., Tukey's HSD (Honestly Significant Difference) will be used to identify which levels of science achievement show significant difference in terms of logical thinking abilities.

RESEARCH FINDINGS AND DISCUSSIONS

Logical Thinking Abilities among Rural Secondary Students

Table 3 shows the overall mean and standard deviation of logical thinking abilities among Form 4 students in the Interior Division of Sabah, Malaysia.

Descriptive statistics in Table 3 and *Fig. 1* showed that the overall mean of logical thinking abilities among Form 4 students in the Interior Division of Sabah is 3.191 (average item mean = .152) with a standard deviation of 2.158 (average item SD = .103). The average item mean

TABLE 3
Mean and standard deviation of logical thinking abilities
(n = 549)

Subscales	No. of items	Mean	SD	Average item mean[a]	Average Item SD	Range
Conservational reasoning	4	1.384	1.084	.346	.271	0 - 4
Combinatorial reasoning	3	.424	.619	.141	.206	0 - 3
Controlling variables	3	.368	.582	.123	.194	0 - 3
Correlational reasoning	3	.330	.582	.110	.194	0 - 3
Proportional reasoning	5	.516	.749	.103	.150	0 - 4
Probabilistic reasoning	3	.169	.463	.056	.154	0 - 3
Overall	21	3.191	2.158	.152	.103	0 - 12

[a]Average item mean = Scale mean divided by the number of items in each scale

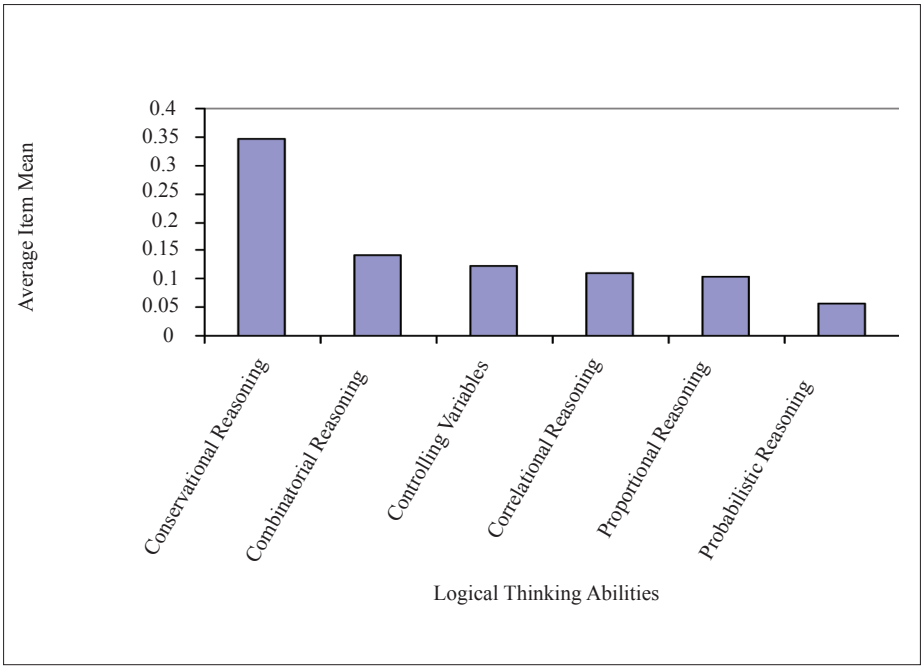

Fig. 1: Average Item Mean of Logical Thinking Abilities (n=549)

according to different modes of logical thinking abilities in descending order are: conservational reasoning (average item mean = .346, average item SD = .271), combinatorial reasoning (average item mean = .141, average item SD = .206), controlling variables (average item mean = .123, average item SD = .194), correlational reasoning (average item mean = .110, average item SD = .194), proportional reasoning (average item mean = .103, average item SD = .150), and probabilistic reasoning (average item mean = .056, average item SD = .154).

These research findings revealed that the acquisition of logical thinking abilities among Form 4 students in the Interior Division of Sabah was low with the average item mean in the range of .056 to .346. Average item mean for all the subscales (except conservational reasoning) were lower than the overall average item mean of logical thinking abilities. Further analysis, based on Lawson's categorization of cognitive development, surprisingly found that 98 percent of the respondents are categorized at the concrete operational stage whereas only 2 percent are categorized at the transitional operational stage. According to Lawson (1995), students can be categorized into three levels of cognitive development i.e. concrete operational, transitional operational, and formal operational based on their performance in GALT instrument.

As shown in Table 3, average item mean according to different modes of logical thinking in descending order are conservational reasoning, combinatorial reasoning, controlling variables, correlational reasoning, proportional reasoning, and probabilistic reasoning. This finding was supported by a model of hierarchical relationships between Piagetian modes of cognitive reasoning and integrated science process skills as proposed by Yap (1985) and Yeany *et al*. (1986). In the proposed model, probabilistic reasoning is situated at a higher hierarchy as compared to proportional reasoning, controlling variables, combinatorial reasoning, and conservational reasoning which are placed at a lower hierarchy of the model.

Students' low logical thinking abilities might be due to the education system which is more examination-oriented. Hence, less emphasis is given to the teaching and use of logical thinking skills. Science teaching and learning strategies are aligned to objectivism with the aim to cover the syllabus within the allotted time without 'investing' adequate time to nurture thinking skills among students. Furthermore, school evaluation system which only emphasizes the acquisition of content knowledge could contribute to low logical thinking abilities among students. Syed Anwar Aly and Merza Abbas (2000) reported that the evaluation of students' science achievement does not give equal emphasis on the process and product component of scientific skills. Almost 100 percent of the evaluation focused on the science product component i.e., concepts, theories, and formulae. Hence, high achievers in science are students who can explain the related concepts and theories and solve routine problems by using related formulae.

In relation to this, logical thinking abilities among students in local higher learning institutions were also reported as low. Syed Anwar Aly (2000) found that only 19 percent of matriculation college students possess high scientific reasoning abilities, 66 percent at medium stage whereas 15 percent possess low scientific reasoning abilities. In the same study, Syed Anwar Aly (2000) reported that only 19 percent of Malaysian students with average age of 19 years old possess high scientific reasoning abilities as compared to 22 percent of American students with average age of 16 years old.

Mean Difference in the Acquisition of Logical Thinking Abilities based on Students' Gender

Independent sample t-test results (Table 4 and *Fig. 2*) showed that there is no significant difference in the overall mean of logical thinking abilities based on students' gender ($t = -1.721$, $df = 483.410$, $p = .086$). Thus, the first null hypothesis which stated that there is no significant difference in the acquisition of logical thinking abilities based on students' gender is failed to be rejected.

Although male students ($M = 3.367$, $SD = 2.373$) scored higher than female students

TABLE 4
Independent sample t-test results for mean difference in logical thinking abilities based on gender (n = 549)

Subscales	Gender	n	Mean	SD	Mean difference	Effect size	t	df	p
Conservational reasoning	Male	251	1.498	1.201	.209	.193	-2.222*	477.331	.027
	Female	298	1.289	.966					
	Overall	549	1.384	1.084					
Proportional reasoning	Male	251	.582	.777	.122	.163	-1.893	515.368	.059
	Female	298	.460	.720					
	Overall	549	.516	.749					
Controlling variables	Male	251	.387	.612	.035	.060	-.684	547	.495
	Female	298	.352	.557					
	Overall	549	.368	.582					
Probabilistic reasoning	Male	251	.163	.440	-.012	-.026	.281	547	.779
	Female	298	.175	.482					
	Overall	549	.169	.463					
Correlational reasoning	Male	251	.339	.627	.017	.029	-.331	547	.741
	Female	298	.322	.542					
	Overall	549	.330	.582					
Combinatorial reasoning	Male	251	.398	.601	-.048	-.078	.903	547	.367
	Female	298	.446	.635					
	Overall	549	.424	.619					
Overall	Male	251	3.367	2.373	.323	.150	-1.721	483.410	.086
	Female	298	3.044	1.949					
	Overall	549	3.191	2.158					

* $p < .05$
The effect size is the mean difference divided by the pooled standard deviation

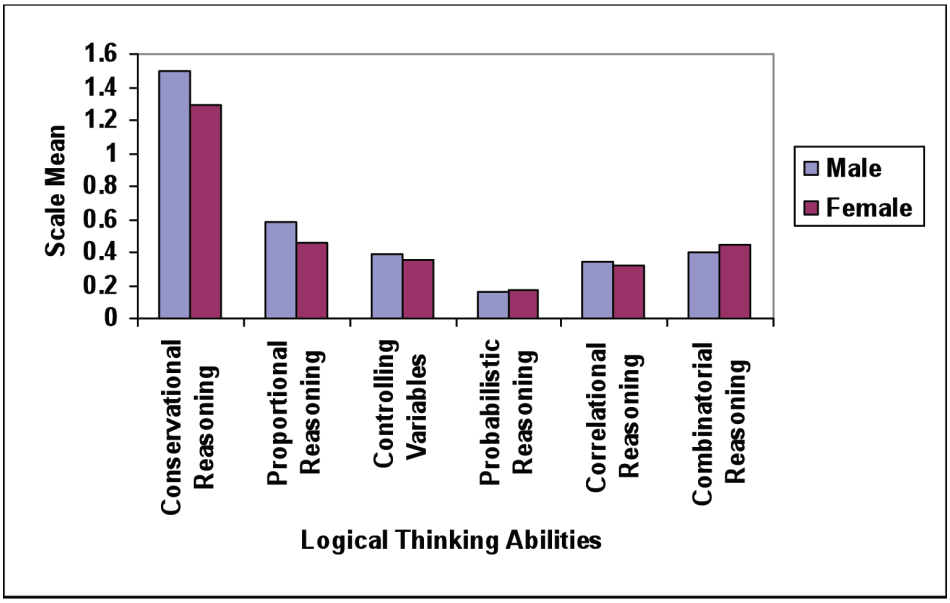

Fig. 2: Mean difference in logical thinking abilities based on gender (n = 549)

(M = 3.044, SD = 1.949), but at t = -1.721 and p = .086, the mean difference is insignificant. However, further analysis showed that male students (M = 1.498, SD = 1.201) scored significantly higher than female students (M = 1.289, SD = .966) in conservational reasoning at t = -2.222, df = 477.331 and p = .027.

The finding of this study also surprisingly revealed that up to 97.2 percent of male respondents and 98.7 percent of female respondents are categorized at concrete operational stage whereas the remaining are categorized at transitional operational stage. Hence, there is no significant difference in the acquisition of logical thinking abilities based on gender. This finding was found to be consistent with the findings of Keig and Rubba (1993), Michael Liau (1982), and Roadrangka (1995). As an example, Michael Liau (1982), in his research to investigate primary school students' ability in conservation of length via three Piagetian experiments, he found that there is no significant difference in the ability of conservation of length between male and female students. However, this finding was contradicting with previous researchers (DeLuca, 1981; Hernandez, Marek, and Renner, 1984; Howe and Shayer, 1981; Meehan, 1984; Shemesh, 1990). Previous researches had found a significant difference in logical thinking abilities between male and female students. Male students performed better in Piagetian formal reasoning tasks as compared to their female counterparts.

Mean Difference in the Acquisition of Logical Thinking Abilities based on Students' Science Achievement at Lower Secondary Level

One-way ANOVA results in Table 5 showed that there is a significant difference in the overall mean of logical thinking abilities according to students' science achievement at lower secondary level ($F(2, 496) = 64.614$, $p<.0005$). This finding successfully rejected the second null hypothesis which stated that there is no significant difference in the acquisition of logical thinking abilities according to students' science achievement at lower secondary level. On the other hand, one-way ANOVA revealed that there is a significant difference in the mean of conservational reasoning ($F(2, 496) = 35.156$, $p<.0005$), proportional reasoning ($F(2, 496) =$

TABLE 5
One-way ANOVA results for mean difference in logical thinking abilities based on students' science achievement at lower secondary level (n = 499)

Subscales	Sources of Variation	SS	df	MS	F	p
Conservational reasoning	Between group	70.785	2	35.393	35.156*	< .0005
	Within group	499.339	496	1.007		
	Overall	570.124	498			
Proportional reasoning	Between group	20.605	2	10.302	19.497*	< .0005
	Within group	262.085	496	.528		
	Overall	282.689	498			
Controlling variables	Between group	9.149	2	4.574	13.983*	< .0005
	Within group	162.266	496	.327		
	Overall	171.415	498			
Probabilistic reasoning	Between group	4.260	2	2.130	10.608*	< .0005
	Within group	99.600	496	.201		
	Overall	103.860	498			
Correlational reasoning	Between group	.295	2	.147	.435	.648
	Within group	168.146	496	.339		
	Overall	168.441	498			
Combinatorial reasoning	Between group	10.804	2	5.402	14.380*	< .0005
	Within group	186.318	496	.376		
	Overall	197.122	498			
Overall	Between group	474.691	2	237.345	64.614*	< .0005
	Within group	1821.934	496	3.673		
	Overall	2296.625	498			

* $p < .05$

19.497, $p<.0005$), controlling variables ($F(2, 496) = 13.983$, $p<.0005$), probabilistic reasoning ($F(2, 496) = 10.608$, $p<.0005$), and combinatorial reasoning ($F(2, 496) = 14.380$, $p<.0005$) based on students' science achievement at lower secondary level.

Post-Hoc Tukey's HSD multiple comparison results (Table 6 and *Fig. 3*) showed that students with better achievement in science scored significantly higher than students with medium and low achievement in science for conservational reasoning, proportional reasoning, controlling variables, probabilistic reasoning, combinatorial reasoning, and logical thinking abilities as a whole.

These mean differences might be due to the existence of possible relationships between logical thinking abilities and students' science achievement as pointed out by Lawson (1982b) and Roadrangka (1995). Logical thinking abilities play an important role in the understanding and learning of abstract science

TABLE 6
Post-Hoc Tukey's HSD comparison results for mean difference in logical thinking abilities based on students' science achievement at lower secondary level (n = 499**)**

Subscales	Science achievement at lower secondary level	n		Low	Medium	High
			M	1.0444	1.2119	1.9048
Conservational reasoning	Low	180	1.0444	-		
	Medium	151	1.2119	-.1675	-	
				(p = .285)		
	High	168	1.9048	-.8603*	-.6928*	-
				(p< .0005)	(p< .0005)	
			M	.3278	.4172	.7917
Proportional reasoning	Low	180	.3278	-		
	Medium	151	.4172	-.0894	-	
				(p = .505)		
	High	168	.7917	-.4639*	-.3744*	-
				(p< .0005)	(p< .0005)	
			M	.2556	.3179	.5655
Controlling variables	Low	180	.2556	-		
	Medium	151	.3179	-.0623	-	
				(p = .585)		
	High	168	.5655	-.3099*	-.2476*	-
				(p< .0005)	(p< .0005)	
			M	.0944	.1126	.2976
Probabilistic reasoning	Low	180	.0944	-		
	Medium	151	.1126	-.0181	-	
				(p = .929)		
	High	168	.2976	-.2032*	-.1850*	-
				(p< .0005)	(p = .001)	
			M	.3000	.3907	.6429
Combinatorial reasoning	Low	180	.3000	-		
	Medium	151	.3907	-.0907	-	
				(p = .372)		
	High	168	.6429	-.3429*	-.2521*	-
				(p< .0005)	(p = .001)	
			M	2.3222	2.7881	4.5595
Overall	Low	180	2.3222	-		
	Medium	151	2.7881	-.4659	-	
				(p = .071)		
	High	168	4.5595	-2.2373*	-1.7714*	-
				(p< .0005)	(p< .0005)	

* p < .05

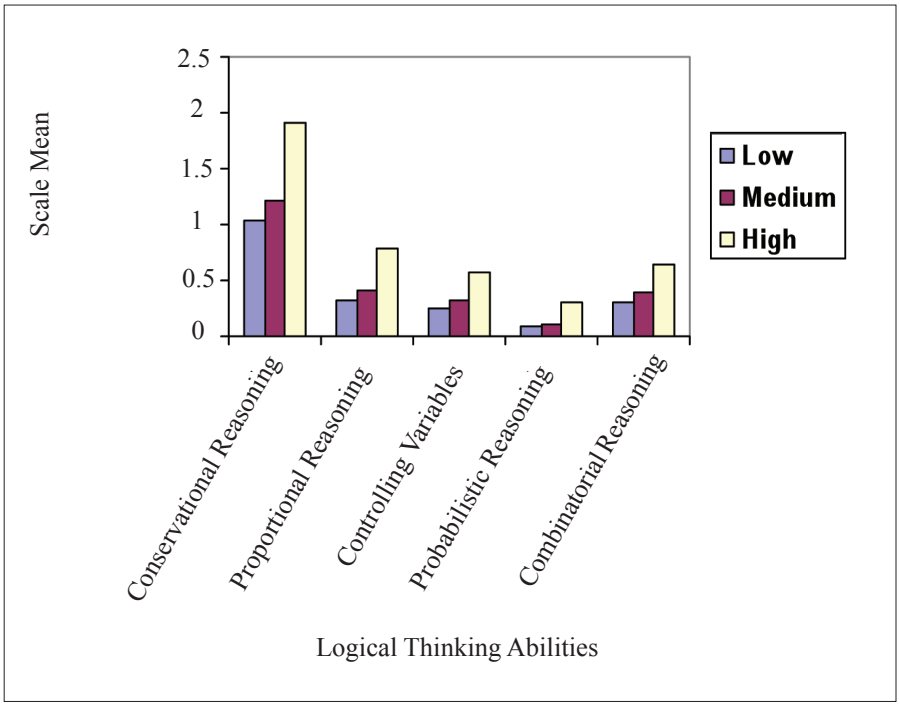

Fig. 3: Mean difference in logical thinking abilities based on students' science achievement at lower secondary level (n= 499)

concepts at secondary level and this is translated into better science achievement among students (Lawson, 1982b, 1985; Linn, 1982).

Previous research studies (e.g., Bitner, 1991; Boulanger and Kremer, 1981; Hofstein and Mandler, 1985; Howe and Durr, 1982; Keig and Rubba, 1993; Krajcik and Haney, 1987; Lawson et al., 1975; Lawson, 1982a, b; Marek, 1981; Mitchell and Lawson, 1988; Piburn, 1980; Piburn and Baker, 1989; Roadrangka, 1995; Siti Hawa Munji, 1998; Staver and Halsted, 1985) suggested that formal reasoning abilities are closely related to science achievement. For instance, Lawson (1982b) showed that students' score in 'Lawson Classroom Test of Formal Reasoning' (Lawson, 1978) was correlated with their achievement in school subjects i.e., social studies, science, and mathematics. This finding provides concrete evidence that formal reasoning abilities can also be related to students' general performance, not only to science and mathematics.

On the other hand, Roadrangka (1995) found that there is a relationship between formal operational reasoning abilities and students' achievement in biology, physics, and chemistry. Students at formal operational stage scored significantly higher in biology, physics, and chemistry tests compared to those at concrete operational stage. Students at formal operational stage were also found to obtain significantly higher score in physics and chemistry tests than students at transitional operational stage. Concrete thinkers are unable to develop the understanding of abstract concepts. Conversely, formal thinkers are able to develop the understanding of concrete and abstract concepts (Inhelder and Piaget, 1958). Hence, students' success in science will be guaranteed by using different modes of formal operational reasoning (Lawson, 1982b, 1985; Linn, 1982; Tsaparlis, 2005; Tai et al., 2005; Lewis and Lewis, 2007). For instance, Lewis and Lewis (2007) emphasized the need to include a focus

on the development of formal thought as well as a content review in the efforts to help at-risk students in general chemistry.

IMPLICATIONS OF THE STUDY

In the effort to develop students' logical thinking abilities, some changes in the evaluation system and science teaching and learning strategies need to be seen more intentionally. In relation to this, different subjects such as planning and developing instructional programs, classroom activities, laboratory activities, teaching materials, measurement-assessment methods, and pre-service teacher education strategies need to be considered for the purpose of developing students' cognitive thinking abilities (Schneider and Renner, 1980; Moshman and Thompson, 1981; Akdeniz, 1993; Çepni and Özsevgeç, 2002; Özsevgeç, 2002).

The importance of logical thinking abilities in our education system as emphasized by Renner and Philips (1980, p.193): "The purpose which runs through and strengthens all other educational purposes – the common thread of education is the development of the ability to think" needs to be fully understood by all the relevant parties (e.g. Curriculum Development Centre, schools, science teachers) who are involved directly and indirectly in the planning and implementation of science curriculum in this country. As pointed out by Renner and Philips (1980), students should be given more opportunities to develop their thinking abilities for intellectual development via various approaches. In relation to this, Yaman (2005) has shown that problem-based learning (PBL) approach was effective in the development of logical thinking skills. On the other hand, the creative and critical thinking based laboratory method was also found effective in developing creative and logical thinking abilities (Koray and KÖKSAL, 2009).

Hence, logical thinking abilities should be given new emphasis in the teaching and learning of science in the effort to improve students' science achievement at all levels of schooling. Lawson (1985) stressed that the schooling system is not meant for the teaching of facts and concepts which are specific to a particular knowledge domain, but to assist students in acquiring thinking skills.

REFERENCES

Akdeniz, A.R. (1993). The implementation of a new secondary physics curriculum in Turkey: An exploration of teaching activities. Unpublished Doctoral Dissertation, University of Southampton, UK.

Bitner, B.L. (1991). Formal operational reasoning modes: Predictors ofcritical thinking abilities and grades assigned by teachers in science and mathematics for students in grades nine through twelve. *Journal of Research in Science Teaching*, *28*(3), 265 - 274.

Boulanger, F. D. and Kremer, B.K. (1981). Age and developmental level as antecedents of science learning. *Journal of Research in Science Teaching*, *18*(4), 371 - 384.

Çepni, S. and Özsevgeç, T. (2002). *Science teachers' assessment tools and their relation with students' cognitive development.* Education: Changing Times, Changing Needs, First International Conference on Education, Faculty of Education Eastern Mediterranean University, May 8 - 10, Gazimagusa, Turkish Republic of Nothern Cyprus.

Cohen, H.G. (1980). Dilemma of the objective paper-and-pencil assessment within the Piagetian framework. *Science Education*, *64*(5), 741 - 745.

DeLuca, F.P. (1981). Application of cluster analysis to the study of Piagetian stages of intellectual development. *Journal of Research in Science Teaching*, *18*(1), 51 - 59.

Hernandez, L.De., Marek, E.A. and Renner, J.W. (1984). Relationships among gender, age, and intellectual development. *Journal of Research in Science Teaching*, *1*(4), 365 - 375.

Hofstein, A. and Mandler, V. (1985). The use of Lawson's Test of Formal Reasoning in the Israeli science education context. *Journal of Research in Science Teaching*, *22*(2), 141 - 152.

Howe, A.C. and Durr, B.P. (1982). Analysis of an instructional unit for level of cognitive demand. *Journal of Research in Science Teaching*, *19*(3), 217 -224.

Howe, A. C. and Shayer, M. (1981). Sex related differences on a task of volume and density. *Journal of Research in Science Teaching*, *18*(2), 169 -175.

Inhelder, B. and Piaget, J. (1958). *The Growth of Logical Thinking: From Childhood to Adolescence*. New York: Basic Books, Inc.

Keig, P.F. and Rubba, P.A. (1993). Translation of representation of the structure of matter and its relationship to reasoning, gender, spatial reasoning, and specific prior knowledge. *Journal of Research in Science Teaching*, *30*(8), 883 - 903.

Koray, Ö. and KÖKSAL Mustafa Serdar. (2009). The effect of creative and critical thinking based laboratory applications on creative and logical thinking abilities of prospective teachers. *Asia Pacific Forum on Science Learning and Teaching*, *10*(1). Retrieved January 1, 2009 from http://www.ied.edu.hk/apfslt/v10_issue1/koksal/index.htm#con.

Krajcik, J.S. and Haney, R.E. (1987). Proportional reasoning and achievement in high school chemistry. *School Science and Mathematics*, *87*(1), 25 - 32.

Krejcie, R.V. and Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*(3), 607 - 610.

Lawson, A.E. (1978). The development and validation of a classroom test of formal reasoning. *Journal of Research in Science Teaching*, *15*(1), 11-24.

Lawson, A.E. (1982a). The relative responsiveness of concrete operational seventh grade and college students to science instruction. *Journal of Research in Science Teaching*, *19*(1), 63 - 77.

Lawson, A.E. (1982b). Formal reasoning, achievement, and intelligence: An issue of importance. *Science Education*, *66*(1), 77 - 83.

Lawson, A.E. (1985). A review of research on formal reasoning and science teaching. *Journal of Research in Science Teaching*, *22*(7), 569 - 617.

Lawson, A.E., Nordland, F.H. and DeVito, A. (1975). Relationship of formal reasoning to achievement, aptitudes, and attitudes in preservice teachers. *Journal of Research in Science Teaching*, *12*(4), 423 - 431.

Lewis, S.E. and Lewis. J.E. (2007). Predicting at-risk students in general chemistry: Comparing formal thought to a general achievement measure. *Chemistry Education Research and Practice*, *8*(1), 32 - 51.

Linn, M.C. (1982). Theoretical and practical significance of formal reasoning. *Journal of Research in Science Teaching*, *19*(9), 727 - 742.

Marek, E.A. (1981). Correlations among cognitive development, intelligence quotient, and achievement of high school biology students. *Journal of Research in Science Teaching*, *18*(1), 9 - 14.

Meehan, A.M. (1984). A meta-analysis of sex differences in formal operational thought. *Child Development*, *55*, 1110 - 1124.

Liau, T.L. (1982). Three Piagetian experiments: An investigation into the ability of Malaysian primary school children from a school with an urban character and from a school with a rural character to conserve length. Unpublished Master Dissertation, Universiti Sains Malaysia, Penang.

Miles, J. and Shevlin, M. (2001). *Applying Regression and Correlation. A Guide for Students and Researchers*. London: Sage Publications.

Mitchell, A. and Lawson, A.E. (1988). Predicting genetics achievement in nonmajors college biology. *Journal of Research in Science Teaching*, *25*(1), 23 - 37.

Moshman, D. and Thompson, P.A. (1981). Hypothesis testing in students: Sequences, stages, and instructional strategies. *Journal of Research in Science Teaching*, *18*(4), 341 - 352.

Özsevgeç, T. (2002). Determination of the relationships between middle school students' profiles and their cognitive development levels in the selected science topics. Unpublished Master Dssertation, Karadeniz Technical University, Turkey.

Piburn, M. (1980). Spatial reasoning as a correlate of formal thought and science achievement for New Zealand students. *Journal of Research in Science Teaching*, *17*(5), 443 - 448.

Piburn, M. D. and Baker, D. R. (1989). Sex differences in formal reasoning ability: Task and interviewer effects. *Science Education*, *73*(1), 101 - 113.

Pusat Perkembangan Kurikulum, Kementerian Pendidikan Malaysia. (2001). *Huraian Sukatan Pelajaran Sains KBSM Tingkatan Empat.* Kuala Lumpur: Kementerian Pendidikan Malaysia.

Renner, J. W. and Philips, D. G. (1980). Piaget's developmental model: A basis for research in science education. *School Science and Mathematics*, *80*, 193 - 198.

Roadrangka, V. (1995). *Formal operational reasoning ability, cognitive style and achievement in Biology, Physics, and Chemistry concepts of Form 4 students in Penang, Malaysia.* SEAMEO Regional Centre for Education in Science and Mathematics, Penang.

Roadrangka, V., Yeany, R.H. and Padilla, M.J. (1983). The construction of a group assessment of logical thinking (GALT). Paper presented at the *56th annual meeting of the National Association for Research in Science Teaching*, Dallas, Texas, April 5 – 8, 1983.

Shemesh, M. (1990). Gender-related differences in reasoning skills and learning interests of junior high school students. *Journal of Research in Science Teaching*, *27*(1), 27 - 34.

Schneider, L.S. and Renner, J.W. (1980). Concrete and formal teaching. *Journal of Research in Science Teaching*, *17*(6), 503 - 518.

Siti Hawa Munji. (1998). Cognitive styles, intelligence, level of cognitive development, study habits and academic achievement of university students. Unpublished Doctoral thesis, University Malaya, Kuala Lumpur.

Staver, J. R. and Halsted, D. A. (1985). The effects of reasoning, use of models, sex type, and their interactions on posttest achievement in chemical bonding after constant instruction. *Journal of Research in Science Teaching*, *22*(5), 437 - 447.

Syed Anwar Aly. (2000a). Hypothetico-deductive reasoning and concept acquisition: Implications for strategies in the Malaysian smart schools. Kertas dibentangkan dalam *Simposium Pendidikan Sains dan Teknologi*, Pulau Pinang, 30 March – 2 April, 2000.

Syed Anwar Aly and Merza Abbas. (2000b). Penyerapan kemahiran saintifik dalam proses pengajaran dan pembelajaran kimia di tahap menengah. Kertas dibentangkan dalam *Seminar Pendidikan Sains dan Matematik*, UiTM Shah Alam, 2 – Oktober, 2000.

Tai, R.H., Sadler, P.M. and Loehr, J.F. (2005). Factors influencing success in introductory college chemistry. *Journal of Research in Science Teaching*, *42*, 987 - 1012.

Tobin, K.G. and Capie, W. (1981). The development and validation of a group test of logical thinking. *Educational and Psychological Measurement*, *41*, 413 - 423.

Tsaparlis, G. (2005). Non-algorithmic quantitative problem-solving in university physical chemistry: A correlation study of the selective cognitive factors. *Research in Science and Technological Education*, *23*, 125 - 148.

Wilson, A.H. and Wilson, J.M. (1984). The development of formal thought during pretertiary science courses in Papua New Guinea. *Journal of Research in Science Teaching*, *21*(5), 527 - 535.

Yaman, Suleyman. (2005). Effectiveness on development of logical thinking skills of problem based learning skills in science teaching. *Journal of Turkish Science Education*, *2*(1), 31 - 33.

Yap, K.C. (1985). Validation of hierarchical relationships among Piagetian cognitive modes and integrated science process skills for high school students with different cognitive reasoning abilities. Unpublished Doctoral dissertation, University of Georgia.

Yeany, R. H., Yap, K. C. and Padilla, M. J. (1986). Analyzing hierarchical relationships among modes of cognitive reasoning and integrated science process skills. *Journal of Research in Science Teaching*, *3*(4), 277 - 291.

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Enhancing Writing Ability through Multiple-Intelligence Strategies

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ABSTRACT

This quasi-experimental research investigates how multiple-intelligence strategies and instructions can be used to improve the writing ability of students. The experimental group was taught the five multiple intelligences related to writing: verbal-linguistic, logical-mathematical, visual-spatial, interpersonal and intrapersonal. Students were also taught the five multiple-intelligence strategies related to writing which were brainstorming, topic-word association, rank ordering, mind-mapping, and metacognition. Both the experimental and the control groups were given two compositions: a narrative and an expository. After two months of training they were given a posttest to find out whether there was any significant difference in the writing ability of students. Writing ability was measured based on the Six-Trait Analytic Writing Rubric. Paired Sample T-Test, ANOVA, and MANOVA were used to analyze the data collected. Significant improvement is seen in the overall writing ability of students and also in the six traits analyzed after two months of training.

Keywords: Multiple intelligences, writing ability, narrative and expository compositions, Six-Trait Analytic Writing Rubric

INTRODUCTION

Malaysian schools are basically exam-oriented and tend to favour those who perform well in linguistic and mathematical areas because these skills are highly valued in the culture. Because of the focus on verbal-linguistic skill, teachers also tend to emphasize this skill while teaching. Most of the time students are taught using the same approach for the whole class. Students who are linguistically inclined are able to learn from this approach of writing by the teacher. Students who are not linguistically inclined will find the traditional approach to writing dull and they might not be interested to follow the lesson. Knowing individual differences of ESL learners can help ESL teachers select more effective teaching methods. Teachers need to design different activities and tasks to cater to students' needs and interests and the multiple-intelligence approach provides an avenue for this purpose. This study investigates the application of multiple-intelligence strategies to improve the writing ability of students.

LITERATURE REVIEW

The theory of multiple intelligences provides a way of understanding intelligence which teachers can use as a guide to develop classroom activities and to address multiple ways of learning and knowing (Christison, 1999). Teaching strategies informed by multiple-intelligence theory can transfer some control from teachers to learners by giving students choices in the ways they will learn and demonstrate their leaning. By focusing on problem-solving activities that draw on multiple intelligences, these teaching strategies encourage learners to build on existing strengths and knowledge (Kallenbach, 1999).

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Students can extend their learning strategies in response to the demands of instruction, context, and task (Kroonenberg, 1995; Skehan, 1995). Learning can happen more successfully when the teacher makes the processes of learning more transparent through strategy training (1991). Teachers should identify the students' preferred learning styles and multiple intelligences so that they can use their strengths in these areas to learn effectively, in this case to learn about writing and to improve their writing skill. Fuey (1986) demonstrated that ESL teachers should be wise enough to identify, investigate, and respond to differences in the emphasis students place on modes of learning. She points out that students from different educational backgrounds have varying preferences for rote learning, problem solving, creative thinking, and critical evaluation. Teachers should be able to identify different learning styles of their students and exploit the strengths or intelligences of these students to teach writing.

RESEARCH OBJECTIVE

This research aims to determine the effect of a series of multiple- intelligence instruction and strategies on the writing ability of Form 1 students. The effects on the six writing traits: ideas, organization, voice, word choice, sentence fluency and conventions, are discussed. The effect of multiple-intelligence instructions on the writing ability of the low and high achievers is also discussed.

THEORETICAL FRAMEWORK

This research is based on the Theory of Multiple-Intelligence (Gardner, 1983) and Triachic Theory (Sternberg, 1985). The Theory of Multiple Intelligences recognizes that every person has different needs, interests, and abilities. By knowing this one can tap into a student's area of strength so that the student will be able to learn more effectively. According to the Triachic Theory, the training of intellectual performance must be socioculturally relevant to the individual. Training programmes should provide links between training and the real world. Training programmes should also actively encourage individuals to manifest their differences in strategies and styles. It was based on these two theories that the multiple- intelligence strategies and instructions were designed (*Fig. 1*).

RESEARCH DESIGN

This is a quasi experimental research. The design is based on the non-equivalent control group (Campbell and Stanley, 1963). A Paired

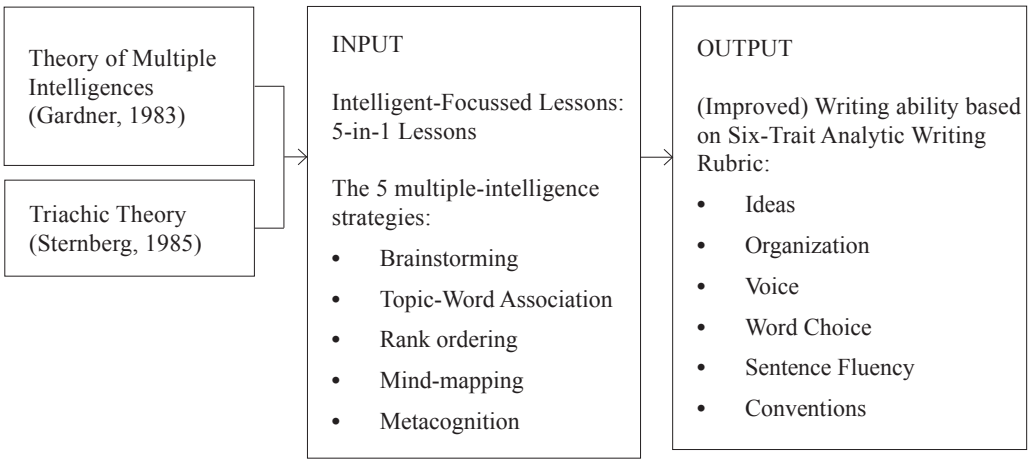


Fig. 1: Multiple-intelligence strategies

Sample T-Test was conducted to make sure the two groups were similar in writing ability before the pretest. This design was chosen because it was the best design for this research as it could control six sources of internal validity namely history, maturation, testing, instrumentation, selection, and mortality. History was controlled as the treatment and control groups ran simultaneously. Because the period of treatment was only two months, the possibility of any event occurring was very slim. Maturation and testing were controlled as they should manifest equally in the experimental and control groups. Maturation was controlled as the participants were from the same age group. Instrumentation was controlled as written tests were used. If the tests were not written and observers and interviewers were used, then there would be bias tendencies. Although intact groups were used the researcher reduced the effect of selection by checking the background of the students in terms of language proficiency, and to make sure that the two groups were almost similar. Mortality was also controlled in this study as the students were attending a government school and it was compulsory for them to attend classes. Careful consideration was taken to make sure that there was not much difference in regression between the control group and the experimental group. Regression was minimized by giving students a few pretests and posttests instead of only one. The average of these tests was taken to reduce the effect of regression.

SUBJECTS

The subjects consisted of 58 Form 1 students in two urban national secondary schools. The experimental group and the control group were similar in characteristics. They have similar family and socio-economic background and were from the same ethnic group.

METHODOLOGY

The Malaysian Adolescent Multiple-Intelligence Test (MAMIT) was administered to the students before the multiple-intelligence training. MAMIT is a profile test designed by a group of Universiti Kebangsaan lecturers to identify the multiple-intelligence profile of students. This test was chosen as it was designed by Malaysians for Malaysians, and it was not culturally biased compared to multiple-intelligence profile tests from other countries. The purpose of using this test was to find out which multiple intelligence(s) the students were inclined towards. This was to enable the students to be put into groups to facilitate the group activity using multiple-intelligence strategies. Students who were good at a certain intelligent were to guide the other students with the multiple-intelligence strategies they were good at. The five multiple-intelligence strategies related to writing were topic-word association, brainstorming, mind-mapping, rank-ordering, and metacognition. The experimental group and the control group were given two compositions: one narrative and the other expository, to determine their writing ability before the training.

The students were given two months of multiple-intelligence instructions. The training consisted of two parts. The first part was the teaching of the five intelligences related to writing (*see* Appendix A). The second part was the teaching of the five multiple-intelligence strategies related to writing: topic-word association, brainstorming, mind-mapping, rank-ordering, and metacognition (*see* Appendices B and C). After the two months, students were given another two tests based on the same genre but different composition questions. The compositions for the posttest were similar to the compositions for the pretest. One month after the posttest a retention test was given to the students. The purpose of the retention test was to check whether the instructions taught were retained by the students after a period of time. The compositions were marked by two experienced teachers who were trained by the researcher on the Six-Trait Analytic Writing Rubric. The Six-Trait Analytic Writing Rubric was chosen as it was quantitative in nature. As this is a quantitative research the test was most appropriate to measure the writing ability

of students after two months of multiple-intelligence training. This rubric has a score of 1 to 6 with 1 the lowest and 6 the highest. The total marks for each composition is 36. The compositions were marked by two trained English Language teachers and were checked for interrater-reliability. The results were then analyzed using Paired Sample T-Test, ANOVA, and MANOVA.

The control group was taught as usual based on the Form I English textbook and syllabus except that they were not taught the multiple-intelligence strategies and instructions related to writing.

To compare the effect of multiple-intelligence instructions between the low achievers and high achievers, the scores for compositions were tabulated and converted to 100 percent. Those with 40 percent and below were categorized as low achievers and those with 41 percent and above were considered high achievers.

FINDINGS AND DISCUSSION

The data were analyzed using Paired Sample T-Test, ANOVA, and MANOVA. Based on the overall results there were significant improvements in the experimental group compared to the control group in writing ability. The writing ability of the experimental group had also improved significantly based on the Six-Trait Analytic Writing Rubric: ideas, organization, voice, word choice, sentence fluency, and conventions. The results of the retention test when compared to the pretest results show significant improvement. When the results were compared to the posttest results there was no significant improvement. The comparison between the pretest and the posttest results is shown in Table 1.

The mean for the experimental group is 2.94 (SD = 3.68). The t score for the experimental group is 4.23. The critical value for $\alpha = 0.1$ is 1.31, $\alpha = 0.05$ is 1.70 and $\alpha = 0.005$ is 2.77. The t score falls within the critical region for all α. This means that the null hypothesis is rejected. The results show that the experimental group has improved significantly after the treatment.

As for the control group the mean is 1.25 (SD = 3.85). The t score is 1.78. The critical values are 1.31 ($\alpha = 0.1$), 1.70 ($\alpha = 0.05$) and 2.76 ($\alpha = 0.005$). Thus, the t score falls within the critical regions for $\alpha = 0.1$ and $\alpha = 0.05$. This indicates that the improvement for total scores in the control group is less significant compared to the experimental group.

To further prove that the experimental group has achieved significant improvement, MANOVA is used to compare the results between the experimental and the control groups after treatment. Table 2 shows the comparison between the results of the experimental group and the control group after two months of training.

As shown in Table 2, the degrees of freedom are 6 and 51. The F value is 6.38 compared to the critical value of 1.90 ($\alpha = 0.1$) and 2.41 ($\alpha = 0.05$). It can be seen here that the experimental group performed better compared to the control group.

TABLE 1
Paired sample T-test showing comparison between posttest and pretest results for total marks

Group	df	Mean	Standard deviation	t score
Experimental	27	2.94	3.68	4.23
Control	29	1.25	3.85	1.78

Note:
EXPERIMENTAL GROUP
Critical value, α 0.1 = 1.31
Critical value, α 0.05 = 1.70
Critical value, α 0.005 = 2.77

CONTROL GROUP
Critical value, α 0.1 = 1.31
Critical value, α 0.05 = 1.70
Critical value, α 0.005 = 2.76

TABLE 2
MANOVA for experimental group and control group after the treatment

Parameter	Value
Lamda	0.57
F value	6.38
Degree of freedom 1	6
Degree of freedom 2	51
Critical value for significant level of 0.1	1.90
Critical value for significant level of 0.05	2.41

The significant improvement for the experimental group is due to the multiple-intelligence training the students went through for two months. This clearly supports the Theory of Multiple Intelligences which recognizes that every person has different needs, interests, and abilities (Gardner, 1983). By knowing this one can tap into students' area of strength so that they are able to learn more effectively. It also supports the Triachic Theory (Sternberg, 1985) which states that instructions must be designed to accommodate different styles and strategies of learning.

This study not only identified the strengths of each student but also made them leaders in their groups based on the intelligence they were good at. As the ability to write encompasses the five intelligences namely verbal-linguistic, visual-spatial, logical-mathematical, interpersonal and intrapersonal, the study made sure that the students were trained to use all these intelligences to improve their writing ability. The result shows that after the multiple-intelligence training, the overall writing ability of students improved significantly. The improvement in writing ability can also be seen based on all the six writing rubrics.

Topic-word association which is related to verbal-linguistic intelligence has shown to increase the writing ability of students in terms of Word Choice. In topic-word association students were asked to write down words associated with the topic. Another strategy, brainstorming has been proven to be effective for generating ideas. Brainstorming is related to verbal-linguistic intelligence and intrapersonal intelligence. For organization, the multiple-intelligence strategy used was rank ordering of ideas. In composition writing, rank-ordering of ideas in a composition is important as good organization will make the composition run smoothly. Rank-ordering is related to logical-mathematical intelligence. For Sentence Fluency, there was a significant improvement. The two multiple-intelligence strategies taught, rank-ordering and metacognition, had definitely improved the writing ability of students in terms of Sentence Fluency. Wrinting convention was not taught directly but through metacognition which was one of the multiple-intelligence strategies. Students were asked to make sure that grammar and punctuation were correct in the metacognition training. It can be seen here that the metacognition strategy was effective in improving writing conventions. One of the strategies taught in visual-spatial intelligence was mind-mapping. Mind-mapping was used to list down ideas for a composition. With mind-mapping, students were able to see the points clearly and their ideas were more organized. Smargoinsky (1985) explained that "non-written" texts are capable of providing the potential for enabling the construction of meaning as written texts.

Table 3 shows the comparison between the experimental group and the control group for the retention test. Lamda is 0.71 and the f value is 3.53. The degree of freedom 1 is 6 and 2 is 51. The critical value for the significance level 0.1 is 1.90 and 0.05 is 2.41. It can be seen that the F value is within the critical region. Thus, the null hypothesis is rejected. In conclusion, there

is significant improvement in the experimental group based on the retention test as compared to the control group.

Based on Table 4, the difference of mean values between the posttest and the pretest for high achievers is 1.66 and –0.73 for the experimental group and control group respectively. The standard deviations are 3.33 and 2.32 respectively. Based on the Paired Sample T-Test the t value for the experimental group is 2.12 as compared to the control group which is –1.26. The critical values for the experimental group are 1.753 ($\alpha = 0.05$), 2.131 ($\alpha = 0.025$), and 2.602 ($\alpha = 0.01$). The critical values for the control group are 1.740 ($\alpha = 0.05$), 2.120 ($\alpha = 0.025$), and 2.567 ($\alpha = 0.01$). For all the critical values, the t value is within the critical region. This means that the null hypothesis is rejected. This indicates that the high achievers in the experimental group have shown great improvement after the treatment as compared to the high achievers in the control group.

The comparison between the experimental group and the control group for low achievers is shown in Table 4. The mean for the experimental group is 3.62 (SD = 3.83) and for the control group is 3.53 (SD = 3.24). The t score for the experimental group is 3.27 and the control group is 3.78. The critical values for the experimental group are 1.833 ($\alpha = 0.05$), 2.821 ($\alpha = 0.01$), and 3.250 ($\alpha = 0.005$). The critical values for the control group are 1.771 ($\alpha = 0.05$), 2.625 ($\alpha = 0.01$), and 3.012 ($\alpha = 0.005$). It can be seen that both groups have improved but the experimental group has improved more.

CONCLUSION

The results show that multiple-intelligence instructions have proven to be successful in improving the writing ability of students. Students should be taught based on their strengths and these strengths can be used to help others to improve their intelligences, thus their writing ability. The results also show that multiple-intelligence instructions and

TABLE 3
Comparison between experimental group and control group for the retention test

Parameter	Value
Lamda	0.71
F value	3.53
Degree of freedom 1	6
Degree of freedom 2	51
Critical value for significant level of 0.1	1.90
Critical value for significant level of 0.05	2.41

TABLE 4
Paired sample t-test showing comparison between experimental group and control group for high achievers

Group	df	Mean	Standard deviation	t score
Experimental	15	1.66	3.33	2.12
Control	17	- 0.73	2.32	- 1.26

Note: EXPERIMENTAL GROUP
Critical value, α 0.05 = 1.753
Critical value, α 0.025 = 2.131
Critical value, α 0.01 = 2.602

CONTROL GROUP
Critical value, α 0.05 = 1.740
Critical value, α 0.025 = 2.120
Critical value, α 0.01 = 2.567

TABLE 5
Paired sample t-test showing comparison between experimental group and control group for low achievers

Group	df	Mean	Standard deviation	t score
Experimental	9	3.62	3.83	3.27
Control	13	3.53	3.24	3.78

Note: EXPERIMENTAL GROUP
Critical value, α 0.05 = 1.833
Critical value, α 0.01 = 2.821
Critical value, α 0.005 = 3.250

CONTROL GROUP
Critical value, α 0.05 = 1.771
Critical value, α 0.01 = 2.65
Critical value, α 0.005 = 3.012

strategies have greater effect on high achievers as compared to low achievers. This may be due to the fact that high achievers could understand the instructions better and have the ability to apply the strategies they have learnt to increase their writing ability.

Students should know their own multiple intelligences. By doing so, they can make use of their strength to improve their writing ability as well as the writing ability of others. Teachers should incorporate multiple-intelligence strategies when teaching writing as the approach not only improves their writing ability but also makes the lesson more interesting and effective.

REFERENCES

Armstrong, T. (2003). *The Multiple Iintelligences of Reading and Writing.* Alexandria, V.A: ASCD.

Ary, D. and Jacobs, L.C (2006). *Introduction to Research in Education*. USA: Thomson Wadsworth.

Bill, T. (1995). Minds of their own: Visualizers compose. *English Journal, 84*(8), 27 – 31.

Campbell, D. T. and Stanley, J.C. (1963). *Experimental and Quasi Experimental Designs for Research*. Stokie IL: Rand Mcnally.

Campbell, L., Campbell, B. and Dickinson, D. (1993). *Teaching and Learning Through Multiple Intelligences.* New York: Plume/Penguin.

Campbell, L. (1997). How teachers interpret MI theory. *Educational Leadership*, *55*(1), 15 – 19.

Christison, M. A. (1996). Teaching and learning through multiple intelligences. *TESOL Journal*, *6*(1), 10 – 14.

Culham, R. (2010). *Traits of Writing*. U.S.A: Scholastic Books.

De Vries, K. (2004). Teaching to their strengths. Multiple intelligences theory in the college writing classroom. Retrieved March 3, 2006 from http://web.mit.edu/kdevries.www/Intro2004.pdf.

Dunn, P. A. (2001). *Talking, Sketching, Moving: Multiple Literacies in the Teaching of Writing.* Portsmouth, NH: Boynton.

Dunn, R. and Dunn, K. (1978). *Teaching Students Through Their Individual Learning Styles*. Englewood Cliffs, NJ: Prentice Hall.

Flower, L. and Hayes, J. R. (1981, December). A cognitive process theory of writing. *College Composition and Communication*, *32*, 365 – 387.

Furey, P. R. (1986). A framework of cross-cultural analysis of teaching methods. In P. Pyrd (Ed.), *Teaching cross cultures in university ESL programme* (pp. 15 -28). Washington D.C: National Association for Students' Affair.

Gardner, H. (1983). *Frames of Mind: The Theory of Multiple Intelligences.* New York: Basic Books.

Gardner, H. (1993). *Multiple Intelligences: The Theory in Practice.* New York: Basic Books.

Gardner, H. (1999). *Intelligence Reframed: Multiple Intelligences for the 21st Century*. New York: Basic Books.

Grisworld, J.D. (2002). *Writing Lessons Using the Multiple Intelligences.* U.S.A: Teacher Created Resources.

Grow, Gerald. (2004). Writing and multiple intelligence. Retrieved January 2, 2006 from http://www. longleaf.net.grow.

Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W.C. (1984). *Multivariate Data Analysis.* U.S. A: Prentice Hall Inc.

Hayes, J. R. (1989). *The Complete Problem Solver* (2nd Ed.). Mahwah, NJ: Erlbaum.

Hecker, L. (1995). Walking, tinkertoys, and Legos: Using movement and manipulatives to help students write. *English Journal*, *84*(8), 46 – 52.

K. Amar Singh and Jasvir Kaur. (2008). The effects of mind mapping strategies on the development of writing skills of selected Form Three students. Unpublished master's thesis, Universiti Putra Malaysia.

Kallenbach, S. (1999). Emerging themes in adult multiple intelligences research. *Focus on Basics, 3A*, 16 -20.

Kementerian Pendidikan Malaysia. (2003). *Huraian Sukatan Pelajaran Kurikulum Bersepadu Sekolah Menengah, Tingkatan 1*. Kuala Lumpur: KPM.

Khairi Izwan Abdullah, Wee, D. and Tee, H. B. (2002). *English Form 1.* Kuala Lumpur: Pustaka Alhas (M) Sdn. Bhd.

Klein, K. and Linda, H. (1994). The write moves: Cultivating kinesthetic and spatial intelligences in the writing process. *Presence of mind: Writing and the domain beyond the cognitive.* Portsmouth, NH: Boynton.

Kraemer, H.C. and Thiemann, S. (1987). *How Many Subjects? Statistical Power Analysis in Research.* Newberry Park, CA: Sage.

Kroonenberg, N. (1994/1995). Developing communication and thinking skills via electronic mail. *TESOL Journal*, *4*(2) 24-27.

Lazear, D. (2000). *The Intelligent Curriculum: Using Multiple Intelligences to Develop Your Own Potentials.* U.S.A: Zepyhr Press.

Lazear, D. (2000). *Pathways of Learning: Teaching Students and Parents about Multiple Intelligences*. Kuala Lumpur: Masterpiece Publication Sdn. Bhd.

Lenig, S. (1992). Using drama to teach composition. *TETYC*, *19*(4), 305 – 12.

Reid, J. M. (1993). *Teaching ESL Writing.* U.S.A: Prentice Hall Regents.

Reid, J. M. (1998). *Understanding Learning Styles in the Second Language Classroom.* U. S. A: Prentice Hall Regents.

Rao, Z. (2007). Training in brainstorming and developing writing skills. *English Language Teaching Journal*, *61*(2).

Silver, H., Strong, R. and Perini, M. (1977). Integrating learning styles and multiple intelligences. *Educational Leadership*, *55*(1), 22 – 27.

Siti Rahayah Ariffin, Noriah Ishak et al. (2004). *Manual Instrument: Malaysian Adolescence Multiple Intelligences Test (MAMIT)*. Bangi: UKM.

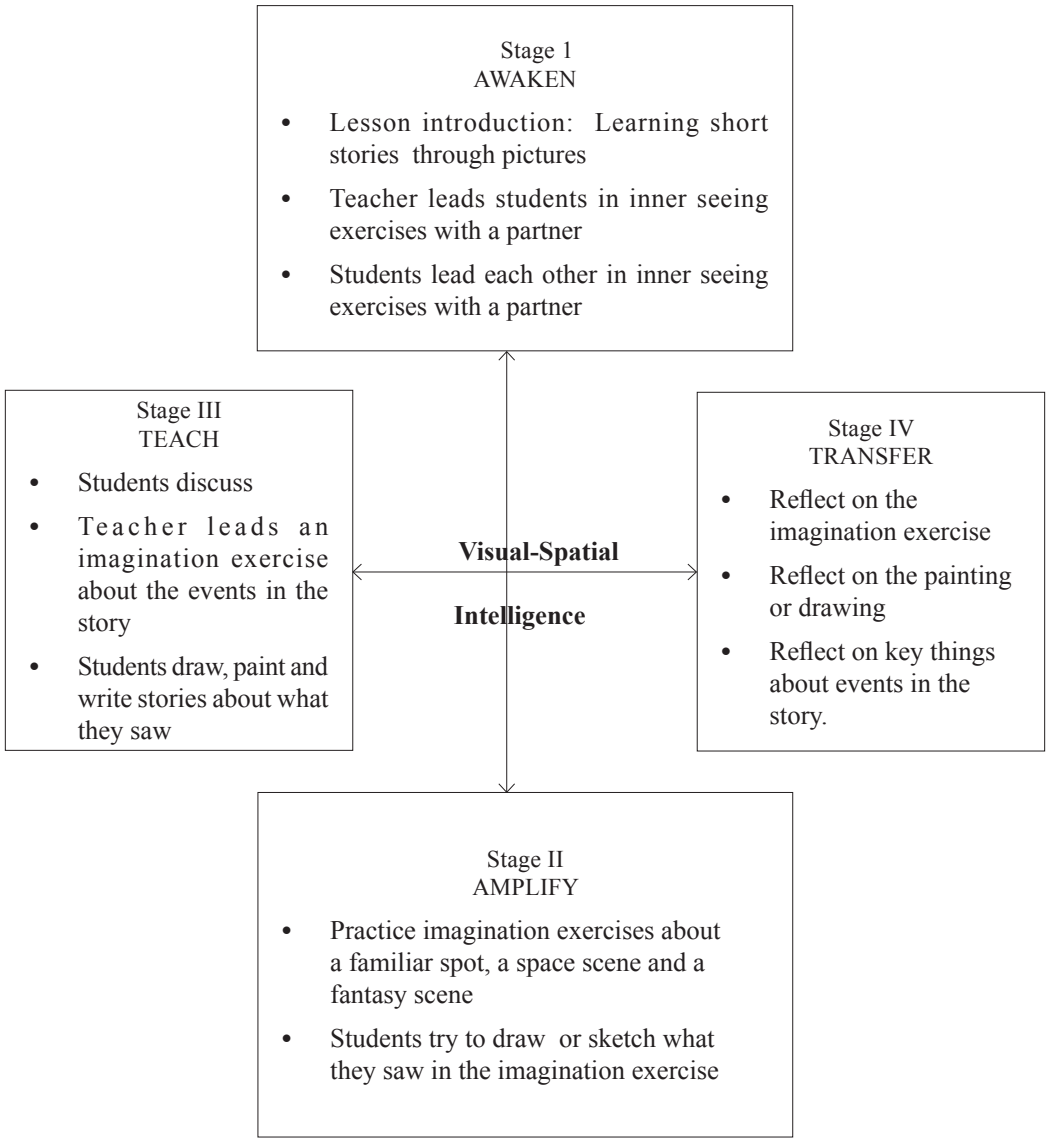
Smagorinsky, P. (1995). Multiple intelligences in the English class: An overview. *English Journal*, *84*(8), 19 – 26.

Sternberg, R. (1994). *Beyond I.Q.: A Triachic Theory of Human Intelligence.* New York: Cambridge University Press.

Teaching expository writing using multiple intelligences theory. Retrieved March 3, 2006 from http://www.academon.com/lib/paper/ 4518. html.

APPENDIX A

Sample of Multiple-Intelligence Instructions (Part 1)



APPENDIX B

Sample Multiple-Intelligence Instructions (Part II)

Class: Form 1B
Time: 2.20 – 3.30 pm
Theme: Social Issues
Topic: Safe Homes

Objective: Students should be able to write a talk about 'Safety at Home.'

Materials: Display paper, marker pens

How the lesson is carried out:

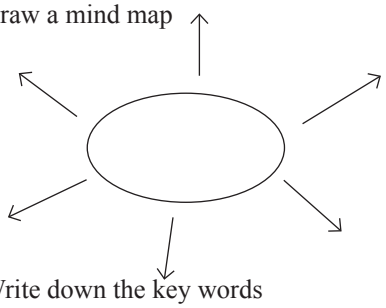
1. Set induction : Students look at the pictures and say what is right and what is wrong in each picture. (visual-spatial)
2. Students read and talk on safety tips for children. (verbal-linguistic)
3. Students match the paragraphs with the main idea given. (logical-mathematical)
4. Students are asked to write a talk about safety at home. Students can choose the following topics:
   - Safety in the kitchen
   - Safety in the bathroom
   - Safety against strangers
   - Getting help in case of emergencies
5. Students use the following strategies to help them in their writing:
   - Topic-word association (verbal-linguistic)
   - Brainstorming (interpersonal)
   - Mind-mapping (visual-spatial)
   - Rank-ordering (logical-mathematical)
   - Metacognition (intrapersonal0
6. Students are asked to write a talk with an *introduction, content* and *conclusion.*
7. Students are asked to think of words related to the topic and write in the box at the corner of the display sheet. (verbal-linguistic)
8. Students study the topic and in groups brainstorm the points. (interpersonal)
9. Students discuss and rank-order the points. (logical-mathematical)
10. Students then mind-map the points on the display sheet. (visual-spatial)
11. Students ask themselves questions related to the topic before they write out the composition. (intrapersonal)
12. Conclusion: Students present their discussion to the class. (verbal-linguistic)

APPENDIX C

The 5 Multiple-Intelligence Strategies for Writing

1. Brainstorming (Interpersonal Intelligence)
   - ♠ Discussion
   - ♠ Get ideas
   - ♠ Do not bother which is right or wrong
   - ♠ Just write down!

2. Mind-Mapping (Visual-Spatial Intelligence)
   - ♠ Draw a mind map



   - ♠ Write down the key words
   - ♠ Key words are points related to the topic
   - ♠ Use your imagination!

3. Rank-Ordering (Logical-Mathematical Intelligence)
   - ♠ Arrange the points logically
   - ♠ Use Paragraphs
   - ♠ Use Linkers

4. Topic-Word Association (Verbal-Linguistic Intelligence)
   - ♠ Write words which are related to topic
   - ♠ Word Association

5. Metacognition (Intrapersonal Intelligence)
   - ♠ Think about what you are writing:
     - Did I answer the question?
     - Are the points relevant/enough?
     - How do I improve on it?
     - Do people understand what I wrote?

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Infusion of Thinking Skills in English Language Instructional Development at Tertiary Level

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ABSTRACT

The inclusion of thinking skills in a subject is considered necessary to ensure that students develop their thinking and possess greater control of their learning. To determine if the infusion of thinking skills is present in a subject, an evaluation of the subject from the planning to the assessment stage needs to be carried out. This study aims to evaluate the level of emphasis in the infusion of thinking skills in English language instruction in a Diploma Science program in a higher institution in Malaysia. A comprehensive study was carried out on the major stages of the instructional development based on Chen's Taxonomy of Program Evaluation (2005). Specific data from documents was collected and analyzed, after the data was categorized according to the level of thinking skills listed in the Cognitive-Affective Taxonomy (Ghazali Mustapha, 1998) and the Mental Operation Questions (Moore, 1995). The three stages of the instructional development were then tied up to determine if they complement each other in the infusion of thinking skills. The quality of instruction provided will contribute to the success of the whole program, enabling students to possess equal opportunity to explore knowledge in depth and allowing them to apply it more effectively in the real world.

Keywords: Assessment, English, evaluation, instruction, implementation, planning, tertiary, thinking

INTRODUCTION

There are still many issues to be discussed in relation to the teaching of thinking skills, especially in higher education. Many higher institutions of learning are still bound to the elements of tradition in setting a program (Darn, 2006), resulting in the practice of conventional teaching and learning. Presently, many higher institutions have a scenario where lectures and rote-memorizations are very much a part of the teaching and learning process (Paul, 2005; Paul et al., 1997; Darn, 2006). The system is still not open to new ideas, values and thoughts, and curriculum development is influenced by the subject matter, making it content-based (Sowell, 2000). As a result, there is a lack of emphasis in thinking skills across the curriculum. In many cases, failure in infusing thinking skills in the subjects produces knowledge-based syllabus (Sandel, 2002; Noor Zainab, 2003).

Curriculum content affects teachers' approach to teaching (Sandel, 2002) and since there are limitations, teachers are forced to work within the boundaries set in the curriculum and exam requirement (Darn, 2006). Many teachers see themselves as responsible only for transmitting knowledge according to the required curriculum to students (Jayakaran, 2003; Noor

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Zainab, 2003). There is a minimum need for teachers to guide students through the teaching of thinking skills. Recent studies (Zohar, 1999; Rajendran, 2001; Ghazali Mustapha, 2000, 2006; Anna Christina Abdullah et al., 2003) have shown that there is still lack of practice by teachers in posing higher order questions to students, and this resulted in limiting students from thinking creatively and critically. Teachers were observed to elicit questions which are at the lower-order level of thinking skills (Barrickman, 1997; Rajendran, 2001; Ghazali Mustapha, 2000; Rosma Osman et al., 2004). As a result, students are deprived from having teachers as facilitators to guide them in thinking and build meaning of their own from what they have learnt (Chan and Wong, 2004).

Besides that, an individual with good thinking skills will also be able to manage the knowledge that he receives (Anna Christina Abdullah et al., 2003). With thinking skills, the young generation will be able to face the realities of life and today's world issues (Beyer, 1988), and be better equipped when they enter the workforce (Hinterer, 2002). Therefore the teaching process in the classrooms should provide students with some space in using thinking skills, thus allowing students to think freely and creatively on how to deal with daily problems.

The main purpose of this study, then, is to carry out an evaluation on an English language subject in the Diploma Science programme at the tertiary level with the following objectives:

i. To determine the presence of thinking skills in an English language subject.

ii. To identify the level of thinking skills emphasized in the subject.

iii. To determine if the planning, implementation and assessment levels complement each other in relation to the infusion of higher order thinking skills.

This study will give new insights and emphasis in relation to the evaluation of the teaching of thinking skills among ESL learners. The results of this study also furnish additional knowledge on the improvement that can be made in the planning, implementation and evaluation stage of a programme. This complete process of evaluation in the study will then provide as a framework that can be used as a basis for other programme evaluations.

METHODOLOGY

The subject evaluated is called BEL 120, an English language subject taught to the first semester students of the Diploma Science programme in a Malaysian university. The sampling is taken from a Science-based programme since thinking and problem-solving skills are supposed to be developed and become part of the objectives of instruction. (Zohar and Tamir, 1993; Kuhn, 1993). The evaluation is carried out at three stages of the instructional development adapted from Chen's Taxonomy of Programme Evaluation (2005), namely the planning stage, the implementation stage and the assessment level of the instructional process. At the planning stage, the evaluation is carried out on the curriculum and the teaching materials for the subject. The evaluation at the implementation stage involves classroom audio recording and an interview with the teacher. At the assessment level, the evaluation includes analyzing exam question papers for the subject.

The research is basically qualitative, with some quantitative data. Data collection is carried out through the analysis of documents listed in Table 1.

The analysis on the documents is carried out through content analysis, and the level of thinking skills is measured using the categorization listed in the COGAFF Taxonomy (Ghazali Mustapha, 1998). In addition, another tool of measurement, the Mental Operation Questions (Moore, 1995), is also used to determine the level of thinking skills in the questions and tasks found in the documents, with the exception on the syllabus, course content, and the scheme of work.

COGAFF Taxonomy was one of the major contributions of Ghazali Mustapha's Ph.D Study done in Leicester University, UK. His study was related to Thinking Skills infusion by teachers

TABLE 1
Analysis of documents

Instructional development		Documents involved
Planning level	Curriculum	Syllabus, course content, scheme of work
	Teaching materials	Textbook & Workbook
Implementation level	Classroom audio recording	Tape scripts
	Interview	Tape scripts
Assessment level	Final exam questions	Written exam papers

in handling Reading Comprehension. His work has been made available on the Eletronic Thesis On-line Services (EthOS) in the British Library (http://ethos.bl.uk). The taxonomy is formulated from a combination of Bloom's Cognitive Taxonomy (Bloom, 1956) and Krathwohl's Affective Taxonomy (Krathwohl, 1956). The word "COGAFF" itself derives from the words "cognitive" and "affective." The taxonomy is used as a tool to measure the cognitive and affective level in the question types and tasks posed in the learning situations. COGAFF Taxonomy consists of seven categories of questions, starting from the highest level of thinking skills, the affective skills, moving down to evaluation, synthesis, analysis, and application, and the lower order thinking skills, comprehension and knowledge. The Mental Operation Questions (Moore, 1995) is a system for classifying questions, which is developed based on Guildford's Structure of the Intellect model (1956) and Bloom's Taxonomy (1956). Here, four categories of questions are developed: factual, empirical, productive, and evaluative. For analysis purposes in this study, a checklist for each category is given in Appendix 1.

RESULTS AND DISCUSSION

The results of the analysis for this study are tabled according to the three stages of the instructional process, starting with planning, implementation, and finally the assessment level.

The Planning Level

At this level, the evaluation is divided into two parts: analysis of the curriculum and the analysis of the teaching materials.

Analysis of the Curriculum

For the curriculum, the syllabus, course content and the scheme of work are analyzed, guided by the categorization listed in the COGAFF Taxonomy. The study on these documents will move towards looking for keywords that indicate the use of thinking skills according to the items listed in the COGAFF Taxonomy (Ghazali Mustapha, 1998). From the analysis of data, it is observed that both lower and higher order thinking skills are given equal amount of priority in the teaching objectives. Table 2 shows that 50% of the elements of higher order thinking skills are present in the teaching objectives, whereas the other 50% lies in the lower order thinking skills. The higher order thinking levels that are present in the teaching objectives are identified as the synthesis level, which is utilized to write well-organized paragraphs and essays, and application level that is used to write grammatically correct sentences. For the lower thinking skills, the emphasis is given mostly to the comprehension level, since some of the objectives of the course are to comprehend passages, and listen to and understand a variety of texts.

Even though the teaching objectives of BEL 120 aims to promote both lower and

higher order thinking skills, it is observed that the course content and the scheme of work have more elements related to the lower order thinking skills, compare to those related to the higher order thinking skills. According to the descriptor in Table 2, 52% of the items in the course content and the scheme of work cater to the lower order thinking skills. The lower-order thinking skills involve students to gain accuracy in using grammar in the language, thus, require students to acquire knowledge and recall information that they receive. If the grammar that is taught is aimed to provide students the opportunity to explore the text in a more meaningful way, the course content and the scheme of work would promote the elements of higher order thinking skills. In addition, there are also some elements that develop students' knowledge and comprehension level as the course content includes identifying topic sentences, outlining, and presenting main ideas. These elements of lower-order thinking skills could be transferred into higher order thinking skills if the activities involved making inferences and drawing conclusion, as shown in the 48% of the items (Table 2) in the course content and the scheme of work that are catered to the higher order thinking skills. Besides those activities mentioned earlier, skills involving mostly the analysis and synthesis levels can also be found in activities such as brainstorming and the writing of thesis statements, topic sentences, and the whole essay. The scheme of work for this subject has also included evaluation skills, as students are required to express agreement and disagreement, use reasoning powers and justify opinions in the teaching of speaking skills.

In summary, the analysis on BEL 120 curriculum shows evidence of both lower and higher order thinking skills in relation to the teaching of thinking skills. However, the inclusion of higher order thinking skills is limited to mainly analysis and synthesis levels, with a touch of the evaluation level. The highest level of the higher order thinking skills found in the COGAFF Taxonomy, the affective level, is still unavailable in the curriculum for this subject. Considering that the syllabus is the main frame in the planning of a programme, it is important that the higher order thinking skills from the level of analysis to affective being included and highlighted into the syllabus at the tertiary level.

TABLE 2
Analysis of the BEL 120 syllabus at the planning stage

Level	Taxonomy	Frequency of descriptors						Total of frequency	Frequency of higher and lower order thinking skills
		Teaching objective		Course content		Scheme of work			
7	Affective	0	50%	0	48%	0	48%	0	35 (48%)
6	Evaluation	0		0		2		2	
5	Synthesis	1		6		7		14	
4	Analysis	0		2		5		7	
3	Application	3		3		6		12	
2	Comprehension	3	50%	7	52%	6	52%	16	38 (52%)
1	Knowledge	1		5		16		22	

The fact that evaluation placed highest in the cognitive domain is not necessarily highest in thinking or problem solving. Bloom et al. (1956) suggest that evaluation may lead to the affective domain, which is one reason why it is placed last as the highest level in the higher-order category of the COGAFF taxonomy. Other reasons for placing the affective domain last in the taxonomy may include;

i. Feelings and attitudes (affective aspects) are elements of emotional climates often come into play once a cognitive assessment (involving analysis, synthesis, or evaluative) is engaged. For example, a student might only be able to express his/her feelings and/or attitudes over an issue once he/she has made a cognitive assessment of the issue (Edwards and Mercer, 1987). However, sometimes the reverse process happens.

ii. Effective teaching includes recognizing that all students bring their feelings, as well as their minds and bodies, into the classroom. Understanding how to engage and capitalize on this internal state of needs, preferences, anxieties, curiosity, and excitement will be the dynamic which transforms the classroom into a place where learning is recognized by the students as something to be valued for itself rather than as a means to someone else's evaluation (Morgan and Saxton, 1991).

Barrett's (1972) Taxonomy of *Cognitive and Affective Dimensions* categorized comprehension skills into five major levels: Literal comprehension (1.0), Reorganization (2.0), Inferential Comprehension (3.0), Evaluation (4.0), and Appreciation (affective) (5.0). The tasks in each category have been structured from easy to difficult. Barrett (1972), according to Clymer (1968), utilized the work of Bloom, Sanders, and Guszak in designing the taxonomy, and explicitly categorized the affective domain (which he refers to as appreciation) as the last category in his taxonomy. This further supports placing the affective domain as the highest category (7.0) in the COGAFF taxonomy.

With the inclusion of all seven levels of thinking skills in the syllabus, only then, the infusion of thinking skills in the instructional development becomes successful at the implementation and assessment levels.

Analysis of the Teaching Materials

For the teaching materials of BEL 120, the overall analysis that is carried out using the categorization listed in the COGAFF Taxonomy and Mental Operation Questions shows that lower order thinking skills are more frequently utilized than the higher order thinking skills in the questions and tasks found in the modules. From Table 3, it is found that the integration of lower order thinking skills is at 42% and the higher order thinking skills is at 58% in the questions and tasks. The highest frequency of lower order thinking skills are found mainly in the reading (81%) and listening (85%) sections (Table 3). Similar frequency is found in the categorization done by Mental Operation Questions (Table 4).

In these two language skills, the lower order thinking skills are especially found at the comprehension level. For example, the reading comprehension questions are mostly limited to questions at the knowledge and comprehension levels, such as true-false questions and comprehension questions (Appendix 2, Sample A, No 3 & 4). The listening section also offers questions and tasks that are lower order in nature. For example (Appendix 2, Sample B, No 2 & 3), students are asked to listen and match the people and make a note of where and when each of the people met, and what they said to each other. These types of questions can be converted into higher order form if they include predictions, such as asking who the people might be and what they might be saying to each other.

Even though the overall analysis on the teaching materials of BEL 120 have shown that more emphasis is given to the lower order thinking skills in the design of questions and tasks, the writing and speaking sections do consist of questions and tasks that are mostly higher order in nature. Table 3 shows that the

TABLE 3
Analysis of the questionings/tasks in the teaching materials at the planning stage for BEL 120 (COGAFF Taxonomy)

Level / Taxonomy	Frequency of descriptors											
	Questionings/Tasks										Total	
	G		R		W		L		S			
7 Affective	0	59 (50%)	0	22 (19%)	0	22 (76%)	0	7 (15%)	3	49 (67%)	3	159 (42%)
6 Evaluation	0		1		1		0		6		8	
5 Synthesis	1		0		9		0		9		19	
4 Analysis	3		13		6		4		21		47	
3 Application	55		8		6		3		10		82	
2 Comprehension	22	60 (50%)	55	93 (81%)	4	7 (24%)	34	39 (85%)	7	24 (33%)	122	223 (58%)
1 Knowledge	38		38		3		5		17		101	

TABLE 4
Analysis of the questionings/tasks in the teaching materials at the planning stage for BEL 120 (Mental Operation Questions)

Taxonomy	Frequency of descriptors											
	Questionings/Tasks										Total	
	Grammar		Reading		Writing		Listening		Speaking			
Factual	49	49 (49%)	89	89 (75%)	10	10 (29%)	35	35 (85%)	16	16 (27%)	199	199 (56%)
Empirical	51		27		13		6		30		127	
Productive	1	52 (51%)	1	30 (25%)	11	25 (71%)	0	6 (15%)	10	43 (73%)	23	156 (44%)
Evaluative	0		2		1		0		3		6	

frequency of higher order thinking skills in the writing section is at 76% and in the speaking section is at 67%. Similar results can be seen in Table 4, in which the frequency of higher order thinking skills in the writing section is at 71% and in the speaking section is at 73%. Both sections provide students opportunity to utilize their thinking skills at the higher order thinking skills mainly at the application, analysis, and synthesis level.

In relation to thinking skills, the teaching material for BEL 120 does not show consistency in the inclusion of all stages of thinking skills, especially in the higher order. The teaching materials need to be specially designed to ensure that all domains of thinking skills are equally covered, and at the same time, complement fully with the required curriculum.

The Implementation Stage

A study on the implementation level is carried out to determine the level of thinking skills that is infused in the classroom of BEL 120. It covers classroom audio recording and an interview with the subject teacher.

Classroom Audio Recording

The classroom audio recording consists of recorded data taken in the classroom, as well as transcribed and analyzed. There are six classroom scenes recorded during one semester of the programme. Three recordings are selected for the purpose of this analysis. Each class is conducted for approximately two hours.

The actual teaching that takes place in the classrooms has shown that questions are posed to the students continuously throughout the session. However, based on the descriptors on COGAFF Taxonomy (Table 5), most of the questions and tasks posed at the lower order thinking level amount to 59%, whereas those of higher order thinking level amount to 41%. The descriptors on Mental Operation Questions (Table 6) also portrays a similar result, in which lower order thinking questions and tasks are found at 51%, and higher order thinking questions and tasks at 49%.

The lower order thinking skills involved in the questions posed to students are mostly at the knowledge level. For example, when the teacher explains about how to write an essay, students are asked the following questions to test their knowledge on the topic of the essay.

Why is reading important?
Do you think that reading is important?
(Appendix 3, Excerpt 1)

The higher order thinking questions posed to the students is at the analysis level. In relation to a topic on reading for essay writing, the teacher posed the following questions.

Can you give me the supporting detail for why reading is important for students?
If I say reading is important for students, what is the big question that you have in your mind?
(Appendix 3, Excerpt 1)

Questions at the analysis level can also be found in the questioning related to grammar which deals with error analysis. Even though there are questions posed at the analysis level, there is no evidence of other types of higher order thinking questions such as evaluation and the affective levels.

Besides posing questions to the students, the teacher has also given out tasks for the students to handle inside and outside the classroom.

TABLE 5
Analysis of the classroom scenes at the implementation stage for BEL 120 (COGAFF Taxonomy)

Level	Taxonomy	Frequency of descriptors	Frequency of higher and lower order thinking skills
		Question type / Task	
7	Affective	0	29 (41%)
6	Evaluation	0	
5	Synthesis	7	
4	Analysis	10	
3	Application	12	
2	Comprehension	15	41 (59%)
1	Knowledge	26	

TABLE 6
Analysis of the classroom scenes at the implementation stage for BEL 120 (Mental Operation Questions)

Categories of questions		Total number of questions and tasks	Total number and percentage of lower and higher order thinking skills
Mental Operation Questions	Bloom's Taxonomy		
Factual	Knowledge & comprehension	36	36 (51%)
Empirical	Application & analysis	27	34 (49%)
Productive	Synthesis	7	
Evaluative	Evaluation	0	

Most of the tasks given to the students in the classrooms are at the lower order level of the thinking skills. The tasks seem to be aimed to facilitate students in comprehending what is taught and applying the knowledge given to them. One example is a group task (Appendix 3, Excerpt 2) in which students are given sample essays written by their seniors for them to read, and then, they are required to produce an essay based on one of the topics taken from the samples. The fact that the students have already been exposed to the samples before they begin writing limits their creativity when writing their own essays. However, some level of creativity is still needed as the students are required to produce an essay titled "My favorite person" (Appendix 3, Excerpt 2). Besides creativity, students are also required to utilize their thinking skills at the application level, since they have to produce the essay based on the knowledge gained from the teacher and the sample essays. This task also requires the students to exchange the essays upon completion for peer marking. As they are required to identify mistakes on the exchanged essays, thinking skills at the analysis level is needed here for them to identify the problems.

In conclusion, there are lower order thinking involved in the question types and tasks given to students. This is clearly shown in Tables 5 and 6, in which the lower order thinking skills involved are mainly at the knowledge and application level, while the higher order thinking skills involved are only at the analysis and synthesis level. The other higher order thinking domains, namely the evaluation and the affective domains, are non-existent in the classroom scene of BEL 120.

Teachers should be made aware that it is important to elicit higher order questions and tasks in the classrooms. To create this awareness, the infusion of thinking skills should be fully carried out at the planning stage of this programme in order to provide the necessary guidelines for the teachers to carry out at the implementation stage.

Interview

The interview was conducted on a lecturer who is teaching Basic English Language class (BEL 120). When asked whether she is aware of the teaching of the thinking skills, the interviewee revealed her knowledge of thinking skills. Even though she is aware of the different theories of thinking skills, she is most familiar with the Bloom's Taxonomy, and she feels that it serves as the best guideline for Malaysian students. She believes that thinking skills should be taught according to the level and ability of the students. She claims that when she teaches BEL 120, the thinking skills involved are very basic, but then, the analysis using the COGAFF Taxonomy and the Mental Operation Questions reveals that the

students are more exposed to the higher-order thinking skills than the lower order thinking skills in her classrooms.

According to the frequency descriptors that are shown in Table 7, the higher order thinking skills that are found in the questions and tasks mentioned by the interviewee are calculated at 65% according to the analysis by COGAFF Taxonomy and 61% by the Mental Operation Questions.

The numbers in Tables 8 and 9 also demonstrate that most of the higher order thinking questions and tasks come under the application and analysis levels of the COGAFF Taxonomy or the Empirical category of the Mental Operation Questions. Some examples of these kinds of questions and tasks are listing out verbs relating to Night Market, developing sentences from the verbs that are listed, and then adding in link words to the sentences to form a paragraph (Appendix 4, Excerpt 1).Very few questions and tasks fall under the other levels of the higher order thinking skills. The affective skill, which is the highest level of thinking skills in the COGAFF Taxonomy, is totally neglected. The interviewee avoids getting students to be involved with their emotions, because she feels it would be insensitive to those who have experienced some tragedy in their lives. Therefore, for example in writing, she deals with topics that are related with "hand phone, about holidays, about my room that would be the normal topic for them" (Appendix 4, Excerpt 2). Besides the writing skills, higher order thinking skills are also introduced to the students in speaking. One example comes under the synthesis level of COGAFF Taxonomy or productive category of the Mental Operation Questions:

> *I will ask them, "is your…for example…next week is your…your mum's birthday. You are all siblings. Now, you sit down and discuss what's the best…what is the best gift for you to buy for your mum," and then you give them a few choices, for example, a handbag, a voucher, and then they will discuss. It is something, which is very much related to them.*
> *(Appendix 4, Excerpt 3)*

Even though most questions and tasks fall under the higher order thinking skills, it is also mentioned by the interviewee that students are allowed to memorize language expressions that are used in certain situations in speaking, and recall information on grammar in the classroom learning. Therefore, the process of lower order thinking skills such as memorizing and recalling are also encouraged by the interviewee in her classroom instruction.

From the interview, it is found that the interviewee feels that she needs short courses to refresh her memory on the topic of teaching thinking skills. Thus, in creating more awareness in thinking skills, teachers should be given extra training in order to enhance their ability in the actual practice of teaching thinking skills in the classroom. Considering that thinking skills is included in the syllabus, it becomes the responsibility of the administrators in the educational institutions to provide teachers with the knowledge and skills that they need in implementing the teaching of thinking skills more effectively.

TABLE 7
Comparison of the levels of thinking skills utilized in the questions and tasks by interviewee 2

Level of thinking skills	COGAFF Taxonomy	Mental Operation Questions
Higher order thinking skills	65%	61%
Lower order thinking skills	35%	39%

TABLE 8
Levels of thinking skills utilized in the questions and tasks by interviewee (COGAFF Taxonomy)

Categories of questions COGAFF Taxonomy	Total number of questions and tasks	Total number and percentage of lower and higher order thinking skills
Affective	1	15 (65%)
Evaluative	1	
Synthesis	2	
Analysis	4	
Application	7	
Comprehension	0	8 (35%)
Knowledge	8	

TABLE 9
Levels of thinking skills utilized in the questions and tasks by interviewee (Mental Operation Questions)

Categories of questions		Total number of questions and tasks	Total number and percentage of lower and higher order thinking skills
Mental Operation Questions	Bloom's Taxonomy		
Factual	Knowledge & comprehension	9	9 (39%)
Empirical	Application & analysis	10	14 (61%)
Productive	Synthesis	2	
Evaluative	Evaluation	2	

The Assessment Stage

The evaluation at this level is carried out to determine the degree of thinking skills infused in the questions posed in the assessment for students in BEL 120. The questions are selected from three sets of the written final exam papers. Here, the questions are divided into three sections. Section A involves the testing of grammar, Section B is on reading and finally, Section C deals with writing. The written paper carries 60 marks in which 20 marks is awarded to each section.

In the three sets of the question papers, the analysis on Section A (Tables 10 & 11) reveals that the questions included are of both lower order (50%) and higher order thinking level (50%). The section tests mainly on the parts of speech and tenses, and consists of three sets of questions. All the questions allow students to utilize their thinking skills only at the knowledge and application level as the questions (Appendix 2, Sample C & D) requires students to underline the correct word out of three choices given in the bracket; and to "write the correct form of the verbs given in the brackets." These questions could be upgraded into higher order thinking levels by formulating them into cloze questions.

Compared to Section A of the BEL 120 paper, which gives equal emphasis to both lower and higher order thinking skills, Section B (Reading Comprehension) is found to have put more emphasis on the lower order thinking skills.

The frequency of descriptors in Table 9 and 10 reveals that the lower order thinking skills that are found in the questions are calculated at 79% according to the analysis by COGAFF Taxonomy and 100% by the Mental Operation Questions. The questions consist of true-false items and open-ended questions based on a given passage; and vocabulary testing consists of questions such as providing answers to words and phrases refer to in the passage (Appendix 5, Sample A) and finding the meaning of certain words through multiple choice questions (Appendix 5, Sample B). The types of questions included in this section does not challenge the students into using any of the higher order thinking skills except to test their comprehension level, which falls under the factual category of the Mental Operation Questions. Instead, students should be allowed to infer from the passage, or write a sentence using the words selected from the passage, in order to encourage the utilization of higher order thinking skills.

TABLE 10
Frequency of descriptors in the evaluation of the assessment stage for BEL 120 according to sections (COGAFF Taxonomy)

Level / Taxonomy		Section A (Grammar)				Section B (Reading)				Section C (Writing)				Total average of frequency
		Apr 07	Oct 06	Apr 06		Apr 07	Oct 06	Apr 06		Apr 07	Oct 06	Apr 06		
7	Affective	0	0	0	50%	0	0	0	21%	0	0	0		45%
6	Evaluation	0	0	0		0	0	0		0	0	0	63%	
5	Synthesis	0	0	0		0	0	0		1	1	1		
4	Analysis	0	0	0		0	0	0		0	0	0		
3	Application	3	3	3		2	1	1		1	0	1		
2	Comprehension	0	0	0	50%	5	4	5	79%	0	1	0	37%	55%
1	Knowledge	3	3	3		1	0	0		0	1	1		

TABLE 11
Frequency of descriptors in the evaluation of the assessment stage for BEL 120 according to sections (Mental Operation Questions)

Level / Categories of questions		Section A (Grammar)				Section B (Reading)				Section C (Writing)				Total average of frequency
		Apr 07	Oct 06	Apr 06		Apr 07	Oct 06	Apr 06		Apr 07	Oct 06	Apr 06		
1	Factual	3	3	3	50%	8	9	9	100%	1	1	1	33%	61%
2	Empirical	3	3	3	50%	0	0	0	0%	1	1	1	67%	39%
3	Productive	0	0	0		0	0	0		1	1	1		
4	Evaluation	0	0	0		0	0	0		0	0	0		

On the other hand, the writing part that falls under Section C includes both lower and higher order thinking skills. However, according to Table 10 and 11 that portrays the analysis by COGAFF Taxonomy and the Mental Operation Questions, about one-third of the questions analyzed fall under the lower order thinking skills, whereas the other two thirds fall under the higher order thinking skills. In this section, there is only one question that requires students to write an essay based on the situation given and points provided (Appendix 5, Sample C). Even though the students are given the main points to the situation to assist them in their writing, they are able to utilize their thinking at the synthesis level, which ask students to be creative by putting a number of ideas or objects together in a way that is unique and new to them (COGAFF Taxonomy, 1998). In addition, the students also needs to utilize their thinking at the knowledge and comprehension level in order to understand the information and expand the points given to them, as well as include new ideas when necessary.

Overall, greater priority has to be given to the inclusion of higher order thinking level in the formulation of questions at the assessment level. Of course, the move to do so can only be carried out if the infusion of thinking skills at all levels becomes a reality at the planning and implementation stages of the instructional development. The changes will help students to move away from the learning culture of memorizing exam techniques in schools to a thinking society that can help them to become more independent and better equipped in facing future challenges.

CONCLUSION

The evaluation of the English language subject at the tertiary level has shown that elements of thinking skills are visible, and the presence of thinking skills is evident in the English language instruction at the tertiary level. However, more emphasis is given to the teaching of lower order thinking skills than higher order. This is evident in *Fig. 1*, which shows that even though elements of higher order thinking skills are visible, emphasis is given more to the inclusion of lower order thinking skills in all the areas of the instructional development stages, except in the interview. Here, it is revealed that the teachers' question types and tasks in their teaching consist of more elements of the higher order thinking skills, and yet, the analysis carried out in the classroom reveals that these elements are not found to be dominant in the actual teaching. This evident show that even though it is claimed in the interview that thinking skills is utilized at a higher level, it is not demonstrated in actual teaching practice in the classroom.

Another inconsistency found in the evaluation of the teaching of thinking skills in BEL 120 is between the curriculum and other areas of the instructional development stages. The curriculum is considered as a plan for teaching and learning (Wiles and Bond, 1998), and it provides a guideline to the kinds of implementation carried out in the programme (Chen, 2004). However, the frequency of higher order thinking skills found in the curriculum is not at par with the frequency found in the teaching materials, classroom scenarios, interviews, and the exam question papers. There seems to be a loss of translation from the syllabus to the actual teaching, and teachers may not be solely be influenced by the syllabus when they teach.

The analysis on the curriculum also reveals that the levels of higher order thinking skills that are included in the teaching are mainly at the application, analysis and synthesis levels, with a touch of evaluation and none of the affective level. These two highest levels of higher order thinking skills are not given enough attention across the instructional development, and therefore deprive students from utilizing their thinking skills to the maximum.

In Malaysia, the education system is designed to complement with the National Education Blueprint (2006-2010), and therefore thinking skills can be considered as one of the important elements to be included in the instructional development as part of fulfilling its vision in preparing individuals to have first-class

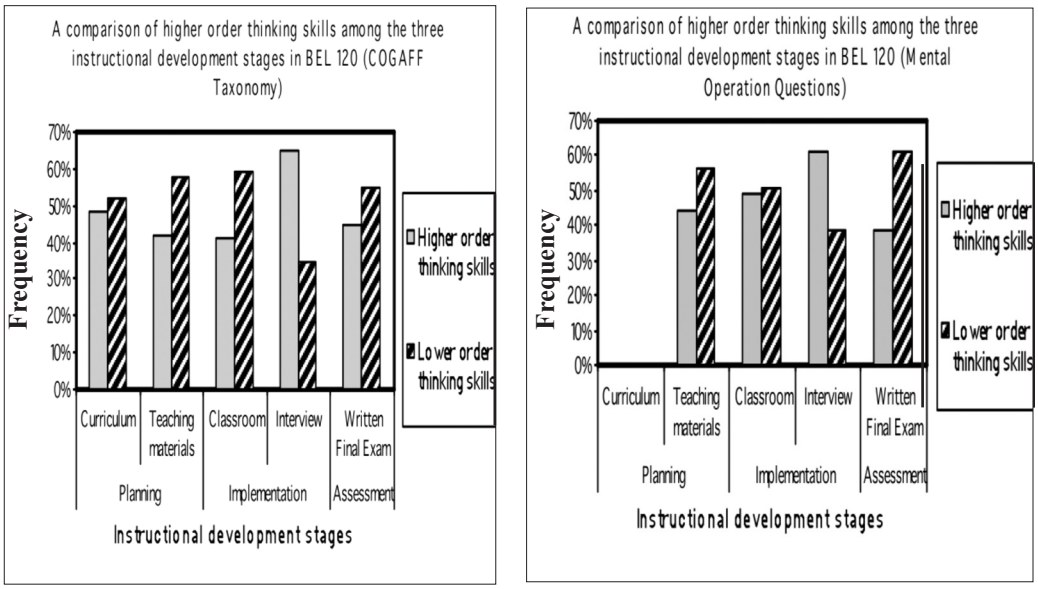


Fig. 1: Comparison of levels of thinking skills across the 3 stages of BEL 120

mindset who are knowledgeable, competitive, has a high performance culture, integrity, and strong moral values. It is imperative, then, to have a continuity of the inclusion of thinking skills from schools to the tertiary level in order to fulfill the Malaysian government's vision in producing individuals who are intellectually, spiritually, emotionally, and physically balanced and harmonious, as stated in the Philosophy of Education (2006). Thinking skills, from the lower domain at the knowledge level to the higher order at the affective domain, should be included in the instructional development at a the planning, implementation, and assessment stages of the English language subjects at the tertiary level. The synchronization in the infusion of thinking skills at all three levels of the instructional process will produce quality instruction and in turn, contribute to the success of a programme at the tertiary level. With this scenario, only then programmes in the tertiary level can provide a platform for the individuals to move forward and cope with the demands of globalization.

REFERENCES

Anna, C. A., Susila, M. and Michael, L. (2003). A study on the use of higher order thinking skills in the teaching of the English language in Penang. In A. Pandian, G. Chakrawathy and S. Che Lah (Eds.), *English language teaching & literacy: Research & reflections* (pp. 165-174). Serdang: UPM Publication.

Barrett, T.C (1972). *Taxonomy of Reading Comprehension. Reading 360 Monograph*. Lexington, Mass.: Ginn.

Barrickman. (1997). Challenging all students to think. *The Delta Kappa Gamma Bulletin* p5-11.

Beyer, B. K. (1988). *Developing a Thinking Skills Program*. Boston: Allyn & Bacon, Inc.

Bloom, B.S. (Ed.) (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook I, Cognitive Domain*. New York; Toronto: Longmans, Green.

Chan, S. H. and Wong, B.E. (2004). Developing CALL materials to promote critical thinking in the ESL classroom. In M. E. Vethamani and S. Rafik-Galea (Eds.), *Theory and practice* (pp. 95-128). Serdang: UPM Publication.

Chen, H.T. (2005). *Practical Program Evaluation: Assessing and Improving Planning, Implementation and Effectiveness*. Thousand Oaks, CA: Sage Publications, Inc.

Clymer, T. (1968). *What is "Reading": Some Current Concepts, Innovation, and Change in Reading Instruction*. 67th Yearbook of the National Society for the Study of Education, Part H. Chicago University Chicago Press.

Darn, S. (2006). Thinking outside the teacher's box. Steve Darn Teacher Development Unit, School of Foreign Languages, Izmir University of Economics, Turkey.

Edwards. D. and Mercer, N. (1987). *Common Knowledge: The Development of Understanding in the Classroom*. London: Methuen.

Ghazali, M. (1998). An Investigation into teachers' questions and tasks to develop reading comprehension: The application of the COGAFF Taxonomy in developing critical thinking skills in Malaysia. Unpublished PhD Thesis. University of Leicester, UK.

Ghazali, M. (2000). Too convergent to be divergent. In S.H. Chan, M.A. Quayum, and Rosli Talif. *Diverse voices* (pp. 75- 88). Serdang: UPM Publication.

Ghazali, M. (2006). Classroom instruction and assessment in literature: Has EQ been considered? Paper presented at *MICELT Conference* Melaka, 8-10 May 2006.

Hinterer, S. (2002). A study to determine the effect of skill-focused curriculum and instruction on student achievement as evidenced in GED and ACT pre/post scores. Unpublished Master Thesis. Salem nternational University.

Jayakaran Mukundan. (2003). Understanding roles in English Language Teaching (ELT). In A. Pandian, G. Chakrawathy and S. Che Lah (Eds.), *English language teaching & literacy: Research & reflections* (pp. 3-18). Serdang: UPM Publication.

Krathwohl, D., Bloom, B. and Masia, B. (1956). *Taxonomy of educational objectives. Handbook II: Affective domain*. New York: David McKay.

Kuhn, D. (1993). Sciences as argument: Implications for teaching and learning scientific thinking. *Science Education*, *77*(3), 319-337.

Moore, K. (1998). *Classroom Teaching Skills* (4th Ed.). Boston: McGraw-Hill.

Morgan, N. and Saxton, J. (1991). *Teaching Questioning and Learning*. London: Routledge.

Nor Zainab, A. R. (2003). The educational factors which influence the ESL students' motivation towards learning English language. In A. Pandian, G.Chakrawathy and S. Che Lah (Eds.), *English language teaching & literacy: Research & reflections* (pp. 46-54). Serdang: UPM Publication.

Paul, R. (2005, Summer). The state of critical thinking today. *New Directions for Community Colleges*, *30*. Wiley Periodicals, Inc.

Rajendran, N. (2001). Language teaching and the enhancement of higher order thinking skills. In W.A. Renandaya and N. R. Sunga (Eds.), Language *curriculum and instruction in multicultural societies - Anthology series 42*. Singapore: SEAMEO Regional Language Centre.

Rosma, O., Ghazali, M., Turiman, S., Ibrahim, N. and Bahaman, A. S. (2004). Teachers' perception on thinking skills as an Innovation in English Language Teaching. In M. Jayakaran, Z.A. Dzeelfa and S. R. S. Dulip (Eds.), *ELT matters 2: Development in English language learning and teaching* (pp.177-185). Serdang: UPM Publication.

Sandel, L. (2002). Taking the journey. *Kappa Delta Pi Record*, *38*(2), 85 – 88.

Sowell, E.J. (2000). *Curriculum*: *An Integrative Introduction*. New Jersey: Prentice Hall, Inc.

Zohar, A. and Tamir, P. (1993). Incorporating critical thinking into a regular high school Biology curriculum. *School Science and Mathematics*, *93*(3), 136-140.

Zohar, A. (1999). Teachers metacognitive knowledge and the instruction of higher order thinking. *Teaching and Teacher Education*, *15*, 413-429.

APPENDIX 1

COGAFF Taxonomy Checklist

NO	TAXANOMY
7.0	**Affective** Questions at this level ask students to respond with a statement of feeling, emotion, attitude, opinion, and devotion without appraisal Keyword: Feeling, emotion, opinion, attitude, devotion, spiritual
6.0	**Evaluation** Questions at this level ask students to use criteria to make and justify judgments about something Keyword: Judge, assess
5.0	**Synthesis** Synthesis questions ask students to be creative by putting a number of ideas or objects together in a way that is unique and new to them. There are many different solutions but no right answers. Keyword: Create
4.0	**Analysis** Questions at this level direct students to determine the part of a problem, solution or idea and show how they are related. Keyword: Why
3.0	**Application** Questions at this level require students to demonstrate the use of ideas. They must apply their knowledge and understanding to new situations and use it to solve problems. Keyword: How, solve
2.0	**Comprehension** Questions at this level require students to express ideas in their own way and demonstrate understanding of a communication, idea or object. Keyword: Understand, restate, compare
1.0	**Knowledge** Questions at this level require pupils to recall memory for previously learned facts, concepts, generalization and theories Keyword: Who, what, where, when

MENTAL OPERATION QUESTIONS CHECKLIST

Categories of questions		
Mental operations questions	Guilford's structure of the intellect	Bloom's taxonomy
Factual Student simply recalls information *Eg: "Define…"* *"Who was…"* *" What did the text say…."*	Cognitive/ memory	Knowledge/ Comprehension
Empirical Student integrates and analyzes given or recalled information. *Eg: "Compare…"* *"Explain in your own words…"* *"Calculate the…."* *"Based on the text,..	Convergent thinking	Application/ Analysis
Productive Student thinks creatively and imaginatively and produces unique ideas or responses. *Eg: "What will life be like…"* *"What's a good name for…"* *"How could we …"* *"What are some possible solutions…?*	Divergent thinking	Synthesis
Evaluative Student makes judgments or expresses values. *Eg: " Which is best?"* *" Why do you favor this…."* *" How would you rate…?"*	Evaluative thinking	Evaluation

APPENDIX 2

Sample A

Reading

1 What methods do you use to remember things? Look at the pictures below. What methods is the man using to remember his shopping list? Have you ever tried any of these methods?

2 Which of the things below do you think improve your memory? Which don't help?

3 a Read the text and check your answers to exercise 2.

b Which of the methods in the pictures in exercise 1 are mentioned in the text?

4 Mark the following statements True, False or Don't know. Then compare your answers with a partner.

10 ways to improve your memory

A good memory is often seen as something that comes naturally, and a bad memory as something that cannot be changed, but actually there is a lot that you can do to improve your memory. However, it does mean taking responsibility and making an effort. Here are the experts' top tips.

1 Take an interest – make an effort

2 Repeat things

3 Form a mental picture

4 Invent a story

Sample B

MODULE 2

Memory

Listening and speaking

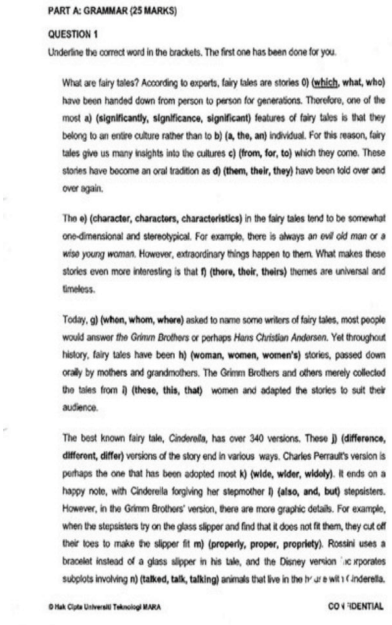
First meetings

Language focus 1

Past simple and continuous

Analyse

Sample C



PART A: GRAMMAR (25 MARKS)

QUESTION 1

Underline the correct word in the brackets. The first one has been done for you.

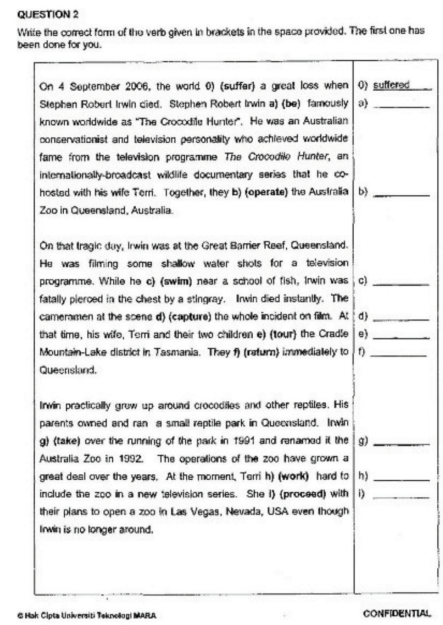
What are fairy tales? According to experts, fairy tales are stories 0) **(which, what, who)** have been handed down from person to person for generations. Therefore, one of the most a) **(significantly, significance, significant)** features of fairy tales is that they belong to an entire culture rather than to b) **(a, the, an)** individual. For this reason, fairy tales give us many insights into the cultures c) **(from, for, to)** which they come. These stories have become an oral tradition as d) **(them, their, they)** have been told over and over again.

The e) **(character, characters, characteristics)** in the fairy tales tend to be somewhat one-dimensional and stereotypical. For example, there is always an *evil old man* or a *wise young woman*. However, extraordinary things happen to them. What makes these stories even more interesting is that f) **(there, their, theirs)** themes are universal and timeless.

Today, g) **(whon, whom, where)** asked to name some writers of fairy tales, most people would answer *the Grimm Brothers* or perhaps *Hans Christian Andersen*. Yet throughout history, fairy tales have been h) **(woman, women, women's)** stories, passed down orally by mothers and grandmothers. The Grimm Brothers and others merely collected the tales from i) **(those, this, that)** women and adapted the stories to suit their audience.

The best known fairy tale, *Cinderella*, has over 340 versions. These j) **(difference, different, differ)** versions of the story end in various ways. Charles Perrault's version is perhaps the one that has been adopted most k) **(wide, wider, widely)**. It ends on a happy note, with Cinderella forgiving her stepmother l) **(also, and, but)** stepsisters. However, in the Grimm Brothers' version, there are more graphic details. For example, when the stepsisters try on the glass slipper and find that it does not fit them, they cut off their toes to make the slipper fit m) **(properly, proper, propriety)**. Rossini uses a bracelet instead of a glass slipper in his tale, and the Disney version incorporates subplots involving n) **(talked, talk, talking)** animals that live in the house with Cinderella.

Sample D



QUESTION 2

Write the correct form of the verb given in brackets in the space provided. The first one has been done for you.

On 4 September 2006, the world 0) **(suffer)** a great loss when Stephen Robert Irwin died. Stephen Robert Irwin a) **(be)** famously known worldwide as "The Crocodile Hunter". He was an Australian conservationist and television personality who achieved worldwide fame from the television programme *The Crocodile Hunter*, an internationally-broadcast wildlife documentary series that he co-hosted with his wife Terri. Together, they b) **(operate)** the Australia Zoo in Queensland, Australia.	0) suffered a) _____ b) _____
On that tragic day, Irwin was at the Great Barrier Reef, Queensland. He was filming some shallow water shots for a television programme. While he c) **(swim)** near a school of fish, Irwin was fatally pierced in the chest by a stingray. Irwin died instantly. The cameramen at the scene d) **(capture)** the whole incident on film. At that time, his wife, Terri and their two children e) **(tour)** the Cradle Mountain-Lake district in Tasmania. They f) **(return)** immediately to Queensland.	c) _____ d) _____ e) _____ f) _____
Irwin practically grew up around crocodiles and other reptiles. His parents owned and ran a small reptile park in Queensland. Irwin g) **(take)** over the running of the park in 1991 and renamed it the Australia Zoo in 1992. The operations of the zoo have grown a great deal over the years. At the moment, Terri h) **(work)** hard to include the zoo in a new television series. She i) **(proceed)** with their plans to open a zoo in Las Vegas, Nevada, USA even though Irwin is no longer around.	g) _____ h) _____ i) _____

APPENDIX 3

EXCERPTS FROM TAPESCRIPT

CLASSROOM AUDIO RECORDING (LESSON 1)

Excerpt 1

FS: Yes... Now, for example I give you a topic sentence as simple like this. For example, reading is important for... what? Student ? Now, this is the topic sentence. Now, when you write a topic sentence, you have to write everything. You have re-write the first paragraph, your introduction paragraph. Reading is important for students. That would be your topic sentence. Now, in order to tell more, to elaborate this one. To get more ideas to this one, you have other small ideas, right?

(Students response)

FS: Okay, this supporting ideas, are called supporting details. It is not support, its supporting. Now, whatever you tell here will give you more ideas to make you... to enable you to understanding the topic sentence. Now, ***can you give me the supporting detail for why reading is important for students? Now, if I say reading is important for students, what is the big question that you have in your mind?***

(Students response)

FS: Benefit of reading? I'm asking about question. The big question..

(Students response)

FS: Very good! So, if i say reading is very important for student, it is already written at the back of your head, a big one . . . WHY! Some of you are very smart; they are talking about the benefits of reading. Very good. But some students they are quite slow and then they sometimes can be smarter they say in a long sentence. They say... WHY? ***Why is reading important? Do you think that reading is important?***

(Students response)

FS: Do you read a lot? No?

(Students response)

Excerpt 2

FS: Now, I'm going to let you read some of the samples but make sure you return the papers to me. Don't take it now.

FS: Now the length of the essays is more or less like 200 words. Take one each, i hope i have enough. Please return them to me. You read first then I'm going to ask you to ask you to write something that is very simple. ***You can write in groups, okay. If it is not enough you can always share with your friends. You have more? Enough? I'm giving you more on "My Favourite Person". It can be your mother; it can be grandfather and so on.***

FS: Please return them to me. Do you have enough? Anymore? Have you had enough? Anymore? This is one they did well? Who else haven't got this one yet? Please come and get them... and then after reading yours, you can always exchange with your friends. Don't write anything. You've got to return them to me. Yes, while you are reading, I would like you to write down your full name plus your hand phone number and UiTM number. Because this is for reference regarding your 'Just English' magazine. Can somebody spare me a sheet of paper? Yes...write down there columns. One for name, your IC and your phone number because for 'Just English', there will be three issues. There are going to give you, one issue first and the next two would be given later. That's why they need the names and the phone number especially. Bow many are they in your class? 27?

(Students response)

APPENDIX 4

EXCERPTS FROM TAPESCRIPT (INTERVIEW)

Excerpt 1

FY: …Ok, when you talk about verbs, you have to know. It is very bad for you to know only the base form. You have to know at least the past form and the past participle. All this will help you in your writing." When I give them a certain…for example, "ok, we're going to do writing. Would you like to do writing? Writing is very boring. No, it's not boring if you know how to do it, " I told them. And then, ok, now, let's look at…let me give you one situation. ***For example, you are in the night market. Have you been to the night market before? We have one…very big one in Jengka. So, they say 'yes…yes.' Ok, now I would like you to take out a piece of paper and list down all the verbs that are related to the night market. What you see, what you can feel there, you just list them down." So, they will just list, and then, I will tell them to develop sentences. From there, for example, "now, when you use present tense…when you go to the night market, y'know, what kind of tense do you normally relate to? All is present tense. Now, when you use present tense, you must make sure that you know you can use present tense. You can use present continuous tense, as well as future tense." This is how I build, from the very simple on. And then, they start writing. And then, I will ask them to write only 5 sentences, because I am not very ambitious with them for the first time. I ask them to write five sentences about the situation there, the night market. And then I will ask them to come one by one, or I just project using the OHP and so on.*** I point out that the…actually I'm…I was trying to connect their mistake, but I'm not the kind of…I'm not the kind to do it on my own, when I check their work, it is always in the classroom. It's pair work or group work. All of them will be around me. …

Excerpt 2

FY: Normally, when I teach…if I know…the first time I see my students, I would ask to … right…for example…whether I'm teaching reading, speaking or listening, or other …for other subjects as well, not only for 120, I would always ask them to come up with an essay, a very short essay about themselves…like 'myself'. From that essay, I have a rough idea of what the students…normally they are very sincere. Young students are very sincere; especially BEL 120, y'know, and they would talk about anything about themselves. If I know I have orphans from my class, I would not ask them to write anything related to family or my beloved mother or y'know, like the person I like a lot. I would never ask them. I'll try my best to hinder asking that question. ***So, I'll be dealing more about hand phone, about holidays, about my room that would be the normal topic for them. I will always …because I believe that if students do not feel comfortable in your class, having to do things that they don't like, there'll be no learning.*** It is always …when they are relaxed, then only I start my teaching. I'll always ask them, "are we ready to roll?" Then I would start. If I see students still fumbling with their textbooks, looking at their pencil cases, I would not start my lessons. So, that's it.

Excerpt 3

FY: For BEL120, for example, for BEL 120, they are not assigned, …for example, they don't have individual task, y'know. They only have group discussion***. For example, I will ask them, "is your…for example…next week is your…your mum's birthday. You are all siblings. Now, you sit down and discuss what's the best…what is the best gift for you to buy for your mum," and then you give them a few choices, for example, a handbag, a voucher, and then they will discuss.*** It is something, which is very much related to them, and then, maybe, they have gone to so many places. You just give them…"ok, what are the interesting places that you have visited? List them down. Which is the best; whether it is a resort, whether it is a beach resort, higher level resort and so on.

APPENDIX 5

Sample A

IV Women are also beginning to take legal action against their abusive husbands. A salesclerk in Beijing said that after getting married, **she** and her husband often **argued** over everything. Then last summer, her husband beat her up, damaging her eardrum and breaking several ribs. She made a police report and subsequently asked for a divorce. Because her husband **confessed** to beating her up, the court quickly granted her a divorce.

V In the past, most women in China did not leave their abusive husbands. Very often, the abusive husband would get away easily with his crimes because the police would only ask him to sign a written agreement stating that he would never beat his wife again. It was also difficult for women to get a fair hearing in the courts. Nowadays, however, the courts are being increasingly fair to abused women. They are **frequently** given protection from their abusive husbands and even allowed to divorce their husbands. This is a big change in China and the women can be thankful that the government is at last supporting the rights of abused women.

Adapted from **Newsweek**, January 2003

QUESTION 1

What do the following words and phrases refer to in the passage?

a) its (line 12) : _____
b) a family matter (line 15) : _____
c) They (line 19) : _____
d) which (line 23) : _____
e) she (line 28) : _____

(2½ marks)

Sample B

CONFIDENTIAL

QUESTION 2

Based on the information in the passage, write T next to the statements which are true and F next to the statements which are false.

a) Walt Disney was raised on a farm in Chicago.
b) Roy Disney mortgaged his farmhouse to help finance his new company.
c) The first public screening of a Mickey Mouse film was in 1928.
d) The Mickey Mouse Club was solely for children in America.

(2 marks)

QUESTION 3

Underline the meaning of each word as it is used in the passage.

a) renowned (line 2)
i) known
ii) creative
iii) famous

b) talent (line 8)
i) knowledge
ii) ability
iii) prospect

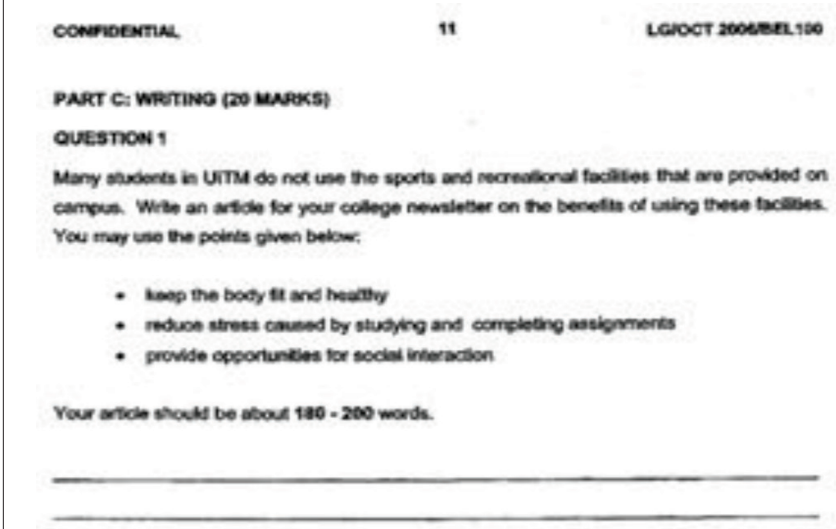
c) featured (line 21)
i) designed
ii) produced
iii) introduced

d) overnight (line 22)
i) dark
ii) surprise
iii) instant

e) severe (line 33)
i) serious
ii) sudden
iii) important

f) grateful (line 41)
i) thankful
ii) big
iii) happy

Sample C



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PART C: WRITING (20 MARKS)

QUESTION 1

Many students in UiTM do not use the sports and recreational facilities that are provided on campus. Write an article for your college newsletter on the benefits of using these facilities. You may use the points given below:

- keep the body fit and healthy
- reduce stress caused by studying and completing assignments
- provide opportunities for social interaction

Your article should be about **180 - 200** words.

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Students' Perception of the Teaching of Historical Thinking Skills

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ABSTRACT

History is a compulsory subject for all Malaysian secondary school students. History teaching and learning processes focus on historical thinking skills such as chronology, exploring evidence, making interpretations, imagination, and rationalizing. Competency in historical thinking skills enables students to think critically and creatively, to understand historical criteria, to perceive historical events emphatically, to explore complex and abstract ideas, and to appreciate ways historians construct past events using evidence to establish historical significance. A study on students' perceptions of the teaching of historical thinking skills in the subject was conducted in two secondary schools in Miri, Sarawak. The participants were 80 Form Four Science and Arts stream students. The findings showed students' perception of the teaching of historical thinking skills range from moderate to moderately high level. The result also showed no significant difference in perception between male and female students on all four historical thinking skills (chronology, exploring evidence, interpretation, and imagination). However, on the skill of rationalizing, male students showed a more positive perception (mean=3.85) compared to female students (mean=3.63). In addition, the t-test showed no significant difference in perception between Science and Arts stream students on four aspects of historical thinking skills (chronology, interpretations, imagination, and rationalizing). On the skill of exploring evidence, Arts students showed a more positive perception (mean=4.16) compared to Science students (mean=3.64). The implication of this study is that history teachers need to equip themselves with historical thinking skills so that the process of teaching and learning can be more effective which in turn could help enhance students' acquisition of historical thinking skills.

Keywords: History education, history curriculum, historical thinking skills, secondary school, Malaysia

INTRODUCTION

Many decades ago, Dewey (1916) in his book *Democracy and Education* observed that*,* "All which the school can or need do for pupils, as far as their minds are concerned is to develop their ability to think" (cited in Schleifer, 1997, p. 78). Many educators support Dewey's rallying cry that education should be about developing children's thinking, not by telling them what to think, rather by helping them to find their own paths to meaning. If thinking is about how children make sense of things, then developing their thinking skills will help them gain more out of learning and out of life. Teaching children to be good thinkers is both a rational and a moral effort and can be seen as the fulfilment of the potential of individuals through particular processes of education. These processes require more than mere isolated sets of thinking skills. They are inevitably also a matter of developing attitudes and dispositions.

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In studying history, the main objective is the acquisition of knowledge and understanding. It is with understanding that provides the frame of reference within which the items of information or historical facts find their place and meaning. History differs from most other subject matter in that it's central concern is with the action of people and the significance and consequences of those actions. Historical events cannot be understood without reference to the motives and beliefs of the participants, although there can never be absolute certainty why they acted as they did. Despite the concern for evidence and rigour, historians have to make selections from the mass of evidence available and offer an interpretation of why and how events occurred as they did. This is because the wider the base of information, the greater the potential for developing understanding through the perceptions of significant connections and relationships (Fisher, 2008).

HISTORY IN THE SCHOOL CURRICULUM

History has been an integral component of the school curriculum. School history in particular, frequently is seen as a vehicle in which students supposedly learn the civic lessons that will influence them to become dependable and useful citizens. Thus history education plays its role to pass on desirable social attitudes, values, and behaviours (Cuban, 2001). In the Malaysian context, history has been recognized as an important subject in the effort to produce loyal and patriotic Malaysian citizens. To help nurture the spirit of citizenship, history learning is made compulsory to all students at both lower and upper secondary levels. Recently, there has been talk that history learning should begin at Year 1 in the primary school. The new status given to history is a significant change from the former curriculum whereby history was an optional subject at upper secondary level. Students could opt not to learn history while those in the science stream had been discouraged from learning history as a school subject (Abdul Rahim, 1999; Abdul Ghani 2008).

Despite the importance of history, its intended purpose and its alleged civic significance in school curriculum arguments remain about the quality of history education. As early as the nineteenth century, psychologist G. Stanley Hall (cited in Wineburg, 2004) claimed that history was the most poorly taught in school, and current researchers have claimed that its popularity has not grown. Surveys reveal that adults look back on history courses as "boring" and students' perceptions remain that history is boring and is poorly taught (Seixas, 2004; Wineburg, 2004). Unsurprisingly, a number of parties have levelled criticisms concerning the teaching and learning of history and poor achievement in the subject, and expressed dissatisfaction with the way teachers are teaching the subject. Not only students have become victims, but history as a subject continued to be perceived as "boring" and "side-lined" due to ineffective teaching strategies (Abdul Rahim, 1999; Aini Hassan, 1999).

TEACHING HISTORICAL THINKING SKILLS

Historical thinking skill (HTS) is generally defined as a process of using historical information, including deciphering context, perspective, point of view, and perceived facts to understand the past. Thinking in history, or the use of phrases such "thinking history" also may refer to a process of using critical thinking skills or higher level of thinking skills in the study of history. Other researchers in the field have defined the term "historical thinking" as simply "thinking like a historian". This definition implies that a person's effort and ability to place historical information or a historical document, including interpretations, meanings, and context, into the social setting in which it was created. Profesional historians use the process of defining value, objectivity, bias, sources, and content when interpreting and evaluating historical information or primary source documents. Helping secondary students to accomplish this task in history education is one of the challenges faced by many history teachers (Cuban, 2001; Seixas, 2004; Wineburg, 2004).

HTS is important to history education for several reasons. History provides opportunities to teach process skills, such as critical thinking, data analysis, making or identifying generalization, discovering biases, and recognizing perspectives. Recent studies have included the concept of historical empathy, or understanding the deeper context of historical events. Developing these skills through history learning would help students to develop process skills that enable them to engage in higher order thinking skills. The emphasis on historical thinking is seen as the key to helping students better understand the historical content by understanding the historical context. Providing opportunities for students to develop these higher level thinking skills prepares them to exercise a greater understanding of the past, but also increase awareness of their own perceptions and cultures and a greater understanding of others (Wineburg, 2004; Yeager and Foster, 2001).

The Malaysian Secondary School Integrated Curriculum, better known as KBSM, emphasizes teaching and learning processes that focus on the development of critical and creative thinking skills (CCTS) across all subjects. The thinking skills (TS) that students need to master are categorized into two components: critical thinking skill and creative thinking skills (KPM, 2004). Critical thinking is defined as the ability to evaluate, to judge, and to draw conclusion of an idea or concept. Creative thinking is the ability to generate and create original ideas. The CCTS are arranged in hierarchical order from basic skills to more complex skills. The CCTS model adopted by the Ministry of Education (KPM), as shown in *Fig. 1*, serves as a guide for teachers in developing CCTS in the process of teaching and learning.

In the KBSM history curriculum, CCTS is realized through the concept of Historical Thinking Skills (HTS) which is defined as a

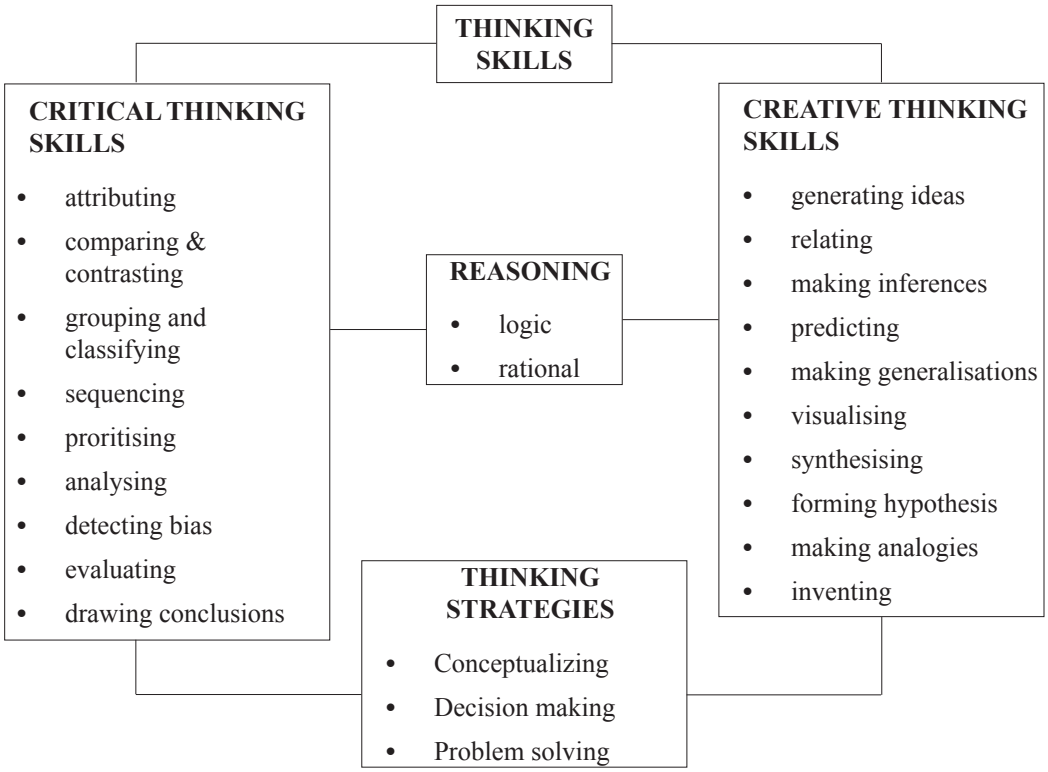

Fig. 1: The CCTS Model (KPM, 2004, p.9)

cognitive process that enables students to explore complex and abstract ideas in learning history. The HTS that have been identified are as follows:

i. Chronology: this skill comes under the critical thinking skill of sequencing. Chronological Skills contain two important elements: timelines and time convention. Timelines contain a series of events which happened according to chronology whereas time convention involves dates and events.

ii. Exploring Evidence: this is the critical thinking skill which emphasizes the skill of identifying primary and secondary sources and then comparing them.

iii. Interpretation: is the skill of analysing a historical event by analysing and explaining it through teaching and learning activities. Competence in this skill enables students to become aware of the fact that historians and researchers of history do analysis and that they will differentiate between facts in using the perspectives of historians.

iv. Imagination: is linked to perceptions of the mind or on thoughts or visualising an idea, concept, situation or event. Through imagination students develop empathy in the situations of an event.

v. Rationalizing: is the highest skill as it requires the skill of evaluating an event. Rationalizing requires students to go through the cognitive process of thinking and making sound evaluations as they resolve the issues involved in historical events.

In the History Learning and Teaching Module (KPM, 2000), the objectives of applying HTS are to enable students to: i) think critically and creatively; ii) understand the features of history; iii) develop empathy for historical events; iv) explore complex and abstract ideas with the teacher's guidance; and v) understand how historians re-construct past events using evidence to determine the significance of certain events. These objectives would be achieved through organized teaching and learning activities in the classroom. Consequently, teachers need to rectify their teaching styles and learning activities and adapt their instructional methods to the development of HTS using investigative methods such as questioning, simulation, evaluating, assessing and arguing. Students participate actively in the learning process through series of activities including role-plays, historical simulations, and classroom discussion. Using primary source document, written, visual and photographic evidence the teacher sought to develop and build students' abilities in HTS.

STUDENTS' PERCEPTION OF THE TEACHING OF HTS

This study was designed to examine what occurred in the classroom on the teaching of HTS and higher order thinking skills. The main aim was to look into students' perception on the instructional methods employed by their teacher to help inculcate HTS. Specifically the objectives of the study were:

1. To identify the students' level of perception of the teaching of HTS.

TABLE 1
Perception level

Mean score	Perception level
1.00 - 2.33	Low level
2.34 - 3.66	Moderate
3.67 - 5.00	High

2. To determine differences in student's perception towards the teaching of HTS between male and female students.
3. To determine differences in students' perception towards the teaching of HTS of Science and Arts students.

METHODOLOGY

A survey method using questionnaires was chosen for the study. The respondents comprised eighty (N=80) Form 4 students from SMK Baru Miri (n=40) and SMK Merbau (n=40) in Miri Division, Sarawak. The choice of location was of convenience since a writer of this article was

TABLE 2
Mean values of students' level of perception on the teaching of HTS

HTS	Item	Mean	Std. dev.
Chronology	Q1.Teacher relates past, present and future events.	3.83	0.973
	Q2.Teacher sequences times and events.	3.75	0.893
	Q3.Teacher identifies changes and progress over time.	3.86	0.910
	Q11.Teacher arranges lessons systematically.	4.05	0.966
	Q27.Teacher shows progress using time lines and sequences of events.	3.56	0.978
Exploring evidence	Q16.Teacher guides students to search for information.	4.07	1.052
	Q18.Teacher participates in activities.	4.12	4.12
	Q19.Teacher encourages the collection of information from primary and secondary sources.	3.52	0.856
	Q20.Teacher uses a variety of resources.	3.89	0.993
	Q22.Teacher uses diverse teaching methods.	3.80	3.80
	Q24.Teacher uses many resources to teach HTS.	4.01	0.947
Interpretation	Q4.Teacher compares resources for factual evidences.	3.94	1.035
	Q5.Teacher generates ideas.	3.64	0.997
	Q7.Teacher analyzes historical events.	3.65	1.007
	Q8.Teacher differentiates facts and interpretations.	3.69	1.038
	Q12.Teacher uses mind maps.	4.15	0.969
	Q21.Teacher uses different learning resources.	3.81	0.901
Imagination	Q14.Teacher creates questions from historical events.	3.75	0.907
	Q17.Teacher guides students to evaluate.	4.02	0.940
	Q23.Teacher asks students to role play.	3.83	0.892
	Q25. Teacher shows historical movies.	3.83	1.141
	Q26. Teacher asks students to imagine.	3.55	1.029
	Q27. Teacher develops empathy.	3.56	0.978
Rationalizing	Q6. Teacher draws conclusion using logics.	3.56	0.979
	Q10.Teacher draws conclusion based on historical evidence.	4.03	0.683
	Q13.Teacher gives rationales for historical events.	3.90	0.963
	Q15.Teacher resolves problems on certain issues raised by historical events.	3.47	1.030
	Q28.Teacher creates situations for discussion.	3.26	1.003
	Q29.Teacher raises questions on critical thinking.	3.70	0.919
	Q30.Teacher tests thinking skills on history.	3.91	1.008

a teacher in one of the schools. The respondents consisting of twenty male and twenty female students from the Science and Arts stream were randomly selected from the two secondary schools. In both schools the history test results in the 2007 Penilaian Menengah Rendah (Lower Secondary Assessment) for SMK Baru Miri showed 62.74% students scored Grades A, B, and C while in SMK Merbau 56.85% scored Grades A, B, and C. Female students performed better than male in both schools with 71 female students scored Grades A and B in SMK Baru Miri and 95 female students scored Grades A and B in SMK Merbau. Generally, students with good performance in the PMR are placed in the Science stream. Since history is a core subject, both Science and Arts have to learn history.

Data was collected using a 30-item, 5-point Likert scale (Strongly Disagree – Strongly Agree) questionnaire. The questionnaire comprised two parts: part A is about the demography of respondents. Part B comprised of statements on perception of the teaching of HTS: Chronology (5 items), Exploring Evidence (6 items), Interpretation (6 items), Imagination (6 items), and Rationalizing (7 items). Prior to the data collection, a pilot study of the instrument was conducted with a class of students in a different school in Miri. The internal consistency of the instrument was found to be at r=0.96 (Cronbach Alpha). The data collected in the study was analyzed using descriptive statistics (frequencies, means, and standard deviations) and inferential statistics (t-tests). The significance level or alpha was set at p= 0.05. The level of perception of the students on the teaching of HTS was gauged using the following scale.

RESULTS

Students' Level of Perception towards the Teaching of HTS

Data was analyzed by examining each of the items in the five HTS identified in the history curriculum. The means and standard deviations students' responses for each item on all five HTS namely Chronology, Exploring Evidence, Interpretation, Imagination, and Rationalizing are shown in Table 2. Out of 30 items in the questionnaire, Item 12, "teacher uses mind maps" has the highest mean (M=4.15) with SD=.969. The second highest is Item 18, "teacher participates in activities" (M=4.12 with SD=.972), followed by Item 16, "teacher guides students to search for information" (M=4.07 with value of SD=1.052). The lowest mean is Item

TABLE 3
Difference in perception towards the teaching of HTS based on gender

Skills	Gender	N	Mean	Standard deviation	df	t value	P
Chronology	Male	40	3.79	0.63	78	-0.264	0.79
	Female	40	3.83	0.55			
Exploring	Male	40	3.87	0.67	78	-0.414	0.68
Evidence	Female	40	3.93	0.57			
Interpretation	Male	40	3.83	0.58	78	0.300	0.76
	Female	40	3.79	0.58			
Imagination	Male	40	3.66	0.77	78	0.158	0.87
	Female	40	3.63	0.64			
Rationalizing	Male	40	3.85	0.37	78	2.465	0.01*
	Female	40	3.63	0.40			

Significance level p=0.05

TABLE 4
Difference in perception towards the teaching of HTS based on stream

Skills	Stream	N	Mean	Standard deviation	df	t-value	P
Chronology	Science	40	3.86	0.53	78	0.719	0.47
	Arts	40	3.76	0.63	78		
Exploring	Science	40	3.64	0.64	78	-4.021	0.00*
Evidence	Arts	40	4.16	0.49	78		
Interpretation	Science	40	3.72	0.54	78	-1.465	0.15
	Arts	40	3.91	0.60	78		
Imagination	Science	40	3.58	0.58	78	-0.792	0.43
	Arts	40	3.71	0.80	78		
Rationalizing	Science	40	3.68	0.38	78	-1.340	0.18
	Arts	40	3.80	0.41			

Significance level = 0.05

28, "teacher creates situation for discussions" (M=3.26 with SD=1.003). In general students' perception on the teaching of HTS ranged from moderate to moderately high in all the five HTS.

Students' Perception towards the Teaching of HTS Based on Gender

Table 3 shows the means of the students' perception toward the teaching of HTS based on gender. The results showed that there was no significant difference on the skills of chronology, exploring evidence, interpretation, and imagination based on gender. Both male and female students' seemed to have similar perceptions of teachers' teaching of HTS. However for the skill of rationalizing, the t-test showed a significant difference in perception towards the teaching of HTS based on gender. Apparently male students have a higher perception (M=3.85) towards rationalizing as compared to female students (M=3.63).

Students' Perception on the Teaching of HTS Based on Stream

Table 4 shows the results of t-test in perception of the teaching of HTS based on the stream of study. The finding showed that there was no significant difference on perception of Science and Arts students on four HTS namely chronology, interpretation, imagination, and rationalizing in history learning. However, a close scrutiny revealed that Science seemed more critical in their perception of history teachers with a mean score lower compared to Arts students. For HTS on exploring evidence, the Arts students gave high perception (M=4.16) compared to the Science students (M=3.64).

DISCUSSION

The findings of this study indicate that students in both schools perceived the efforts made by their history teachers in teaching historical thinking skills as moderately high. Data analysis using t-test indicates there was no significant difference in the students' perception of the teaching historical thinking skills between male and female students irrespective of Science or Arts classes. Based on the analysis of the students' perception, it can be inferred that the history teachers in both schools did not fully exhibit strong traits of historical thinking skills in their teaching and learning activities, indicating that they possessed limited ability to "think like

historians". If teachers entering history classes with limited ability in historical thinking skills, then it can be expected that they will not be able to develop the myriad of skills in their students. The finding in this study supported the reports by Zahara and Nik Azleena (2007) on the readiness of teachers to teach historical thinking skills. Their study which involved 114 history teachers in the Dungun Terengganu showed that teacher's readiness with regard to the teaching of historical thinking skills were moderate as a whole. The findings also indicated that there was a significant difference between teachers who were trained to teach history and those who were not (Zahara and Nik Azleena, 2007).

Teachers bring with them to the classrooms their vision of history and how history should be taught. Often this history represents the history they learned in their schooling or university education. Just as students' historical thinking is significant, one can argue that teachers must be prepared to teach historical thinking skills. Whether acting as a facilitator or teaching students step by step in scaffolding methods, they need to know how to teach historical thinking. They must be aware of their own ability to use the appropriate resources, approaches, activities, and to think like historians in order to guide students to success. If teachers enter classroom with a limited vision of history, or without preparation in teaching or helping students to analyze data sources and to think critically about the data, then they cannot be expected to teach higher order thinking or exhibit strong traits of thinking like historians. Administrators, teacher education programs and teachers themselves should be concerned with the development of teachers and that teachers are adequately prepared to teach students to think historically.

In his day, Hall (cited in Wineburg, 2004) promoted two ideas to rectify his concerns about poor teaching of history. First, history teachers should be subject specialists who knew and understood their subject matter, and second, that schools should increase time devoted to historical studies. Hall further argued that teachers should adapt their instructional methods to the developmental level of their students, including efforts to learn history using an investigative method, a notion that appears similar to the current concept of historical thinking. The findings of this study indicate that history teachers have not diversified their instructional methods to the developmental level and student ability. Apparently teachers used similar strategies and activities to both Science and Arts classes. Wineburg (2001) emphasized that teachers need to use history education as a vehicle to higher level thinking, arguing that history provides a significant opportunity to teach these higher level of critical thinking skills. In this sense, history curriculum and history teaching serve as a means in developing critical and creative thinking skills.

Historical thinking skills involve certain distinct problems that cannot be collapsed into mere generic critical thinking (Seixas and Peck, 2004). In this study, students perceived the skill of imagination being the least emphasized by history teachers. Imagination is important because the history of an event, place, background, time frame, names, and time period will be difficult to visualize if merely words are used. Husband (1996) asserts that the skill of using imagination enables students to enter the minds, and to empathize with the feelings, of those involved in a particular historical event. It is an ability to see and understand the world from a perspective not our own. Imagining must be based on historical evidence if it is to have any meaning. Exercises that ask students to imagine being a medieval knight or a Malay Chieftain of Melaka make no sense unless they have rich information about life during those times.

CONCLUSION

One must be careful not to extrapolate general conclusions based on a study which focused on a small number of participants as in the present study. This study has examined how students perceived the teaching of historical thinking skills by their history teachers. Nonetheless the findings of this study may provide indications what concur in the classroom regarding the

teaching of historical thinking skills. Accepting the notion that students can learn to think like historians relies on the belief that teachers have the ability to think like historians and are able to guide students through the process. Teachers' ability and preparation determine what is happening in the classroom. Effective teaching of history depends largely on the efforts and approaches of the teacher. Inevitably, history teachers have to be prepared with knowledge and effective skills of teaching history. Teachers also have to listen to the views and opinions of students about their teaching methodologies that can help make history lessons more meaningful and appealing.

REFERENCES

Abdul Rahim Abd Rashid. (1999). *Pendidikan Sejarah: Falsafah, Teori dan Amalan.* Kuala Lumpur: Dewan Bahasa & Pustaka.

Abdul Ghani Abu. (2008, January 14). Sejarah masih relevan. *Utusan Malaysia.*

Aini Hassan. (1999). Pengajaran dan pembelajaran sejarah di sekolah: Guru sebagai broker ilmu sejarah. *Masalah Pendidikan*, *21*, 109-123.

Bourdillon, H. (Ed.). (1994). *Teaching History*. London: The Open University.

Cuban, L. (2001). Why bad reforms won't give us good schools. *The America Prospect*, *12* (Winter 2001). Retrieved July 17, 2009 from http://www.prospect.org/print/V12/I/cuban-html.

Dewey, J. (1916). Democracy and education. Retrieved July 17, 2009 from http://books.google.com.my/books?id=35Jb0IYJaVC&printsec=frontcover&dq=john+dewey+education.

Fisher, R. (2008). *Teaching Thinking* (3rd Ed.). London: Continuum Instructional Publishing Group.

Fisher, T. (2003). History's future: Facing the challenge. *Teaching History*, *112,* 35-37.

Husband, C. (1996). *What is History Teaching? Language, Ideas and Meaning in Learning about the Past.* Buckingham: Open University Press.

Husband, C. (2001). What's happening in history? Trends in GCSE and A level examinations 1993-2000. *Teaching History* 103. Puzzling History Edition.

Kementerian Pendidikan Malaysia. (2000). *Modul Latihan Pengajaran dan Pembelajaran Sejarah.* Pusat Perkembangan Kurikulum.

Kementerian Pendidikan Malaysia. (2000). *Sukatan Pelajaran Sejarah KBSM*. Pusat Perkembangan Kurikulum.

Kementerian Pendidikan Malaysia. (2004). *Huraian Sukatan Pelajaran Sejarah Tingkatan 5*. Pusat Perkembangan Kurikulum.

Schleifer, M. (1997). Philosophy and community education. *Analytic teaching*, *17*(2), 93- 100.

Seixas, P. and Peck, C. (2004). Teaching historical thinking. In A. Sears and I. Wright (Eds.), *Challenges and prospects for Canadian social studies* (pp. 108-117). Vancouver. Pacific Educational Press. Retrieved August 6, 2010 from www.culturahistorica.es/seixas/seixas-pec-pdf.

Wineburg, S. (2001). *Historical Thinking and Other Unnatural Acts.* Philadelphia: Temple University Press.

Wineburg, S. (2004, March). Crazy for history. *Journal of American History*, *90.*

Yeager, E. A. and Foster, S. J. (2001). Why people in the past acted the way they did: An exploratory subject in historical empathy. *Journal of Social Education*, *13* (Summer/Spring 2001), 8-24.

Zahara Aziz and Nik Azleena. (2007). Kajian tinjauan kesediaan guru-guru sejarah menerapkan kemahiran pemikiran sejarah kepada para pelajar. *Jurnal Pendidikan*, *32*(2007), 119-137.

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Impact of Multimedia Instructional Materials on Creative Thinking

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ABSTRACT

This study aimed to investigate the impact of utilising multimedia instructional materials (MIM) on engineering students' creative thinking in Malaysia. Fifteen MIM were developed based on the principles of Cognitive Theories of Multimedia Design (Mayer, 2001) and Cognitive Load Theory (Sweller et al., 1998). The MIM were used by 27 mechanical engineering students in lab sessions over a period of 5 weeks. Torrance Tests of Creative Thinking (TTCT) verbal forms A and B were administered to the students as pretest and posttest respectively to measure students' creative thinking in terms of fluency, flexibility, originality, and overall creativity capabilities. Two semi-structured focus group interviews were also conducted with five volunteer students in each group. Data were analysed using a paired sample t-test comparing pre and posttests results and also between genders. The t-test analysis shows that there was a significant increase in the students' creative thinking in the posttest for all the creative thinking elements stated. Students' responses during the interview supported the statistical findings.

Keywords: Cognitive load, creative thinking, multimedia learning

INTRODUCTION

Creativity requires knowledge. Creative acts do not simply appear in a flash although it is undeniably true that some individuals are naturally gifted with such a talent (Guildford, 1950). For all other individuals born without the natural gift of creative potential, creativity is a skill that can be learnt (Amabile, 1998). It requires among other things, knowledge, and it entails the cognitive interplay between new and existing knowledge (de Bono, 1990; Sweller, 2009). De Bono (1990) states that the cognitive process of creativity involves the ability to use and communicate ideas, and how new and old ideas are manipulated to create one's own novel ideas. This cognitive manipulation of ideas and knowledge is part of the complex phenomenon of the human cognitive system which is often explored as an information processing system (Sweller, 2009). A system which includes working memory, long term memory and schemas, and how these three components are able to process, integrate, and transform information into knowledge which might lead to novel ideas.

The advancement of knowledge and changes in how information can be represented in today's technological era also affect how information can be cognitively manipulated. The growth of computer technology has made it possible to transform commonly static and paper-based representations into pictorial and dynamic representations (Mayer, 2001). It was generally based on this development that Cognitive Load Theory (CLT) (Sweller et al., 1998) and Cognitive Theory on Multimedia

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Design (CTMD) (Mayer, 2001) were proposed in order to address how multimedia instructional materials can be designed effectively to ensure appropriate load on learners' cognitive systems, and therefore, facilitate meaningful learning.

Studies of multimedia learning are not entirely new in educational research. The emphasis has however been mostly on retention, transfer and problem-solving performance (Mayer and Anderson, 1992; Mayer et al., 2007; Paas et al., 2007; Seufert and Brünken, 2006). The literature that relates the significance of multimedia learning to the enhancement of creative thinking is scant. Sweller (2009) has recently described the human cognitive architecture based on evolutionary biology and instructional processes (in relation to CLT) that could facilitate creativity. There is however no description of the cognitive architecture and its association with multimedia learning. This study, therefore, was an attempt to investigate whether the use of multimedia instructional materials (MIM), which were designed based on four principles of CTMD, could enhance engineering students' creative thinking.

APPROPRIATE DESIGN OF MULTIMEDIA INSTRUCTIONAL MATERIALS FOR CREATIVE THINKING

This study has its basis in cognitive load, multimedia learning, and creativity theories. *Fig. 1* depicts the framework which was used for the design of the MIM. The framework was adapted from the principles of CTMD and CLT (Mayer, 2001; Sweller et al., 1998). The framework considered the load on students' cognitive system in order to ensure that information can be processed appropriately to assist students in the enhancement of their creative thinking.

Cognitive Load and Multimedia Instructional Design

Cognitive Load Theory (CLT) focuses its argument on the assumption that effective and meaningful learning occurs when the interaction between the architecture of the human cognitive system and the learning environment is understood and accommodated. There is a need to understand firstly, what is

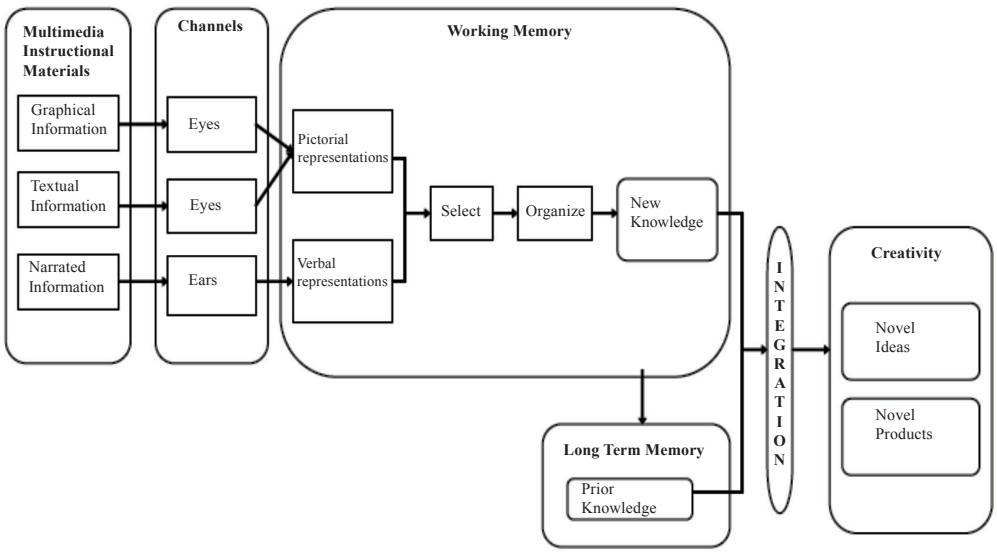

Fig. 1: Framework for the design of multimedia instructional materials to promote creative thinking

involved in building the complex system of human cognition and in what ways the elements function and secondly, how the instructional materials should be designed and developed in order to accommodate this complexity (Cook et al., 2009; Paas and Kester, 2006). CLT posits that the human cognitive system consists of a working memory which is limited in its capacity and duration and the effectively unlimited but schematic long-term memory. Schema is the form in which knowledge in long-term memory is stored, and schema is the categorisation of information according to its manner of use (Sweller et al., 1998). The design of the learning materials should accommodate this structure to ensure that information processed in the working memory can be constructed and transferred into and retrieved from long-term memory without cognitively overloading the working memory (Cook et al., 2009; Paas et al., 2003; Sweller et al., 1998). Appropriate load in the working memory can ensure that students are able to process the interacting elements of information and even process novel ideas in the working memory. Cognitive load in the working memory is therefore an essential part of the human cognitive system that should be considered when designing instructional materials.

According to CLT, there are two types of cognitive load: intrinsic and extrinsic cognitive loads. *Intrinsic cognitive load* refers to the natural load imposed by the complexity and interacting elements of the information which has to be simultaneously processed in working memory. These interacting elements are the different types of information that students have to assimilate from the instructional materials for comprehension, and that the instructors have no control over this load (Ayres and Paas, 2007; Cook et al., 2009; Sweller et al., 1998). *Extrinsic cognitive load* can be further categorised into two: a) extraneous and b) germane cognitive loads. *Extraneous cognitive load* is imposed by design of the instructional materials that can hinder students' understanding whereas *germane cognitive load* is extrinsic cognitive load imposed by instructional materials that can actually foster the learning process (Paas et al., 2007; Sweller et al., 1998). *Fig. 1* shows that both textual and graphical information enter into the cognitive system through the eyes, and the narrated information through the ears. Hence, instructional designers have to ensure that each type of information presented in the instructional materials accommodates the other type. Too much textual information to support a graphical image or narrated information which is not synchronous with the graphics may inflict extraneous cognitive load, and therefore, hinder students' understanding.

Moreover, all the cognitive loads are considered additive in CLT, and together they build the overall construct of cognitive load (Cook et al., 2009; Paas et al., 2007). In order for learning to be maximized, the total load should not exceed working memory capacity. CLT also postulates that learning can be affected by students' individual characteristics. Thus, the design of instructional materials, use of multimedia, complexity of task and even students' characteristics need to be considered to ensure increase in germane cognitive load without increasing extraneous load. When this occurs, schemas can be constructed and transferred into long-term memory, and the interaction between the newly built schemas and previously constructed schemas in the long-term memory may assist in the production or construction of novel ideas.

Principles of Multimedia Instructional Design

Studies of multimedia learning have been conducted for several decades, and the focus has been mostly on the design of the multimedia instructional materials and its impact on students' learning and understanding (Mayer, 2001: 2002). The Cognitive Theory of Multimedia Design which was developed based on numerous studies (Harp and Mayer, 1998; Mayer and Anderson, 1992; Mayer and Chandler, 2001; Moreno and Mayer, 1999; Moreno and Mayer, 2000) lists eight principles of how MIM should be designed. The theory suggests ways to ensure

appropriate load on students' cognitive system so that effective learning can be facilitated (Mayer, 2001: 2002). This paper describes four of the principles (Mayer, 2001: 2002) in relation to the design of the MIM used in the study.

- *Multimedia principle*: Meaningful learning can be attained when the MIM include both relevant pictures and words rather than words alone. This is based on the assumption that pictorial information enters into the cognitive system through the eyes while verbal information enters into the cognitive system through the ears. Therefore, both channels of receiving information should be used effectively so that one channel is not overloaded when only one kind of representation of information is presented (Mayer, 2001: 2002).
- *Contiguity principle*: Meaningful learning can be attained when the MIM presents the animated and narrated information simultaneously rather than sequentially. This is based on the assumption that when both the visual and auditory channels are used to enter information into the cognitive system, the chances are high that matching words and pictures may be in the working memory at the same time. Therefore, learners should be able to construct mental connections between them. Studies of this principle indicated that concurrent presentation between animation and narration increases the temporal processing of the cognitive system, reduces overall cognitive load and positively affect students' retention and transfer (Mayer and Anderson, 1992; Moreno and Mayer, 1999).
- *Coherence principle*: Meaningful learning can be attained when the MIM excludes irrelevant and extraneous words, sounds, and animations. This is based on the assumption that extraneous information may increase the extraneous cognitive load, and therefore, overload working memory. Studies by Mayer and colleagues on the insertion of interesting but irrelevant words and pictures (Harp and Mayer, 1998), or sounds and music (Moreno and Mayer, 2000) showed that understanding was negatively affected.
- *Interactivity principle*: Meaningful learning can be attained when the MIM provides students with the ability to control the presentation rate. This is based on the assumption that user interactivity can reduce the chances of cognitive overload by enabling students to be involved in the cognitive process at their own pace. Studies of this principle revealed that as an instructional technique, pacing could assist students to reduce extraneous cognitive load in their cognitive system because pacing allows students to adapt the multimedia presentation to their own cognitive abilities and needs (Hasler et al., 2007; Mayer and Chandler, 2001; Mayer et al., 2003).

Cognitive Process Leading to Creative Thinking

Due to the complexity and mystery of its nature, different researchers and theorists have come up with different interpretations of creativity. Yet, most of them agree that one of the important criteria in being a creative individual is knowledge, and how a person is able to use new information and connect prior knowledge to produce something original, novel and practical (Amabile, 1998). Therefore, based on the framework in *Fig. 1*, in order to relate CLT and CTMD, we are assuming that the design and development of the MIM should consider the students' cognitive system. Since MIM can include graphical, textual and narrated information, the manipulation of these representations of information should ensure that the MIM creates appropriate load in the cognitive system so that new information can be effectively constructed into the learners' new schemas. Newly constructed schemas can be successfully transferred into long-term memory, or they can be manipulated or integrated in working memory with the existing schemas from long-term memory in order to produce novel ideas. Essentially, to develop MIM that would be

helpful to enhance students' creativity, students' cognitive load (as outlined in CLT) needs to be considered in the instructional design of the MIM (as outlined in CTMD).

METHODOLOGY

The objective of this study was to explore the impact of multimedia instructional materials on engineering students' creative thinking. On the other hand, learner characteristics such as attitudes, learning styles, academic achievement, and gender are also essential factors in both CLT and CTMD that are worth exploring, but for this study the distinction in the creative thinking results were compared against learner characteristics only in terms of one learner characteristics, gender.

Participants

The sample consisted of 27 third year mechanical engineering undergraduates (20 males and 7 females) from an engineering-based university located in Kuantan, Malaysia. The age range of the students was from 21 to 26 (M = 22.22), and they were all enrolled in a Mechanism Design subject, one of the compulsory subjects required for graduation. Third year students were chosen since many creativity theorists postulated that to illustrate creative abilities, knowledge is a component that plays an important part in the process (Amabile, 1998; Sweller, 2009). When the pilot study was conducted, the participants had completed 17 credit hours of the university compulsory courses and 45 – 50 credit hours of program courses. They had also passed the pre-requisite course, Dynamics.

Materials

Fifteen multimedia instructional materials (MIM) were designed and developed based on the content of chapter one of the textbook entitled *Machines and Mechanism: Applied Kinematic Analysis* by David H. Myszka (2005). A computer engineering student from a different university was recruited to design and develop the MIM. The content of the MIM covered concepts from almost 80% of the chapter, and the topics chosen were based on the topics that were outlined in the course syllabus. There were five main topics with individual MIM and two of them contained multiple sub-topics with several MIMs. The length of each MIM ranged from 13 to 86 seconds (M = 33.69).

The design and development of the MIM were based on the four principles of Mayer's (2001) Cognitive Theories for Multimedia Design (CTMD) as described in the earlier section. Three different software tools were used in the development of the MIM. These included software to 1) build the models and animation, 2) edit the audio and the video clips, put the text and sound together, and finally 3) combine all MIM and present them according to chapters, topics and sub-topics in a multimedia program.

Fig. 2 shows the screenshot of one multimedia element. The list of the topics for the chapter appears on the right, and by double-clicking on the topic, the multimedia element could be played. Since studies have shown that interactivity elements can reduce cognitive load (Hasler et al., 2007; Mayer and Chandler, 2001; Mayer et al., 2003), the interactivity principle of the CTMD was applied in the design of this MIM. The students were able to control the multimedia by right-clicking anywhere on window, which causes the menu option to appear. Through this drop-down menu, students were able to pause, play and stop, control the speed and volume and even zoom the multimedia to full screen.

To adhere to the coherence principle, there were also no extraneous images, words or sounds added into the MIM. Even though the list of topics appears on the right, students were able to zoom the multimedia to full screen to solely watch the MIM. The textual information was limited to (i) the identification of the parts of the mechanism, (ii) representation of the mechanism in graphics, and (iii) calculation steps to show the use of equations whenever they were necessary. Both the multimedia principle and the contiguity principle were also applied where animation and narration were presented

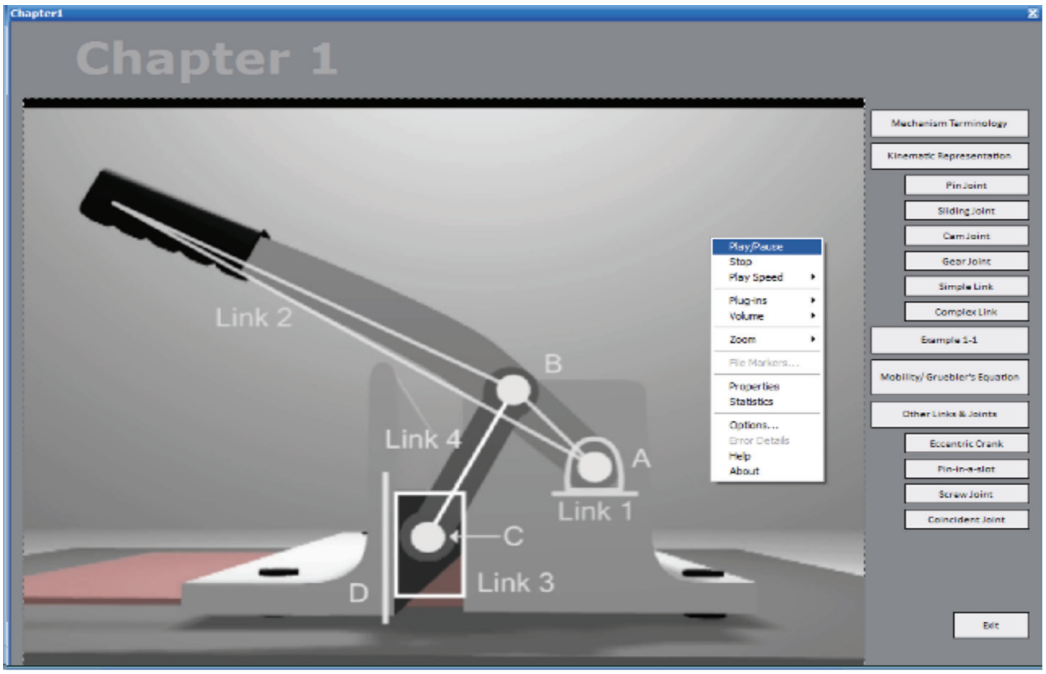

Fig. 2: Screenshot of multimedia instructional materials

concurrently. For instance, while the movement of the mechanism was shown, the explanation of the mechanism was narrated, and sometimes the link would either be highlighted or the graphical representations of the mechanism would be shown.

After the completion of the development of each MIM, the individual multimedia file was sent to the lecturer teaching the course as the content expert to check on the accuracy of the textual, narrated, and graphical representations of information as well as the dynamic representation of the information.

Instruments

Torrance Tests of Creative Thinking (TTCT)

The Torrance Tests of Creative Thinking (TTCT) were developed by E. Paul Torrance and his associates in 1966, and are among the most quoted and referred creative thinking tests. The tests have been renormed several times (Cramond and Kim, 2002) and the latest version of the tests (Torrance, 1998a, b) was used in this study. The creative thinking tests consist of (i) two verbal forms which require respondents to provide answers in words and (ii) two figural forms which require respondents to draw the answers. Both verbal forms (A and B) of the TTCT were used in this study. TTCT verbal form A was used as the pretest, and TTCT verbal form B was used for the posttest. The purpose of using TTCT was to measure whether there was any significant difference in the students' creative thinking as a result of the exposure to the use of the MIM.

The verbal forms of the TTCT contained 6 timed word-based activities which included asking the students to improve a product and provide unusual uses of a common item (Torrance, 1998a, b). The tests measured three elements of cognitive processes of creativity which are fluency (the number of meaningful and relevant responses), flexibility (the diversity of categories of the relevant responses), and

originality (the uniqueness of the responses). All scorings were carried out based on the Scoring Workbook and Norms-Technical Manual (Torrance, 1998c).

Students' interview

A set of semi-structured interview questions in English for the students was also used (*see* Appendix). The purpose of the focus group interview was to find out students' opinions about the use of the MIM, and whether the MIM helped them in their learning or the development of creativity.

Procedures

The study was conducted in the first 5 weeks of the university term. In the first week, in a separate meeting with students during class time, the TTCT verbal form A was administered to all 27 students as a pretest. They then attended their normal weekly lectures (2 meetings x 1 hour), and a lab session (1 meeting x 2 hours). The exposure to the MIM began in the second week of the term in order to avoid the obstacles of the administration and students' registration.

Access to the MIM was during the lab session. Each student was provided with an individual computer and headset. Students were asked to spend the first 10-15 minutes of the class on the MIM, then they could continue with the normal activities during the lab session, which included solving case studies and working on their group project. However, they could refer back to the MIM whenever they needed to. The TTCT verbal form B was administered in a separate session after the fourth lab session as a posttest. Ten volunteer students were interviewed in two focus group interviews with each group consisting of five students.

DATA ANALYSIS

A mixed method approach to the research was used. The quantitative data from the TTCT were analyzed in two ways. Firstly, sample pretest results' for fluency, flexibility, originality, and the overall creativity scores were compared to the sample posttest results. Secondly, the mean scores of all the creative thinking elements of the pre and posttests were compared according to the gender group of the sample. It was hypothesized that the use of the MIM among engineering students would lead to an increase in the overall creative thinking performance as well as in the creative thinking elements.

A paired-samples t-test was conducted to evaluate the impact of using the MIM on students' scores on TTCT elements (fluency, flexibility, originality, and overall creative thinking scores). The quantitative data were then triangulated against the qualitative data from the focus group interview which provided more in-depth information on their learning using MIM.

FINDINGS AND DISCUSSION

Table 1 illustrates descriptively that the posttest scores portrayed an upward trend when compared to the pretest scores for all the elements in the TTCT. All differences were significant. In addition, fluency shows the highest statistically significant increase from the pretest ($M = 77.15$, $SD = 7.466$) to the posttest ($M = 90.41$, $SD = 5.380$), $t(26) = -10.825$, $p < .005$ (two-tailed) compared to the other two elements (flexibility = -11.96, originality = -10.78). A slightly lower mean score difference was reported for the overall TTCT mean score (-12.00). This indicates that the number of answers provided by the students increased considerably, but the production of varied and novel answers was slightly lower. This is most probably attributed to the incongruence between the information represented in the MIM with the type of questions asked in the TTCT. The MIM presented information on concepts of engineering design whereas only two questions in the TTCT dealt with this theme (*see* Appendix for a sample of TTCT questions). We assumed that there is a high chance that students were not able to identify the appropriate schemas from the long-term memory as a result of utilizing the

TABLE 1
Paired samples statistics and test scores of the creative thinking elements and overall creative thinking score

Creative thinking		Pretest		Posttest		
	N	M	SD	M	SD	t-test
Fluency	27	77.15	7.466	90.41	5.380	-10.825**
Flexibility	27	77.56	6.302	89.52	5.041	-11.256**
Originality	27	83.07	11.913	93.85	8.075	-5.570**
Overall (Standard Score)	27	79.30	8.222	91.30	5.915	-8.978**

**$p \leq 0.05$

MIM to manage questions in the TTCT that did not deal with mechanical concepts. Stating so, we considered this to be one of the limitations of the study.

Nevertheless, Table 1 also illustrates that the t-test results exhibited a significance difference between the pretest and posttest for all the creative thinking elements and the overall TTCT result. Generally, such results support the earlier hypothesis that the utilization of MIM could increase engineering students' creative thinking. However, since there were no control groups for comparison, with the sample being tested, it should be noted that we cannot exclude that the difference could have been due to a different variable in the environment other than the MIM such as the nature of the syllabus content which require students to solve case studies which could trigger students' critical and creative thinking or the dynamics of students characteristics namely learning styles or motivational factors.

Although previous studies in multimedia learning have not looked at creative thinking performance, there have been studies that have tested students' transfer performance. Mayer (2001) states that transfer occurs in learning once students are able to understand the new information and transfer it to novel situations. This resonates with the definition of creativity (Amabile, 1998). Studies conducted by Mayer and his colleagues on the principles of CTMD, which use transfer tests showed that students performed better in the transfer test when the multimedia principle (Mayer and Anderson, 1992), contiguity principle (Mayer and Anderson, 1991: 1992), coherence principle (Harp and Mayer, 1998), and interactivity principle (Mayer and Chandler, 2001; Mayer et al., 2003) were effectively applied to the design of the multimedia materials the students used for learning. It should be noted that all the transfer tests in all these studies covered or inquired about the information that had been included in the multimedia presentation. Therefore, since creativity has been commonly defined not only in terms of creative cognitive process, but also as the production of creative ideas and creative products, a means of assessing the creativity of the engineering students in future studies should include assessing the production of engineering products in order to look for the effective transfer of the information represented in the MIM to their constructed products.

The results presented in Table 1 were also supported by the data collected in the focus group interview sessions. In the interviews, most of the students indicated that watching the MIM had helped them to understand engineering concepts better, and to apply the mechanism concepts to create novel ideas and products. Examples of these comments are shown below:

> *S2: The MIM stimulates students' critical thinking about mechanism design, and improve my understanding about the concepts. It helps the students to visualize the motion of the part easily and 100% correct.*

S6: This multimedia file gives me a strong understanding, improve my skills, and give me new experience and new knowledge.

S10: I think the motion and graphics in the multimedia can help me to learn to create device which is new and more complicated.

This indicates that the design of the MIM based on four of the CTMD principles effectively elicited germane cognitive load, which in turn fostered students' understanding and learning. However, one student who was a high achieving student did not agree that the MIM had helped him to enhance his creative thinking; in fact, he stated that it could hinder students' imaginative skills.

S1: It can help the students to imagine the right motion and function of the mechanism, but I think it does not help the students to imagine on their own. It will prevent the students from generating their own imagination skills.

The student's comment indicates that it is worth considering that MIM could also hinder creativity. Some creativity theorists believe that imagination is one of the important factors in creative production (Rhodes, 1987) and generating creative ideas (Milgram, 1990). Some individuals depend on and form their ideas using their imaginative skills. In the case of S1, although the MIM has helped him to understand the mechanism concept, it had prevented him from imagining creatively. In future studies, as mentioned above, students like S1 could make use of their imaginative potential in creating new and novel products. However, since imagination effect is not the focus of this particular study, this phase of the issue will not be discussed further.

It is generally known that the mechanical engineering industry is dominated by males. At the location where the study was conducted, the ratio of the male students to female students was 4:1. Therefore, it would be interesting to find out whether there were differences in the TTCT scores between the genders. Table 2 presents the mean scores for the TTCT results for both pretest and posttest differentiating between the genders.

Generally, Table 2 indicates that 1) the pretest and posttest mean scores of male students were higher than for the female students, and 2) there was an increase in the posttest mean scores for both male and female students for all the creative thinking elements and the overall TTCT results. However, the mean score difference indicates that female students scored higher than the male students for fluency (F = -14.14, M = -12.95), originality (F = -11.43, M = -10.55) and the overall TTCT results (F = -12.42, M = -11.85) whereas it is only for the flexibility mean score (M = -12.15, F = -11.43) that male students scored higher than the female students. This indicates that the use of MIM has helped both male and female students to enhance their creative thinking in the different dimensions of

TABLE 2
Mean scores of the creative thinking elements and overall creative thinking score according to gender

Creative thinking	M Pretest		M Posttest	
	Female (n = 7)	Male (n = 20)	Female (n = 7)	Male (n = 20)
Fluency	73.86	78.30	88.00	91.25
Flexibility	75.86	78.15	87.29	90.30
Originality	79.14	84.45	90.57	95.00
Overall (Standard score)	76.29	80.35	88.71	92.20

creative thinking. The data appears to indicate that it has helped the female students more than the male students. However, there are limitations to the study that need to be considered: 1) the number of students in the sample, 2) the imbalance in numbers between the genders, and 3) the absence of a control group for the sample.

CONCLUSION

Generally, the findings of this study indicate that with appropriate design, the use of multimedia instructional materials may well help suppport creative thinking among engineering students. This in turn might help students to be creative in creating products or solving problems when the opportunities arise.

However, the study has highlighted a few limitations. These limitations and their implications for future studies are discussed below:

1) The design of this study involved only one experimental group of students with no control group for comparison. We suggest that control groups be included in future studies to test the engineering students' use of the MIM on their creative thinking.

2) The data gathered from this study is limited and relied solely on the TTCT results and students' interviews; therefore, we suggest that for future studies, these findings should be supported with transfer tests on the information represented in the MIM, or with the creation of products to measure product creativity. Since the MIM dealt with mechanism concepts, students could be asked to create products by utilizing the mechanism concepts learnt from the MIM.

In summarizing, it is possible that the design of MIM which considers appropriate load on the learner's cognitive system can ensure that new schemas are constructed, and therefore, allow cognitive interaction and manipulation between these new schemas and the existing schemas to produce novel and creative ideas.

REFERENCES

Amabile, T. M. (1998). How to kill creativity. *Harvard Business Review*, *76*(5), 77 -87.

Ayres, P. and Paas, F. (2007). Can the cognitive load approach make instructional animations more effective? *Applied Cognitive Psychology*, *21*, 811-820.

Cramond, B. and Kim, K.-H. (2002). Critique on the torrance tests of creative thinking [Electronic Version] Retrieved October 15, 2008 from http://kyunghee.myweb.uga.edu/portfolio/ review%20of%20ttct.htm.

Cook, A.E., Zheng, R.Z. and Blaz, J. W. (2009). Measurement of cognitive load during multimedia learning activities. In R.Z. Zheng (Ed.), *Cognitive effects of multimedia learning.* (pp. 34-50). New York: Information Science Reference.

De Bono, E. (1990). *Lateral Thinking: A Textbook of Creativity.* London: Penguin Books.

Guildford, J. P. (1950). Creativity. *American Psychologist*, *5*, 444-454.

Harp, S. F. and Mayer, R. E. (1998). How seductive image do their damage: A theory of cognitive interest in Science learning. *Journal of Educational Psychology*, *90*(3), 414-434.

Hasler, B. S., Kersten, B. and Sweller, J. (2007). Learner control, cognitive load and instructional animation. *Applied Cognitive Psychology*, *21*, 713-729.

Mayer, R. E. (2001). *Multimedia Learning*. Cambridge: Cambridge University Press.

Mayer, R. E. (2002). Cognitive theory and the design of multimedia instruction: An example of the two-way street between cognition and instruction. *New Directions for Teaching and Learning*, *89*, 55-71.

Mayer, R. E. and Anderson, R.B. (1991). Animation needs narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology*, *83*(4), 484-490.

Mayer, R. E. and Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology*, *84*(4), 444-452.

Mayer, R.E. and Chandler, P. (2001). When learning is just a click away: Does simple user interaction foster deeper understanding of multimedia messages? *Journal of Educational Psychology*, *93*(2), 390-397.

Mayer, R. E., Deleeuw, K. E. and Ayres, P. (2007). Creating retroactive and proactive interference in multimedia learning. *Applied Cognitive Psychology*, *21*, 795-809.

Mayer, R. E., Dow, G. T. and Mayer, S. (2003). Multimedia learning in an interactive self-explaining environment: What works in the design of agent-based microworlds? *Journal of Educational Psychology*, *95*(4), 806-813.

Milgram, R. M. (1990). Creativity: An idea whose time has come and gone? In M. A. Runco and R. S. Albert (Eds.), *Theories of creativity* (pp. 215-233). London: SAGE Publications.

Moreno, R. and Mayer, R.E. (1999). Cognitive principle of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology*, *91*(2), 358-368.

Moreno, R. and Mayer, R.E. (2000). A coherence effect in multimedia learning: The case of minimizing irrelevant sounds in the design of multimedia instructional messages. *Journal of Educational Psychology*, *92*(1), 117-125.

Myszka, D. H. (2005). *Machines and Mechanisms: Applied Kinematic Analysis* (3rd Ed.). New Jersey: Pearson Prentice Hall.

Paas, F., Gerven, P. W. M. V. and Wouters, P. (2007). Instructional efficiency of animation: Effects of interactive through mental reconstruction of static key frames. *Applied Cognitive Psychology*, *21*, 783-793.

Paas, F. and Kester, L. (2006). Learner and information characteristics in the design of powerful learning environments. *Applied Cognitive Psychology*, *20*, 281-285.

Paas, F., Renkl, A. and Sweller, J. (2003). Cognitive load theory and instructional design: Recent developments. *Educational Psychologist*, *38*(1), 1-4.

Rhodes, M. (1987). An analysis of creativity. In S. G. Isaksen (Ed.), *Frontiers of creativity research* (pp. 216-222). New York: Bearly Limited.

Seufert, T. and Brünken, R. (2006). Cognitive load and the format of instructional aids for coherence formation. *Applied Cognitive Psychology*, *20*, 321-331.

Sweller, J., van Merrienboer, J.J.G. and Paas, F.G.W.C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, *10*(3), 251-295.

Sweller, J. (2009). Cognitive bases of human creativity. *Educational Psychology Review*, *21*, 11-19.

Torrance, E. P. (1998a). *Thinking Creatively with Words: Verbal Response Booklet A*. Bensenville: Scholastic Testing Service, Inc.

Torrance, E. P. (1998b). *Thinking Creatively with Words: Verbal Response Booklet A*. Bensenville: Scholastic Testing Service, Inc.

Torrance, E. P. (1998c). *The Torrance Tests of Creative Thinking Norms-Technical Manual Verbal (Streamlined) Forms A and B*. Bensenville: Scholastic Testing Service, Inc.

Zheng, R. Z. (2009). (Ed.). *Cognitive Effects of Multimedia Learning*. New York: Information Science Reference.

APPENDIX

Students' Interview Questions

The purpose of conducting the students' interview is to further understand their opinions on the use of multimedia instructional materials (MIM) and in what way have the MIMs helped them in their learning or the development of creativity

1. Do you know what creativity is? Can you define creativity?
2. What do you understand about creative thinking?
3. How frequently have you referred to the MIM during your lab session?
4. Can you generally describe your experience of using the MIM?
5. In your opinion, how have the MIM helped you with your learning and understanding?
6. Do you think using MIM has any positive impacts on your learning? Why? In what way has it affected you?
7. Do you think using MIM has any influences on your creativity? Why? In what way has it influenced you?
8. What are the characteristics of the MIM that has helped with your learning and your creativity?

Torrance Tests of Creative Thinking (TTCT) Sample Question

Unusual Uses (Tin Cans)

Most people throw away their tin cans, but they have thousands of interesting and unusual uses. List as many of these interesting and unusual uses as you can.

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Talking Stones: Facilitating Early Childhood Teachers' Thinking

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ABSTRACT

This article provides a brief exploration of three early childhood teachers' thinking when engaging with the pedagogical tool "Talking Stones". The data arises from a qualitative study investigating early childhood teacher learning in an Australian independent co-educational school. This study was a twelve-month participatory action research project involving three early childhood teachers and the researcher. The early childhood teachers designed their learning for this project drawing on the cyclical process of action research: planning, acting, observing, reflecting, and replanning. The project involved the teachers meeting on a monthly basis where they discussed and refined their use of Learning Stories as a tool to enhance their practice as early childhood teachers. The researcher also conducted a pre-project interactive group interview utilizing the pedagogical tool 'Talking Stones'. This pedagogical tool was employed to open up the discussion prior to commencing the project and to assist with triangulation of data. This paper only reports the use of the pedagogical tool. Initial findings indicate that Talking Stones disrupted familiar patterns of talk amongst these teachers and thereby facilitated the verbalizing of internal thinking and a deep-level of reflexivity. Insights into the use of the pedagogical tool are discussed and conclusions drawn about the possibilities of its use to facilitate early childhood teachers' thinking.

Keywords: Feminist poststructuralist, interactive interview, qualitative methods, reflective practice, teacher identity, teacher thinking

INTRODUCTION

Research on "teacher thinking" has long demonstrated that teachers develop and hold implicit theories about learning and teaching (Clark, 2005). Clark (2005) notes that "teachers' implicit theories about themselves and their work are thought to play an important part in the judgement and interpretations that teachers make everyday" (p.180). Yet, despite this being the case, research on teacher thinking has found that teachers find it difficult to articulate their implicit theories (Buchmann, 1990; Clark, 1995: 2005; Denicolo and Kompf, 2005; Kompf and Denicolo, 2003; Pope, 1993).

Clark's (2005) research has highlighted that teachers' implicit theories are in "fact robust, idiosyncratic, and sensitive" (p.180) to particular contexts. At the same time his research has shown that these implicit theories are "incomplete, familiar, and sufficiently pragmatic" (p.180) and provide the teacher with a basis upon which they enact their daily practice in the classroom. However, what Clark (2005) asserts is that without a clear articulation of these theories teachers may never fully realise the impact that they have upon their perception, interpretation, and judgement of their practices. The danger here he says is that teachers may never fully appreciate the "potentially important

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consequences" (p.180) that their implicit theories can have in their teaching practice. Pope (1993) identifies this danger by stating that teachers' implicit theories are not neat reproductions of educational theories; rather they are an *eclectic* collection of ideas and understandings drawn from personal experiences of teachers' daily life in the classroom.

In reading the literature, however, it also becomes clear that research on teacher thinking has tended to maintain a narrow definition (Clark, 2005; Denicolo and Kompf, 2005; Kompf and Denicolo, 2003). Most definitions for teacher thinking have focused specifically on decision making processes. This is said to be largely the result of the significant influence of process-product research (Berliner, 2005; Buchmann, 1990; Calderhead, 1993). This narrow research focus may explain the reason why research to date reports that teachers find it difficult to articulate their implicit theories. Maybe the focus has been too narrow and thus prevented teachers from engaging in conversations that would facilitate their articulation of their implicit theories.

This narrow research focus in terms of the discourses within teacher thinking highlights a potential gap. As Elbaz (1990) explains, the narrowing of the research focus when examining teacher thinking automatically determines and narrows the categories by which the research is organised. Yet by shifting the focus away from this process-product model to research that is able to encompass processes such as imaging, remembering, interpreting, judging, caring, feeling and contemplating, new insights into teacher thinking may be possible (Buchmann, 1990).

Britzman's (1988) paper further highlights this need for an opening up of this narrow research focus. She claims that the last 50 years of research on teachers has done little in the way of opening up of 'imaginative' spaces. Instead the focus has been on 'teacher effectiveness' due to a dominance of positivist research approaches (Britzman, 1988). This problem is aggravated by Elbaz's (1990) claim that there has been a sheer absence of teachers' voices within the research on teacher thinking. An absence that is stated to be a significant factor when considering the assertions made within the research on teachers and their inability to articulate their thinking (Elbaz, 1990). What is being argued here is that this absence, or what has been described elsewhere as a silencing of teachers' voices, has had a significant impact on research approaches, and therefore, has limited research insights into teacher thinking (Cole, 1997; Elbaz, 1990; McAninch, 1993).

Therefore, there is a need for research that will address this gap and support teachers in engaging in the type of thinking that Buchmann (1990) describes as a certain staged freedom to think. This is thinking that is said to collapse spatial distances; anticipates the future whilst thinking about the present and remembering the past as though it were still the present (Buchmann, 1990). The rationale for this study was therefore to privilege the voices of these three early childhood teachers as they engaged in learning in an effort to address this gap in the research on teacher thinking. In doing so it is anticipated that this study is significant as it has the potential to further inform the current research on teacher thinking.

THEORETICAL AND METHODOLOGICAL CONSIDERATIONS

Feminist poststructural notions of identity can assist in understanding 'teacher thinking'. Feminist poststructural notions of identity firmly locate the centrality of a teacher's professional identity and its links with their daily work as a teacher as being paramount (Day, Kington, Stobart and Sammons, 2006; Drake, Spillane and Huffred-Ackles, 2001; Geijsel and Meijers, 2005). As Stronach, Corbin, McNamara and Stark (2002) note; teachers are intricately 'bound up' in the discursive dynamics of the profession as they work on a daily basis attempting to 'address' and 'redress' the difficulties of the job. Placing this very tension as a central aspect of the lived experience of teaching would probably open up a space for the realisation that

teacher thinking "is never complete, never fully coherent, never completely centered securely in experiences" (Zembylas, 2005, p.938). Rather, teacher thinking is something that is always being "produced, negotiated, and reshaped" (Zembylas, 2005, p.938).

Britzman (2003) argues that teachers are required to engage in a form of negotiation on a daily basis as they perform their work within the multiple discourses of school life. In describing this school life as a "broken and uneven place" McWilliam (1994) claims that it is important to create opportunities for teachers to engage in the type of conversations that permits the unpacking of these discourses. The assertion here being that in failing to recognise the complexity of the lived experiences of teachers is a failure to recognise and understand the complex nature of teaching and therefore teacher thinking. Understanding and recognising these tensions and the centrality of a teacher's identity could very well be one of the central categories that have so far been overlooked within research on teacher thinking.

My research has been largely informed by feminist poststructural theories as I sought to better understand teacher thinking. In reading work informed by such theories I found myself unsettling the concept of teacher thinking and how it is created within the tensions of teachers' daily life in school (Davies, 1994; St Pierre, 2000; Stronach et al., 2002; Zembylas, 2003: 2005). As such I sought to develop a research project that would honour the lived experiences of teachers as they engaged in processes designed to facilitate 'teacher thinking'.

METHODOLGY

This research was a 12-month qualitative participatory action research project that took place in an independent co-educational school in Australia. Designing this participatory action research the work of McNiff and Whitehead (2006) was influential. They advocate an action research design that permits the project to evolve in a manner that is responsive to the context and the learning of the participants as it unfolds. Therefore, the design of this participatory action research engaged with a generative cyclical process of action research (McNiff and Whitehead, 2006).

Data collection techniques were developed with the knowledge that the power of participatory action research lies in the concern for the relationship between the social and education theory and practice (Kemmis and McTaggart, 2005). Furthermore, the trustworthiness of participatory action research is closely tied to the skills of the researcher (McNiff, 1988). I drew upon the work of Richardson (Richardson and St.Pierre, 2005) and her term 'crystallisation' rather than 'triangulation' in the design process. Consequently the qualitative data collected consisted of five main sources: pre-project interview using the pedagogical tool Talking Stones; audio taping and verbatim transcribing of group discussions; development of and trialling of professional resources; professional reading responses; journal entries; and my own research journal and field notes.

Participants included three early childhood teachers and me, as both the researcher and a teacher working within this school. My role at the school at this time was the Support Service teacher involved in working with all teachers across the junior area of the school, for example, from early childhood through to Year 6.

At the time of commencing the project, the school had recently introduced Professional Learning Communities into its policy for teacher professional development. The school had drawn heavily on the work of seminal writers on Professional Learning Communities (DuFour and Eaker, 1998; DuFour, Eaker and DuFour, 2005; Senge, 1994; Senge & Society for Organizational Learning, 2005). In drawing on this work the school had established the requirement for Professional Learning Communities to align professional learning goals with school priorities.

The project was therefore designed around the procedures already in place by the school. This included the three early childhood teachers establishing with the school leadership the aim of their Professional Learning Community; that being to explore the work of the New Zealand

Ministry of Education early childhood national curriculum; Te Whäriki, and specifically the use of Learning Stories. Learning stories were seen by these early childhood teachers as a tool that had the potential to facilitate the articulation of their practices and therefore their thinking. This was also an aim that aligned with the school's priority in its work to become recognised as a Mindful school (Kallick and Costa, 2004a, b). The project design involved the teachers participating in a pre-project interactive interview (Maxwell, 2005) using the pedagogical tool Talking Stones to commence the project. They then met once a month over the course of 12 months whereby each meeting included a discussion about the learning they had engaged in over the course of the month. The content of these meetings included the discussion of professional readings undertaken, reviewing and discussing the Learning Stories developed, a discussion of highlights and difficulties encountered in their learning, and a reviewing of their learning aims.

The decision to commence this project with a pre-project interactive interview (Maxwell, 2005) using the pedagogical tool 'Talking Stones' was based on my acknowledgement of my positioning as the researcher. I wanted to establish trustworthiness through an investment in the relationships that I established with these three early childhood teachers (Hendry, 2007). To do so I knew I needed to 'walk with' these early childhood teachers in order to position myself as the embodied, self-consciously reflexive, partial knower, neither an 'insider' nor an 'outsider' (Richardson, 1997, p.185). Thus I made the decision to use Talking Stones for the pre-project interview.

Talking Stones is a pedagogical tool derived from the techniques used in Personal Construct Psychology (Kelly, 1955), adapted by Crosby (1993), and further modified by Wearmouth (2004). Personal Construct Psychology being a theory of personality developed by the American psychologist George Kelly (1955) who based his theory on the premise that people develop constructs as internal ideas of reality in order to understand the world they live in. Talking Stones, arising out of this psychology, has proven to be a powerful projective technique that encourages dialogue and facilitates thinking (Wearmouth, 2004). In fact, Wearmouth (2004) claims that Talking Stones as a pedagogical tool is deeply rooted in the notion of reflexivity. Therefore, she argues that Talking Stones is able to facilitate the articulation of such things as imaging, remembering, interpreting, judging, caring, feeling, and contemplating. This is said to be due to Talking Stones flexibility and thus its ability to enable those engaging with this tool to place meaning into concrete objects "which have no intrinsic meaning themselves apart from their own stone-ness" (Wearmouth, 2004, p.11).

Engaging with Talking Stones involved providing a selection of stones of various shapes, sizes, textures, and colours that were then used by the three early childhood teachers and myself as objects to represent our thinking. I invited the three early childhood teachers to make a selection of stones that they felt represented their current thinking about their practice and the learning they were about to engage in. As selections were discussed the stones were placed upon a cloth in which the borders represented a boundary and the cloth the potential journey of the Professional Learning Community. As the process evolved initial stone selections were built upon. Movement of the stones also took place during the discussion to illustrate proximity and importance of the various stones and what they were representing. Photos of the stones were taken as a visual record to compliment the verbatim transcripts.

Data analysis of the verbatim transcripts of this pre-project interactive interview was achieved by reading and re-reading the transcript to identify themes and to assist in the writing of analytical memos and the categorising of data into theoretical concepts (Maxwell, 2005). Drawing on a number of key works, these procedures were used as a tool to address my own subjectivities as a researcher and to obtain findings that are valid and reliable (Anderson, Herr and Nihlen, 2007; Guba and Lincoln, 2005; Feldman, 2007; Richardson, 1994; Richardson and St.Pierre, 2005; Glesne, 1997).

In presenting a discussion on the findings, I am conscious that the choices I make in how I write are heavily influenced by my own theoretical framings. I am aware that my aim is to tell a new story on teacher thinking; a story of teachers as they worked within the structures of a school. Therefore, my discussion will present a story that openly acknowledges the ungraspable meanings whilst also being concerned with the complexities, limitations and paradoxes within the story (Lather, 2007). Thus I present this discussion on the data arising out of the use of Talking Stones as a 'collective narrative' (Richardson, 1997). It is a narrative that presents the lived experiences of these early childhood teachers collectively, whilst acknowledging and respecting the untidiness and fragmentation of their daily lives within this school. This was a decision I made as I grappled with the challenge of re-presenting the lives of these early childhood teachers as the researcher and writer. Yet this decision to present a collective narrative has been made in the hope of making this task of re-presentation possible whilst remaining accountable to the lives of these three early childhood teachers (Visweswaran, 1994).

FINDINGS AND DISCUSSION

Picking up a stone that reveals an array of lines and cracks, she begins to explain:

> *"I was drawn to this one...I kind of feel like this work...in lots of ways has put cracks in my practice in terms of, challenged my thinking, and it is taking me on a new journey". Her thinking unfolds further as she places a new stone down; a stone that has a glassy, smooth surface and intricate lines of colours, its formation is beautiful. "This, this is a beautiful stone, it is really perfect and it is a beautiful blend. And I guess it kind of represents, for me, where I would like our practices to move towards"*

Cracks emerged from the analysis of data as a key theoretical concept. However, why cracks? In attempting to answer this question the selection of stones that were chosen and the ones drawn upon when talking about cracks assists here. The stones and their physical formations were facilitating the articulation of these thoughts; each stone being referred to when articulating notions of cracks within their practice had physical cracks within its surface. So here the physicality of the stones with their cracks and complex colouring were being used as a means of talking about the complexity of teaching. This accords with Wearmouth (2004) assertion that Talking Stones enables individuals to invest meaning in the concrete object. These early childhood teachers were investing meaning in the stones which had no intrinsic meaning other than their own stone-ness.

In reflecting on this finding of cracks as a key concept Stronach and MacLure (1997) speak about 'openings' in writing their introduction to a book on poststructuralism. They speak about openings as beginnings, or a crack, or a "violent opening such as a rupture or an incision" (Stronach and MacLure, 1997, p.1). Furthering this concept of an opening they describe openings as "not really a breach in the line at all, but just a kind of complication of it. A sort of fold or pocket" (Stronach and MacLure, 1997, p.1). Taking up this concept of a crack as just a sort of "fold or pocket", then, assists in bringing to light the empowering nature of exploring this finding of cracks. The cracks are enabling the early childhood teachers to engage in a type of conversation that is opening up new patterns of dialogue. Maybe a conversation that could be likened to Buchmann's (1990) description of a certain staged freedom to think that collapses spatial distances; anticipates the future whilst thinking about the present and remembering the past as though it were still the present (Buchmann, 1990).

> *Through the act of picking up a stone that has a white strip down the middle with black along the outer edges and*

some small visible cracks along its surface, an unfolding of the past and the future commences: "I picked up this one and I almost saw that as a pathway with a fork in the road. And for me...coming here has been very much a fork in my road. And probably that's practice wise as well as personally. I've certainly chosen to go with my personal philosophy regardless of what...I guess what the ramifications were of that. But to actually stand up and sort of really say to myself that no...I believe in working in a certain way and I'll pursue that instead of being somewhere I couldn't do that".

Here there is a reaching into thinking about what has happened and what has not happened. Britzman (2003) argues that the act of being able to align ones practice with a personal philosophy is difficult due to the contextual demands made upon a teacher. It is a difficulty that causes tensions within a teacher's practice yet is rarely discussed (Britzman, 2003). However, this stone has not only brought about an articulation of this difficulty that Britzman speaks of, the findings also show that it has permitted an exploration of the concept of 'childhood'. This is an important concept for early childhood teachers and one that must be made explicit to better understand the impact that this has upon a teacher's practice (Blaise, 2009; Mac Naughton, 2005).

"I guess in just the child and I quite like the white child with the black background. I think that stands for, umm, that sort of, umm not, well it is innocence I guess. But sort of that freshness that children bring to my life"

Here this finding of cracks as a sort of "fold or a pocket" is facilitating an articulation of an implicit theory of the concept of childhood. The literature demonstrates that early childhood teachers are discursively bound up in the historical discourses that have produced fixed notions of childhood (Blaise, 2009). However, there is reflexivity evident here brought about by the colours within the stones. There is a struggle to articulate exactly what this understanding of the concept of childhood involves; does it involve innocence? This questioning is a necessary aspect if early childhood teachers are to enter into the type of thinking that breaks free of these historical discourses (Blaise, 2009).

In unpacking this finding of cracks further I am mindful that the very act of 'becoming a teacher' is an ongoing process; a process that involves "struggles...to borrow, to negotiate, to claim ownership, and to take up that which seems already complete" (Britzman, 2003, p.54). However, it is a process that also begins to make possible the realisation of the power of embracing these cracks.

"I think in lots of ways the fact that we are prepared to embrace our cracks and all of that. We don't take ourselves too seriously...And I was just thinking of the practice that I have come from. It was smooth and you ticked the boxes... and there was no room for creativity, no room for real personality...and underneath though the cracks were not good cracks they were actually quite dangerous cracks to have underneath the surface. But these, these cracks are just almost like that webbing, that branching out, and where can you go from here and where can it lead...Its alive!"

The cracks have become a way of acknowledging not only their vulnerabilities as early childhood teachers but also how these vulnerabilities hold potential for learning. An awareness of, and an articulation of, the idea that some form of 'fracturing' is normative and not unexpected within teachers practice has been expressed (Zembylas, 2005). This is in keeping with the literature that highlights the importance of breaking free of notions of teaching that fail to recognise its complexities. Britzman (2003)

in particular claims that much of this complexity is denied in most accounts of teacher thinking. Yet there is a growing body of research that is now highlighting that teaching, including the act of engaging in learning and thinking, is an embodied act, and therefore, there must be a recognition of these vulnerabilities (Green and Reid, 2008).

Moving out beyond this concept of cracks and into the "folds and pockets" a further finding emerges; a fork within the road. Already there have been stones representing a fork within the road; *"coming here has been very much a fork in my road"*. The "folds and pockets" living within these cracks provides a sense of travelling or journey as these early childhood teachers articulate their current practice and where they see that this project is taking them.

> *"And I guess this one, I was drawn to this one because it is really perfect and a beautiful rock, a beautiful blend of all of those things and I guess it kind of represents for me where I would like our practice to move towards."*

However, to speak of perfection raises tensions that are said to be ever present in the practice of teaching (Britzman, 2003); tensions that are rarely talked about or recognised. In fact, Britzman (2003) says that there is a 'surprising force of uncertainty' within education that is repressed and denied in many ways. Thus, with this repression there arises a sense of single-handed responsibility to create a sense of perfection in one's practice (Britzman, 2003).

Choosing a stone with colours that are intricately interwoven creates a sense of perfection. She exposes her thinking before her colleagues. This is risky business, not a normal pattern of talk. Talk patterns have shifted. With this shift 'perfection' comes under analysis.

> *(Researcher): "Do you think you have to get to this one? This perfect rock?"*
>
> *(ECT 1): "Umm, I don't know because, and I am not under valuing what we are currently doing because what we are doing at the moment is great. And this is beautiful...this is a beautiful rock also. But I still think at the moment we are at that turning point."*
>
> *(ECT 2): "Maybe it is the cracks. They make it alive."*
>
> *(ECT 1): "I think in lots of ways the fact that we are prepared to embrace our cracks, and all of that..."*
>
> *(ECT 2): "And do you want it? Perfection? Because sometimes it is that mix and match of bringing in and all of that; that's what makes it alive!"*

Through the investment of meaning in these stones and their physical characteristics a discussion has taken place that has made visible the tensions that are ever present within a teacher's practice yet rarely articulated (Britzman, 2003). Perfectionism has been brought under examination by these two early childhood teachers here in the excerpt. The first early childhood teacher (ECT 1) expresses her need to reassure the other two that she is not undervaluing what they are doing, but rather, they are about to engage in a project that will have them thinking about their practice in a manner that will potentially bring about change; a turning point. The second early childhood teacher (ECT 2) shifts the focus on cracks as something that is lacking in their practice to something that potentially can bring about new learning and thinking: it's alive. This sees ECT 1 acknowledge that maybe it is not about perfectionism within her practice but rather an acknowledgement of the many influences that are contributing to their practices as early childhood teachers working together within this context. This exploration of perfectionism could thus be seen as bringing about a sense of purpose; a sense of agency (Britzman, 2003).

> *Reaching back into the bowl containing the stones a new stone is chosen and*

the journey continues along the fork in the road. "I was looking at this and I got it out as you were talking. It sort of brought up, well...I have been through so many changes...and I am in an interesting place...I feel like I am going into a new stage of my practice...I don't quite know what my purpose is at the moment."

Through the act of listening and looking at the stones in the bowl the articulation of these tensions within the journey of teaching has become possible. An articulation that highlights the tensions that Britzman (2003) talks about in relation to the negotiation that teachers undertake on a daily basis as they live and work within the multiple discourses present within a school. Arising from this tension though is the possibility for connections to be made as the idea of links between the forks within the road is explored.

"I am excited. If this is the school at the centre of this...you have chosen to be a link between this and this and what I see as our practice here. But it has taken a long time for me to get to a place working in this room where I have felt a sense of, I guess, respect for the work that we do. And I think that you've been a really strong advocate for that. And so I am happy that you've chosen to be a link between this world and this world."

The stones have become a means of articulating this negotiation that Britzman (2003) speaks of. They have become a means of finding agency within the competing discourses operating in the school through the idea of links between the stones and their placement upon the cloth. This has also uncovered and made visible a deep questioning of identity; *"it has taken a long time for me to get to a place...where I have felt a sense of...respect for the work that we do"*. The stones with their cracks and forks in the road have highlighted the centrality of a teacher's professional identity and its links with their daily work (Day et al., 2006). This is an articulation of practice that emphasises the manner in which a teacher's identity is always being "produced, negotiated and reshaped" (Zembylas, 2005).

With this understanding of a teacher's identity always being in the process of being produced, never centred securely in experience, Zembylas (2005) reminds us that tensions and struggles are the norm, not the exception. This becomes evident with a further unpacking of forks in the road and a leading into the concept of turning points:

"I am not under valuing what we are doing...but I still think at the moment we're at that turning point where we are drawing on new ideas. And being team leader...maybe some of this stuff is about my leadership role and a bit like you were saying about, well where do I fit into respecting everyone's philosophies and making sure we get a nice meld of a team. Where everyone feels valued... and everybody's philosophies are privileged and that we've got a nice melting pot of a team."

There is an articulation of the tensions associated with leadership. A certain questioning is taking place about leadership and the positioning of each member within this team. There is a desire to ensure all members are empowered to feel valued and respected. Within this there is evidence of identity work taking place through the enactment of a form of leadership that will make available space for the accommodation of the diversity of philosophies amongst these three early childhood teachers. Without the use of this pedagogical tool would such an articulation been possible? Drawing on Britzman (2003) who states that this form of conversation is rarely articulated, rather it remains as an internal dialogue and an ongoing tension, then I would assert that Talking

Stones has opened up this space and shifted an internal dialogue to an explicit conversation on leadership between these three early childhood teachers.

This finding is further strengthened when examining the perusing discussion. These three early childhood teachers begin to explore where they hope this work will take them in their practice.

> *"In relation to the school...this is the school? We talk a lot about visible learning, I guess I would really like to see more visibility...of the children's work and learning. So both ways, going more both ways....I just see really beautiful possibilities with things like shared reading, older children documenting the work of the younger, you know, that influence....It is happening already...with you...but its a huge untapped resource, the school. That's so exciting to me. There's all sorts of life going on in the school...so many people to have relationships with to become a real community....we're at a really exciting place....and if all I can do with having a connection and you as that link person is to change one teacher's image of the child, slightly, then you know that's amazing. How exciting!"*

This is an articulation that resonates with Buchmann's (1990) work as she questions whether teaching belongs to the active or contemplative life. By drawing on the work of Aristotle, who noted that an ability to teach is an indication of learning which traditionally has been associated with wisdom and truth, Buchmann maintains that teaching must belong to the contemplative life. Contemplating on what lies ahead can develop a vision and convey a desire to enter into dialogue with others. This focus on entering into a dialogue with others is a necessary object of contemplation (Buchmann, 1990). Being able to share what one delights in, is what Buchmann (1990) says, learners yearn for. Through this very act of contemplation it becomes possible to maintain that teacher thinking is a far greater act than that which can be captured in process-product research. In fact, Buchmann (1990) asserts that the life of teaching and the thinking associated with it must "[proceed] from the fullness of contemplation" (p.54).

CONCLUSION

Extricating the exact nature of this pedagogical tool Talking Stones that enabled teachers to articulate their thinking is difficult. Yet, Talking Stones did prove to be a powerful technique within this context. Talking Stones did disrupt familiar patterns of talk that facilitated these early childhood teachers in engaging in new ways of articulating their thinking. Meaning was invested in the cracks and the colouring within the stones. Investing meaning in the stones in this manner saw an opening up of dialogue and thinking. Much of this discussion could be seen as unsettling. However, as Britzman (2003) clearly demonstrates in her work this is a necessary requirement if teachers are to better understand their own practice and therefore their implicit theories guiding their practice. Thus the implication here is that Talking Stones as a tool used in research on 'teacher thinking' can begin to address this gap.

Furthermore, Talking Stones within this context has highlighted how education is a 'broken and uneven place' (McWilliam, 1994). The findings of cracks made visible the manner in which these early childhood teachers' identities were produced, negotiated, and reshaped as they lived out their practices within this independent school. However, the exact nature of Talking Stones and how they brought about the unfolding of this narrative remains elusive. Why stones? They are nothing more than just that – stones. This is a question that Wearmouth (2004) also asks at the conclusion of her paper whereby she acknowledges that the stones are nothing more than an object that has no other meaning other than their own stone-ness?

I can only draw on the work of Wearmouth (2004) here to begin to address such questions. So far I have been unable to locate any other available research that has adopted this technique. Wearmouth (2004) reports that the flexibility of the pedagogical tool is achieved when individuals are able to invest meaning in the stones. The texture, size, shape and colour enhance the investment (Wearmouth, 2004). The importance of reflexivity in Personal Construct Psychology is also noted (Kelly, 1955, cited in Wearmouth, 2004). As such, it is a psychology of interpersonal understandings as opposed to a psychology of common understandings (Wearmouth, 2004). Knowing this correlation it becomes feasible to see that the stones brought about reflexivity and a focus on interpersonal understandings. They also brought about an articulation of internal thinking; thinking that has been attributed to the development of teachers' implicit theories about teaching and learning. Implicit theories that are said to play a critical role in how teachers enact their daily practice (Clark, 2005). Therefore, the relevance of the findings here are that if future research on teacher thinking is going to begin to address the gap as identified by others in the literature (for example: Clark, 2005; Denicolo and Kompf, 2005; Elbaz, 1990), then the importance of employing a tool that can facilitate the articulation of implicit theories is critical. The silencing of teachers' voices in the research has only to date limited research insights into teacher thinking (Cole, 1997; Elbaz, 1990; McAninch, 1993). This paper has begun to address this very area.

In conclusion then I consider this pedagogical tool Talking Stones to have enabled these early childhood teachers to engage in deep thinking and reflexivity. Yet I acknowledge that it is only one small study with three early childhood teachers. However, it has shown the use of Talking Stones has supported these three early childhood teachers to commence the difficult task of articulating and unpacking their practice and thinking prior to commencing this participatory action research project. Talking Stones in this context was therefore effective in creating a certain staged freedom to think that Buchmann (1990) says is critical. This is a type of freedom to think that may open up the research on teacher thinking and begin to address the limitations and the gaps that have been identified within this body of research. In making this known I conclude by drawing on the work of those who are also calling for research that supports teachers engaging in the type of thinking that will move beyond simple process-product research to research that permits teachers to imagine, remember, interpret, judge, care, feel and contemplate (Britzman, 2003; Day et al., 2006; Zembylas, 2005). Only then may new insights into teacher thinking become possible (Buchmann, 1990).

REFERENCES

Anderson, G. L., Herr, K. and Nihlen, A. S. (2007). *Studying your Own School: An Educator's Guide to Practitioner Action Research*. Thousand Oaks, CA: Corwin Press.

Berliner, D. (2005). The place of process-product research in developing the agenda for research on teacher thinking. In P. Denicolo and M. Kompf (Eds.), *Teacher thinking and professional action* (pp. 3-15). New York: Routledge.

Blaise, M. (2009). Revolutionising practice by doing early childhood politically. In S. Edwards and J. Nuttall (Eds.), *Professional learning in early childhood settings* (pp. 27-47). Rotterdam: Sense Publishers.

Britzman, D. P. (1988). Essay review - On educating the educators: Critical studies in teacher education. *Harvard Educational Review*, *58*(1), 85-94.

Britzman, D. P. (2003). *Practice Makes Practice: A Critical Study of Learning to Teach* (Rev. ed.). Albany: State University of New York Press.

Buchmann, M. (1990). How practical is contemplation in teaching? In C. Day, M. L. Pope and P. Denicolo (Eds.), *Insights into teachers' thinking and practice* (pp. 43-56). London; New York: Falmer Press.

Calderhead, J. (1993). The contributions of research on teachers' thinking to the professional development of teachers. In C. Day, J.

Calderhead and P. Denicolo (Eds.), *Research on teacher thinking: Understanding professional development* (pp. 11-18). London; Washington, D.C.: Falmer Press.

Clark, C. M. (1995). *Thoughtful Teaching*. New York: Teachers College Press.

Clark, C. M. (2005). Asking the right questions about teacher preparation: Contributions of research on teacher thinking. In P. Denicolo and M. Kompf (Eds.), *Teacher thinking and professional action* (pp. 177-188). New York: Routledge.

Cole, A. L. (1997). Impediments to reflective practice: Toward a new agenda for research on teaching. *Teachers and Teacher Education*, *3*(1), 7-27. doi: 10.1080/1354060970030102.

Crosby, S. (1993). *Unpublished Manuscript*. Centre for Personal Construct Education, London.

Davies, B. (1994). *Poststructuralist Theory and Classroom Practice*. Geelong, Vic.: Deakin University Press.

Day, C., Kington, A., Stobart, G. and Sammons, P. (2006). The personal and professional selves of teachers: Stable and unstable identities. *British Educational Research Journal*, *32*(4), 601 - 616.

Denicolo, P. and Kompf, M. (2005). *Teacher Thinking and Professional Action*. London; New York: Routledge.

Drake, C., Spillane, J. P. and Huffred-Ackles, K. (2001). Storied identities: Teacher learning and subject-matter context. *Journal of Curriculum Studies*, *33*(1), 1-23.

DuFour, R. and Eaker, R. E. (1998). *Professional Learning Communities at Work: Best Practices for Enhancing Student Achievement*. Bloomington, Ind.: National Education Service.

DuFour, R., Eaker, R. E. and DuFour, R. B. (2005). *On Common Ground: The Power of Professional Learning Communities*. Bloomington, Ind.: Solution Tree.

Elbaz, F. (1990). Knowledge and discourse: The evolution of research on teacher thinking. In C. Day, M. L. Pope and P. Denicolo (Eds.), *Insights into teachers' thinking and practice* (pp. 15-42). New York: Falmer Press.

Feldman, A. (2007). Validity and quality in action research. *Educational Action Research*, *15*(1), 21 - 32.

Geijsel, F. and Meijers, F. (2005). Identity learning: The core process of educational change. *Educational Studies*, *31*(4), 419-430.

Glesne, C. (1997). That rare feeling: Re-presenting research through poetic transcription. *Qualitative Inquiry*, *3*(2), 202-221.

Green, B. and Reid, J. (2008). Method(s) in our madness? Poststructualism, pedagogy and teacher education. In A. Phelan and J. Sumsion (Eds.), *Critical readings in teacher education: Provoking absences* (pp. 17-31). Rotterdam: Sense Publishers.

Guba, E. G. and Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin and Y. S. Lincoln (Eds.), *The sage handbook of qualitative research*, *3*, 191-216. Thousand Oaks: Sage Publications.

Hendry, P. M. (2007). The future of narrative. *Qualitative Inquiry*, *13*(4), 487-498. DOI: 10.1177/1077800406297673.

Kallick, B. and Costa, A. L. (2004a). *Discovering & Exploring Habits of Mind*. Moorabbin, Vic.: Hawker Brownlow Education.

Kallick, B. and Costa, A. L. (2004b). *Integrating & Sustaining Habits of Mind*. Moorabbin, Vic.: Hawker Brownlow Education.

Kelly, G. (1955). *The Psychology of Personal Constructs*. New York: Norton.

Kompf, M. and Denicolo, P. (2003). *Teacher Thinking Twenty Years On: Revisiting Persisting Problems and Advances in Education*. Lisse: Swets & Zeitlinger.

Lather, P. A. (2007). *Getting Lost: Feminist Efforts Toward a Double(d) Science*. Albany: State University of New York Press.

Mac Naughton, G. (2005). *Doing Foucault in Early Childhood Studies: Applying Post-structural Ideas*. New York, NY: Routledge.

Maxwell, J. A. (2005). *Qualitative Research Design: An Interactive Approach* (2nd Ed.). Thousand Oaks, CA: Sage Publications.

McAninch, A. R. (1993). *Teacher Thinking and the Case Method: Theory and Future Directions*. New York: Teachers College Press.

McWilliam, E. (1994). *In Broken Images: Feminist Tales for a Different Teacher Education*. New York: Teacher College Press.

McNiff, J. (1988). *Action Research: Principles and Practice*. Basingstoke: Macmillan Education.

McNiff, J. and Whitehead, J. (2006). *All you Need to Know About Action Research*. London: Sage Publications.

Pope, M. L. (1993). Anticipating teacher thinking. In C. Day, J. Calderhead and P. Denicolo (Eds.), *Research on teacher thinking: Understanding professional development* (pp. 19-33). London; Washinton, D.C.: Falmer Press.

Richardson, L. (1994). Writing: A method of inquiry. In N. K. Denzin and Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 516-529). Thousand Oaks, CA: Sage.

Richardson, L. (1997). *Fields of Play: Constructing an Academic Life*. New Brunswick, NJ: Rutgers University Press.

Richardson, L. and St. Pierre, E. A. (2005). Writing: A method of inquiry. In N. K. Denzin and Y. S. Lincoln (Eds.), *The SAGE Handbook of Qualitative Research*, *3*, 959-978, Thousand Oaks, CA: Sage Publications.

Senge, P. M. (1994). *The Fifth Discipline: The Art and Practice of the Learning Organization* (A Currency paperback. ed.). New York: Doubleday/ Currency.

Senge, P. M. and Society for Organizational Learning. (2005). *Presence: Exploring Profound Change in People, Organizations and Society*. London: Nicholas Brealey Publishing.

St Pierre, E. A. (2000). Poststructural feminism in education: An overview. *International Journal of Qualitative Studies in Education (QSE)*, *13*(5), 477-515.

Stronach, I., Corbin, B., McNamara, O. and Stark, S. (2002). Towards an uncertain politics of professionalism: Teacher and nurse identities in flux. *Education Policy*, *17*(1), 109-138.

Stronach, I. and MacLure, M. (1997). *Educational Research Undone: The Postmodern Embrace*. Buckingham: Open University Press.

Visweswaran, K. (1994). *Fictions of Feminist Ethnography*. Minneapolis: University of Minnesota Press.

Wearmouth, J. (2004). 'Talking Stones': An interview technique for disaffected students. *Pastoral Care*, *22*(2), 7-13.

Zembylas, M. (2003). Emotions and teacher identity: A poststructural perspective. *Teachers and Teaching*, *9*(3), 213 - 238.

Zembylas, M. (2005). Discursive practices, genealogies and emotional rules: A poststructuralist view on emotion and identity in teaching. *Teaching and Teacher Education*, *21*, 935-948.

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Impact of Information Literacy Training on Academic Self-Efficacy and Learning Performance of University Students in a Problem-Based Learning Environment

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ABSTRACT

Problem-based learning (PBL) has emerged as an innovative educational approach and it is increasingly gaining its prominence in the higher education in Malaysia. Past research shows that academic self-efficacy has strong and positive influence on students' motivation and academic achievement. This study aims to examine the influence of information literacy skills training on academic self-efficacy and learning performance of university students in PBL approach in the Physics course. The Solomon Four –group design was used with 78 students in the American Degree Transfer Program of Taylor's University College in Malaysia participated in this study. The study investigated whether causation existed between information literacy skill training and academic self-efficacy as well as between information literacy training and learning performance. The independent variable was the information literacy training. The dependent variables were the mean academic self-efficacy score in a self-reporting and numerically measurable questionnaire developed by Klobas and learning performance scores which constitutes learning satisfaction, learning attitude, and learning score. A between group Factorial ANOVA and one-way ANOVA showed that the treatment of information literacy skills did have an impact on academic self-efficacy and learning performance. The findings showed that there was a cause-and-effect relationship between information literacy training and improvement in academic self-efficacy and learning performance of university students in PBL environment. This study confirmed that information literacy skill training may help raise the academic self-efficacy and learning performance of university students, which is essential to the learning process in PBL.

Keywords: Information literacy skills, problem-based learning, IL competency standard, academic self-efficacy, experimental design, higher education

INTRODUCTION

A shift of educational paradigm from traditional teaching approach to a problem-based learning (PBL) approach has been observed in most of the universities, university colleges and colleges in Malaysia in the past decade. An example is the successful implementation of PBL in the Medical and Dental Faculties of University Malaya (Salimah, 2003; Mohd Arriffin et al., 2004). PBL is a curriculum development and instructional system that simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem

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solvers confronted with an ill-structured problem that mirrors real-world problems (Finkle and Torp, 1995). This shift to independent learning has made information literacy skills critical to students' survival and success (Winship, 1995; Coombs and Houghton, 1995; Wales and Harmon, 1998). It has been documented that the role of current IL actually forms the basis for lifelong learning (ACRL Task Force, 2000).

A PBL environment has an important role to play in developing a student's ability to learn how to learn. A PBL environment is a student-centred environment which organizes the curriculum around an ill-structured, "real world" problems or scenarios, purported to empower learners by encouraging them to take a deep approach to their own learning. This approach enables students to become more confident and self-directed in their learning. The key philosophy of PBL is "student empowerment", where the concept of PBL is team-oriented with students empowered to identify their learning needs. This philosophy facilitates personal engagement in learning process and reinforces the student's ability to learn how to learn (Boud, 1991; Ryan, 1993). Harvey (2004) described empowerment as the development of knowledge, skills, and abilities in the student to enable them to control and develop their own learning. Students studying under PBL approach may be able to gain a competitive edge with key characteristics of knowledge worker, such as academically skilled, methodologically competent, team worker, creative and information literate. Information literacy is a means of individual empowerment within today's information society (ALA, 1998). According to Hewer (1999), empowerment provides students and facilitators with the necessary skills to find and use information they need for study and leisure, and equips them with transferable skills they can use for all sorts of information retrieval and tasks, enabling them to cope with the information age.

Despite the recognition of the important concept of student empowerment and IL as means of individual empowerment, there is still little research exploring the learning and understanding in PBL environment from this perspective. The findings of this study showed that IL skills training has an impact on improvement of academic self-efficacy and learning performance which serve as a measure of learning outcomes directly or indirectly in PBL environment.

The Problem

PBL educators strongly believe that PBL approach empowers students by encouraging them to take a deep approach to learning and to become more confident and self-directed in their learning (Spronken-Smith, 2006). They also recognise that university students who learn in PBL environments have the ability to learn how to learn in order to prepare themselves for their future professions (Dunlap, 2005). PBL educators see that students have the information technology skills to use search engines, while students believe that they already possess information skills with their increased exposure and wider access to search engine technology and technology skills (Macklin, 2002). However, according to Majka (2001), such students are actually functionally information illiterate. With the overconfidence in information skills, PBL students are only able to fulfil simple information needs, searching information to answer simple question that exhibits only surface learning. They are unable to explore deeper concepts or determine if they have really reduced uncertainty successfully. PBL educators may have over estimated the competence and capabilities of university students in IL skills because they are unaware of the subtle difference between information technology skills and IL skills (Fosmire, 2002). They failed to empower university students by giving them the necessary tools they need during problem solving, to perform excellently and maintain quality in accomplishing their learning tasks. They have omitted the importance of IL skills which helps students to acquire an empowering set of "navigational" skills. This set of skills includes the ability to determine what information is needed, how to access this information effectively, efficiently at the same time evaluate

the needed information and its sources critically while incorporate the selected information into his or her knowledge base and value system.

Overconfidence of the information technology skills as perceived by university students themselves and the omission of PBL educators in embedding IL skill training in PBL will limit students' ability to successfully participate in team work so as to explore their full potential in deep learning. Failing to provide proper IL skill training will limit university students' confidence in information seeking, which will in turn demoralise their learning satisfaction and attitude, and eventually limit their learning performance and affect their success and survival in PBL environment.

PURPOSE OF THE STUDY

The purpose of this study is to provide findings on the impact of IL skill treatment on dependent variables of learning in the PBL environment, namely academic self-efficacy and learning performance.

The null hypotheses of this study state that:

$H_{01:}$ Information literacy skill treatment has no statistically significant impact on the improvement of academic self-efficacy of university students in a problem-based learning environment.

$H_{o2:}$ Information literacy skill treatment has no statistically significant impact on learning performance of university students in a problem-based learning environment.

$H_{o2a:}$ Information literacy skill treatment has no statistically significant impact on learning satisfaction of university students in a problem-based learning environment.

$H_{o2b:}$ Information literacy skill treatment has no statistically significant impact on learning attitude of university students in a problem-based learning environment.

$H_{o2c:}$ Information literacy skill treatment has no statistically significant impact on learning scores of university students in a problem-based learning environment.

LITERATURE REVIEW

Rankin (1999) articulated that IL skills are essential to the learning process, and problem solving process in PBL parallel to IL competency standards set for higher education. Research showed that shifting to independent learning in PBL has made IL skills critical to students' survival and success (Wales and Harmon, 1998). PBL entailed an increased use of libraries and wide variety of information sources (Limberg, 1999). However, studies conducted among university students showed that majority of the students showed a very low level of competency in the use of library and displayed poor information seeking patterns (Zondi, 1992), many experienced problems in locating library information material (Kamanda, 1999). Wurman (2001) pointed out that without IL skills, people are condemned to lack of information, dependence upon others for access to knowledge and information, and even experience an acute level of information anxiety. Mayer (1992) articulated that although IL competency influence the learning performance through the acquisition of knowledge and skills, without self-efficacy, the performance may not even be attempted.

Self-efficacy is the confidence in one's ability to behave in such a way as to produce a desirable outcome (Bandura, 1977). Bandura (1997, p.3) speculated that it is "the belief in one's capabilities to organize and execute courses of action required to produce given attainments". In academic context, academic self-efficacy is the "self-evaluation of one's ability and chances for success in the academic environment" (Robbins et al., 2004, p. 267). Researchers found that academic self-efficacy is a strong predictor of academic performance in college students (Robbins et al., 2004; Pajares, 1996; Chemers et al., 2001). As students' academic expectations and self-efficacy increased, they were more likely to "show higher performance". In PBL research community, researchers recognize the importance of IL skills to the successful implementation of PBL (Breen and Fallon, 2005), but little research has been done.

Given the evidence that academic self-efficacy is closely linked to academic achievement and performance, it warrants a research to study the impact of IL skills training on the improvement of academic self-efficacy of university students in PBL environment.

Unlike the traditional lecture-based approach which assesses learning outcomes based on examination to measure the acquisition of content knowledge, PBL presents some unique challenges for assessment. Due to the fact that PBL is primarily focused on learning how to learn and less on mastery of a particular body of knowledge, traditional methods of course assessment may not be very effective (Major, 2002). Thus, alternative assessment strategies seem necessary as a better measure of knowledge acquisition from PBL. There are alternative assessment strategies such as authentic assessment which uses tasks developed from realistic activities in the professional world (Nightingale et al., 1996) can help bridge the gap between instruction and assessment. Authentic assessment task is defined as complex simulations, case studies, or multi-faceted projects in assessing a range of knowledge, skills and attitudes in the assessment task (Nightingale et al., 1996). Luh et al. (2007) have shown that student' attitudes are factors which significantly influence student performance in PBL courses. Giving students the opportunity to evaluate and reflect on their own learning is a key element in PBL. This will also allow the facilitator to help students in assessing their own performance in solving a problem. The self-evaluation of students can be recorded through the learning satisfaction form. An effective assessment tool must be designed to assess the learning outcome from performing the learning task. Waters (1996) has suggested two options for the assessment: 1) prepare objective questions that test the student's comprehension of the learning tasks given, and 2) create a problem statement to the solution of which requires the student to demonstrate the desired depth of understanding of the learning outcomes. The learning performance in this study thus consists of subjective indicators such as learning satisfaction and attitudes as well as objective indicators such as learning scores, including objective tests and presentation of solutions to learning tasks.

MATERIALS AND METHODS

Sampling

A total of 78 undergraduate students who registered for the Fall-2009 Physics course in the American Degree Transfer Program at Taylor's University College (Malaysia) participated in this study. The list of these students was obtained from the registrar office at Taylor's University College. These participants were randomly assigned to four groups, namely E_1, E_2, C_1, and C_2 during the experiment. All these groups were comparative enough in terms of number and resources. Moreover, the pretest analysis showed no significant difference in the dependent measures.

Research Design

This study utilized Solomon Four–group quasi-experimental design (Solomon, 1949; McGahee, 2009) by setting up two experimental groups and two control groups for the experiment. The design is rigorous and robust enough to eliminate variations that might arise from individual experiences to contaminate the validity of the study (Koul, 1992; Kothari, 2003). Participants were randomly assigned to experimental groups and control groups. The participants were asked to write their name on an identical sticker, fold the sticker along the middle line and put the sticker into a hat. Four students were nominated as representatives to draw the stickers from the hat in turns. The first representative drew a sticker from the hat and stuck it on the list of E_1 group. The second representative drew another sticker and stuck it on the list of C_1 group. The same was followed by the third and fourth representatives. This process was repeated until all the stickers were drawn to create four probabilistically equal groups in order to increase the internal validity of the study.

A carefully crafted ill-structured problem was given to all participants. They were allocated

20 minutes to study the problem. One of the experimental groups and control groups (E_1 & C_1) were given 20 minutes to fill up the pretest questionnaire that measured their academic self-efficacy and learning satisfaction after reading the PBL problem. The other two groups were subdivided into smaller groups of five members before the PBL activities. The pretest instrument was a questionnaire comprising 10 items of learning satisfaction and 27 items of academic self-efficacy. The experimental groups then attended a two-hour IL skill training conducted by the facilitator in collaboration with a librarian before carrying out PBL activities and information seeking activity. The control groups (C_1 & C_2) began the normal process of PBL activities and information seeking activity. All participants were post-tested on their academic self-efficacy and learning satisfaction about the learning task at the end of the PBL process after they submitted their report or solution.

The set up of the Solomon four-group design in this research is as shown in Table 1:

The reasons of using Solomon Four-Group design in this study were:

1. Even though non-random sampling was used to draw the sample, a quasi-experimental study was still possible with the purposive sampling (Gall et al., 1996). This purposive sample can be randomly assigned to two experimental groups and two control groups.
2. The ability to control for instrument reactivity. Instrument reactivity refers to situations where pre-test cues subjects about the treatment and enables them to guess the expectation. In Solomon Four-Group design, half of the participants from both the treatment and control groups were pre-tested while the other half were not. Thus, it was able to control and test instrument reactivity.
3. Ability to assess the presence of pre-test sensitisation.
4. Allowing more confidence in inferring causal relationships as it has higher degree of internal validity.
5. Extraneous temporal effect was avoided as the treatment for the two experimental groups was given at the same time, with the collaboration of the facilitator and the librarian.
6. Most of the threats to internal validity were eliminated.

Treatment

The independent variable of this study was the treatment which aimed to improve the academic self-efficacy and learning performance of the university students by raising their IL skills. The treatment was a two-hour IL skill training programme conducted by the facilitator in collaboration with the librarian in two separate

TABLE 1
Solomon four-group design

Group	Pretest	Treatment	Posttest
1. R Experimental (E_1)	O_1	X	O_2
2. R Control (C_1)	O_3		O_4
3. R Experimental (E_2)		X	O_5
4. R Control (C_2)			O_6

X : Treatment of IL skill training.
O_1, O_3 : Measurement of dependent variables before IL skill training.
O_2, O_4, O_5 and O_6 : Measurement of dependent variables after performing the learning task.

phases. The first phase was a 40-minute lecture of IL knowledge conducted by the facilitator, while the second was 80-minute hands-on IL skill training conducted by the librarian in the library training room. The content of the lecture included the five standards of IL for higher education, the importance of these standards and how to relate and apply the five standards as they participated in PBL. The skills taught are:

1. to determine the nature and extent of the information needed,
2. to access needed information effectively and efficiently,
3. to evaluate information and its sources critically and incorporate selected information into knowledge base and value system,
4. to use information effectively to accomplish a specific purpose individually or as a member of a group, and
5. to understand the economic, legal, and social issues surrounding the use of information and to access and use information ethically and legally.

The librarian conducted a mini-PBL session in the second phase by giving four learning tasks related to a bibliography project that required the participants to work in small groups. The tasks were:

1. to make a list of information sources,
2. to describe the need of citing information sources in a bibliography,
3. to identify the element included when citing a book or websites, and
4. to identify a list of criteria that could be used to critically assess an information source.

These tasks involve the three elements of IL instruction outlined by Nahl and Jakobovits (1993) – critical thinking or information evaluation skills, information use skills, and learning to learn or enjoying the benefits of information success.

A summary of the four groups with and without the pretest as well as with and without the treatment is tabulated in Table 2.

Instruments

The independent variable of this study was the treatment of IL skills. The experimental groups were trained in a two-hour IL skill program by the facilitator in collaboration with the librarian. The dependent variables were the academic self-efficacy scores and learning performance scores on the self-reporting and numerically measurable questionnaire measured in 11-point scale for academic self-efficacy and 5-point Likert scale for subjective measure of learning performance which constitute learning satisfaction and learning attitude respectively. The questionnaire was administered in a pretest and posttest format to one experimental and one control group, and posttest only for others. By precluding the other two groups from pretesting allowed the researcher to determine if the actual act of pretesting influenced the results. If the difference between the posttest

TABLE 2
A summary of the four groups of participants during the experiment

Treatment condition / Pretest condition	ILS training	No ILS training
Pretest	E_1	C_1
No Pretest	E_2	C_2

Notes: Group E_1: Experimental group, with ILS Training and Pretest; Group C_1: Control group, No ILS Training but with Pretest; Group E_2: Experimental group, with ILS Training but No Pretest; Group C_2: Control group, No ILS Training and No Pretest.

results of E_2 and C_2 was different from the E_1 and C_1, then the researcher can assume that the pretest has had some effect upon the results. The questionnaire was used to ascertain the cause and effect relationship between IL skill training and academic self-efficacy as well as between IL skill training and learning performance. The academic self-efficacy questionnaire comprises a series of element developed by Klobas et al. (2007). Learning performance was expressed as a function of learning satisfaction, learning attitude, and learning scores (see *Fig. 1*).

Learning satisfaction was measured by a 10-item self-report rated by a scale from 1 being "strongly disagree" to 5 being "strongly agree". This instrument was adapted from the usefulness instrument developed and tested by Davis (1989). Learning attitude was measured during the whole PBL activities on a scale from 1 being "unsatisfactory" to 5 being "exceptionally satisfactory". The learning assessment was based on a test that consists of 15 multiple-choice questions on the course unit conducted in PBL, and the quality of the solution to the PBL task.

RESULTS AND DISCUSSION

Testing of Hypothesis 1

Information literacy training and academic self-efficacy

The mean score of academic self-efficacy was computed by dividing the total score of the 27 items on academic self-efficacy divided by 27. The mean post-test scores of the academic self-efficacy of the four groups were compared and analysed using 2 (pre-test/ no pre-test) x 2 (treatment / no treatment) between-group factorial ANOVA. In this analysis, 2 factors were each applied in two levels. The first factor was the condition of pretesting and the two levels were pre-test and no pre-test. The second factor was the treatment of IL training and the two levels were IL training and no IL training. Table 3 shows the results of this analysis. From the results in Table 3, it was axiomatic that there was no significant interaction ($F_{1,74}$ =2.24, p = 0.139) between the two main effects. It was therefore concluded that no pre-test sensitisation was present. The analysis of the treatment effect on the post-test scores ($F_{1,74}$ = 10.499, p=0.002) revealed a statistically significant result. This implied that the treatment had an effect and this effect existed without any prerequisite. Information literacy skill training has significantly improved academic self-efficacy of university students despite the presence of the pre-test. Thus, H_{o1} was rejected in favour of the alternative hypothesis. It follows that IL skill treatment has a statistically significant impact on the improvement of academic self-efficacy of university students in a PBL environment.

Testing of Hypothesis 2

Information literacy skill training and learning satisfaction

Learning satisfaction score was computed as the total scores of the 10 items of learning

$$\text{Learning Performance} = \Sigma\ \text{Satisfaction (W), Attitude (W), Score (W)}$$

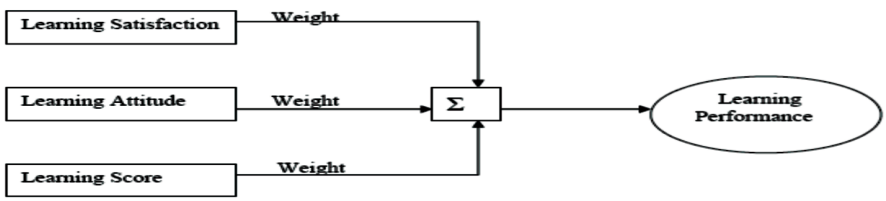

Fig. 1: Expression of Learning Performance (Loh, 2010, p. 35)

TABLE 3
Factorial ANOVA on academic self-efficacy post-test scores of all four groups

Descriptive Statistics

Dependent Variable: ACADEMIC SELF_EFFICACY

experimental group	pretest identifier	Mean	Std. Deviation	N
Experimental group	pretest	7.9923	1.1156	20
	no pretest	7.3502	.6451	19
	Total	7.6795	.9618	39
control group	pretest	6.9939	1.1814	19
	no pretest	6.9827	.6407	20
	Total	6.9882	.9308	39
Total	pretest	7.5059	1.2406	39
	no pretest	7.1617	.6611	39
	Total	7.3338	1.0026	78

Tests of Between-Subjects Effects

Dependent Variable: ACADEMIC SELF_EFFICACY

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13.338[a]	3	4.446	5.136	.003
Intercept	4187.850	1	4187.850	4837.677	.000
TREATMEN	9.089	1	9.089	10.499	.002
PRETEST	2.080	1	2.080	2.402	.125
TREATMEN * PRETEST	1.939	1	1.939	2.240	.139
Error	64.060	74	.866		
Total	4272.629	78			
Corrected Total	77.398	77			

a. R Squared = .172 (Adjusted R Squared = .139)

satisfaction. The post-test learning satisfaction scores of the four groups were compared and analysed using 2 (pre-test/no pre-test) x 2 (treatment/no treatment) between-group factorial ANOVA. Table 4 shows the results of this analysis. There was no significant interaction ($F_{1,74}$ =1.855, p = 0.177) between the two main effects. It can be concluded that no evidence of pre-test sensitisation was present. An analysis on the treatment effect of the post-test scores ($F_{1,74}$=3.011, p=0.087) indicated that no statistically significant result was obtained. An ANCOVA with the pre-test scores used as the covariant was performed to determine the effect of treatment on the post-test scores of Groups E_1 and C_1.

The result from the ANCOVA ($F_{1, 37}$= 6.682, p=0.014) indicated that a statistically significant result was obtained. This indicated that the treatment had an effect on the learning satisfaction regardless of the presence or absence of the pre-test. Thus, no further analysis was needed and the null hypothesis H_{o2a} was rejected in favour of its alternative hypothesis. It follows that IL skill treatment had a statistically significant impact on the learning satisfaction of university students in a PBL environment.

Information literacy skill training and learning attitude

Learning attitude was computed as the total scores from the 8 items on learning attitude. Since there was no pre-test administered for the learning attitude, one-way ANOVA was conducted on the learning attitude in all four groups of subjects. The ANOVA results showed that there were at least two groups of subjects who showed significant difference in the mean scores of learning attitude, with the result F(3, 74) = 15.882, p = 0.00. A further examination of the Turkey Post Hoc test indicated that subjects

TABLE 4
Factorial ANOVA on learning satisfaction post-test scores of all four groups

Dependent Variable: learning satisfaction for post test

experimental group	pretest identifier	Mean	Std. Deviation	N
Experimental group	pretest	41.6500	2.3232	20
	no pretest	39.2632	2.9029	19
	Total	40.4872	2.8550	39
control group	pretest	39.0526	3.5351	19
	no pretest	38.9500	5.3062	20
	Total	39.0000	4.4721	39
Total	pretest	40.3846	3.2169	39
	no pretest	39.1026	4.2538	39
	Total	39.7436	3.8017	78

Dependent Variable: learning satisfaction for post test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	98.740[a]	3	32.913	2.402	.074
Intercept	123033.419	1	123033.419	8977.605	.000
TREATMEN	41.270	1	41.270	3.011	.087
PRETEST	30.193	1	30.193	2.203	.142
TREATMEN * PRETEST	25.419	1	25.419	1.855	.177
Error	1014.132	74	13.704		
Total	124318.000	78			
Corrected Total	1112.872	77			

a. R Squared = .089 (Adjusted R Squared = .052)

TABLE 5
ANCOVA on learning satisfaction for Groups E1 and C

Dependent Variables	Source	MS	df	F	p
Learning Satisfaction	Treatment	58.14	1	6.68	0.014
	Error	8.70	36		

in the experimental groups showed higher scores in learning attitude than those in control groups, while no significant difference was found in learning attitude of subjects between control groups ($p = 0.889$) as well as subjects between experiment groups ($p = 0.970$) (*see* Table 6). Hence, hypothesis H_{o2b} was rejected in favour of its alternative hypothesis. It follows that IL skill treatment had a statistically significant impact on the learning attitude of university students in a PBL environment.

Information literacy skill training and learning score

The learning score of the students was derived from the mark assigned to each student based on the total scores in multiple-choice test questions on the topics covered in PBL and the solution to the learning task. As there was no pre-test for the learning score, one-way ANOVA was performed on learning scores in all groups of subjects. Results of the ANOVA revealed that at least two groups of subjects showed significant difference in the learning score mean (F(3, 74)

TABLE 6
One-way ANOVA for learning attitude post-test scores

ANOVA

Learning attitude

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	163.280	3	54.427	15.882	.000
Within Groups	253.592	74	3.427		
Total	416.872	77			

Learning attitude

Tukey HSD[a,b]

group identifier	N	Subset for alpha = .05	
		1	2
control group with posttest only	20	28.1000	
Control group with pretest posttest	19	28.5263	
experimental group with pretest posttest	20		31.0500
experimental group with posttest only	19		31.3158
Sig.		.889	.970

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 19.487.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

= 4.788, p = 0.004). A further examination of the Turkey Post Hoc test indicated that subjects in experimental groups showed higher learning scores than those in the control groups, while there was no significant difference in learning scores of subjects between control groups (p = 0.778) as well as subjects between experiment groups (p = 0.073) (*see* Table 7). Hence, hypothesis H_{o2c} was rejected in favour of its alternative hypothesis. It follows that IL skill treatment has a statistically significant impact on learning scores of university students in a PBL environment.

Information literacy skills training and learning performance

Since all the subsidiary null hypotheses were rejected in favour of alternative hypotheses, it was reasonable to predict that the IL skill training has an impact on learning performance of university students.

A one-way ANOVA was employed to further analyse the learning performance of the four groups of students. The results were shown in Table 8. The one-way ANOVA analysis showed that at least two groups of subjects showed significant difference in the mean score of learning performance (F(3, 74) = 8.227, p = 0.000). A further examination of the Turkey Post Hoc test indicated that subjects in the experimental groups showed higher scores in the learning performance than subjects in the control groups, while there was no significant difference in the learning scores of subjects between the control groups (p = 0.895) as well as subjects between the experiment groups (p = 0.855) (*see* Table 8). Hence, hypothesis H_{o2} was rejected in favour of it alternative hypothesis. The statistical analysis revealed that there was evidence suggesting that IL skill treatment had a statistically significant impact on learning performance of university students in a PBL environment.

A 2 (pre-test/no pre-test) x 2 (treatment/ no treatment) between-group factorial ANOVA was also performed on the learning performance

TABLE 7
One-way ANOVA for the learning score

ANOVA

LEARNING SCORE

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	817.643	3	272.548	4.788	.004
Within Groups	4212.011	74	56.919		
Total	5029.654	77			

LEARNING SCORE

Tukey HSD[a,b]

group identifier	N	Subset for alpha = .05	
		1	2
Control group with pretest posttest	19	77.1053	
control group with posttest only	20	79.4000	79.4000
experimental group with pretest posttest	20		83.5000
experimental group with posttest only	19		85.3684
Sig.		.778	.073

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 19.487.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

TABLE 8
Results of one-way ANOVA for learning performance

ANOVA

LEARNING PERFORMANCE

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1670.771	3	556.924	8.227	.000
Within Groups	5009.201	74	67.692		
Total	6679.972	77			

Homogeneous Subsets

LEARNING PERFORMANCE

	group identifier	N	Subset for alpha = .05	
			1	2
Tukey HSD[a,b]	Control group with pretest posttest	19	109.5368	
	control group with posttest only	20	111.3950	
	experimental group with pretest posttest	20		118.5050
	experimental group with posttest only	19		120.6105
	Sig.		.895	.855

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 19.487.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

post-test scores of all four groups. Table 9 shows the results of this analysis. From the results in Table 9, it was evident that no significant interaction existed ($F_{1,74}$ =0.004, p = 0.947) between the main effects. It can be concluded that no pre-test sensitisation was present. An analysis on the treatment effect of post-test scores ($F_{1,74}$ = 23.797, p=0.00) revealed a statistically significant result. This implied that the treatment had an effect that existed without any prerequisite. The IL skill training thus significantly improved the learning performance of university students. Thus, as anticipated, H_{o2} was rejected in favour of its alternative hypothesis which was consistent with the results obtained from the one-way ANOVA.

The Solomon four-group design used in this research met all the conditions for a cause-and-effect study. Firstly, this experimental study established a relationship. Secondly, a proper time order was observed, whereby the independent variable was manipulated and then the outcome was observed. Finally, it ruled out alternative explanations because random assignment equates the groups on all extraneous variables at the start of the experiment. Thus, the findings inferred that there was a cause-and-effect relationship (causation) between IL skill training and the two dependent variables, and there was a cause-and-effect relationship (causation) between IL skill training and learning performance, and between IL skill training and academic self-efficacy of university students in a PBL environment.

CONCLUSION

The results have demonstrated that IL skill training in a PBL environment by the facilitator in collaboration with the librarian was effective in improving students' academic self-efficacy and learning performance. The inferential statistics

TABLE 9
Factorial ANOVA on learning performance post-test scores of all four groups

Descriptive Statistics

Dependent Variable: sum of PBL learning satisfaction, learning attitude and score

experimental group	pretest identifier	Mean	Std. Deviation	N
Experimental group	pretest	118.5050	7.4568	20
	no pretest	120.6105	7.3995	19
	Total	119.5308	7.4077	39
control group	pretest	109.5368	9.4244	19
	no pretest	111.3950	8.4867	20
	Total	110.4897	8.8865	39
Total	pretest	114.1359	9.5130	39
	no pretest	115.8846	9.1500	39
	Total	115.0103	9.3141	78

Tests of Between-Subjects Effects

Dependent Variable: sum of PBL learning satisfaction, learning attitude and score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1670.771[a]	3	556.924	8.227	.000
Intercept	1031084.113	1	1031084.113	15232.015	.000
TREATMEN	1610.841	1	1610.841	23.797	.000
PRETEST	76.540	1	76.540	1.131	.291
TREATMEN * PRETEST	.298	1	.298	.004	.947
Error	5009.201	74	67.692		
Total	1038413.980	78			
Corrected Total	6679.972	77			

a. R Squared = .250 (Adjusted R Squared = .220)

revealed that differences in the mean scores of academic self-efficacy and learning performance of students in the treatment group and those in the control groups were statistically significant. With the increase in academic self-efficacy in PBL, students may increase their confidence to accomplish their learning tasks and perform better while learning in the PBL environment. This will catalyse their ability to successfully participate in team work and foster their deep learning and empowerment. The collaboration with librarians to conduct IL skill training is essential in the successful implementation of PBL. Further research is recommended to expand this study to university students from other majors such as business, humanity, laws, arts, or with post graduate students. Students with different majors and maturity may respond differently to an intervention.

REFERENCES

Association of College and Research Libraries. (2000). Information Literacy Competency Standards for Higher Education. Chicago: ACRL. Retrieved July 11, 2009 from http://www.ala.org/acrl/ilcomstan.html.

American Library Association. (1998). Presidential Committee on Information Literacy: Final Report. Chicago: ALA. Retrieved July 11, 2009 from http://www.ala.org/ala/acrl/acrlpubs/whitepapers.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Reviews*, *84*(2), 191-215.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York:W.H. Freeman.

Breen, E. and Fallon, H. (2005). Developing student information literacy to support project and problem-based learning. In T. Barret, I. MacLabhrainn and H. Fallon (Eds.), *Handbook of enquiry and problem-based learning: Irish case studies and international perspectives* (pp. 179-188). Galway: CELT.

Boud, D. and Feletti, G. (1991). *The Challenge of Problem Based Learning.* London: Kogan Page.

Chemers, M. M., Garcia, B. F. and Hu, L.T. (2001). Academic self-efficacy and first-year college student performance and adjustment. *Journal of Educational Psychology*, *93*(1), 55-64.

Coombs, M. and Houghton, J. (1995). Information skills for new entry tertiary students: Perceptions and practice. *Australian Academic Research Librarian*, *26*(4), 260-70.

Davis, F. D. (1989). Perceived usefulness, perceived ease-of-use, and user acceptance of information technology. *MIS Quarterly*, *13*, 319-340.

Dunlap, J. C. (2005). Problem-based learning and self-efficacy: How a capstone course prepares students for a profession. *ETR&D*, *53*(1), 65-85.

Finkle, S.L. and Torp, L.L. (1995). *Introductory Documents*. Aurora: Illinois Math and Science Academy.

Fosmire, M. and Macklin, A. (2002). Riding the active learning wave: Using problem-based learning as a catalyst for creating faculty-librarian partnerships. *Issues in Science and Technology Librarianship*, *34*. Retrieved July 11, 2009 from http://www.istl.org/02-springarticle2.html.

Harvey, L. (2004). Analytic quality glossary, quality research international. Retrieved July 11, 2009 from http://www.quality/researchinternational.com/glossary.

Hewer, S. (1999). What is empowerment? *School Library Bulletin*, *5*(5).

Kamanda, R.W. (1999). Library–use by university students: Case study of the East African School of Library and Information Science. Unpublished doctoral dissertation. Makerere University, Kampara.

Klobas, J. E., Renzi, S. and Nigrelli, M. L. (2007). A scale for the measurement of self-efficacy for learning (SEL) at university (Dondena Working Paper No.2). Milan: Carlo F Dondena Centre for Research on Social Dynamics.

Kothari, C.R. (2003). *Research Methodology*. New Delhi: Wishwa Parkasha.

Koul, L. (1992). *Methodology in Educational Research*. Delhi: Vikas Publishing House, PVT Ltd.

Limberg, L. (1999). Experiencing information seeking and learning: A study of the interaction between two phenomena. *Information Research, 5*(1). Retrieved July 11, 2008 from http://InformationR.net/ir/5-1/paper68.html.

Loh, K.H. (2010). The impact of information literacy skills training on uncertainty reduction, learning performance and academic self-efficacy in a problem-based learning (PBL) environment. Unpublished doctoral dissertation, International Islamic University of Malaysia, Kuala Lumpur.

Luh, S.P., Yu, M.N., Lin, Y.R., Chou, M.J., Chou, M.C. and Chen, J.Y. (2007). A study on the personal traits and knowledge base of Taiwanese medical students following problem-based learning instructions. *The Annals*, Academy of Medicine, Singapore, *36*(9), 743-8.

Major, C. H. (2002). Problem-based learning in general education at Samford University: A case study of changing faculty culture through targeted improvement efforts. *The Journal of General Education*, *51*(4), 235-256.

Mayer, RE. (1992). *Thinking, Problem Solving, Cognition* (2nd Ed.). New York: WH Freeman.

Macklin, A.S. (2002). Integrating information literacy using problem-based learning. *Reference Services Review*, *29*(4), 306-314.

McGahee, T.W. and Tingen, M.S. (2009). The use of the Solomon four-group design in nursing research. *Southern Online Journal of Nursing Research*, *9*(1), 128-134.

Mohd. Ariffin Abu Hassan, Khairiyah Mohd. Yusof, Mohd. Kamaruddin Abd. Hamid, Mimi Haryani Hassim, Azilz Abd. Aziz and Syed Ahmad Helmi Syed Hassan. (2004). A review and survey of problem-based learning application in Engineering Education. Paper presented at *Conference on Engineering Education*, Kuala Lumpur.

Jakobovits, N.D. and Jakobovits, L. A. (1993). Bibliographic instructional design for information literacy: Integrating affective and cognitive objectives. *Research Strategies*, Spring, 73-78.

Nightingale, P., Te Wiata, I., Toohey, S., Ryan, G., Hughes, C. and Magin, D. (1996). *Assessing Learning in Universities*. Sydney: UNSW Press.

Pajares. F. and Kranzler. J. (1995). Self-efficacy beliefs and general mental ability in mathematical problem solving. *Contemporary Educational Psychology*, *20*(4), 426-443.

Rankin, J. A. (Ed.). (1999). *Handbook on Problem-Based Learning.* New York, NY: Medical Library Association and Forbes Custom Publishing.

Robbins, S.B., Lauver, K., Le, H., Davis, D., Langely, R. and Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, *130*(2), 261-288.

Ryan, G. (Ed.) (1993). *Research and Development in Problem Based Learning* (Volume 1). Australia: Campbelltown.

Salimah Mokhtar and Zaitun Abu Bakar. (2003). PBL Implementation in Computer Science and Information Technology. *Journal of Problem-based Learning*, *1*(2). [online]

Solomon, R. L. (1949). An extension of control group design. *Psychology Bulletin*, *46*, 137–150.

Spronken-Smith, R. (2006, July). Problem-based learning: challenging but empowering. Paper presented at *the 31st Improving University Teaching Conference*, Dunedin, New Zealand.

Wales, B. and Harmon, H. (1998). A comparison of two user groups: international and US students in an academic library. *Public and Access Services Quarterly*, *2*(4), 17-37.

Waters, R. and McCracken, M. (1997, Nov). Assessment and evaluation in problem-based learning. Paper presented at the *Frontiers in Education Conference*, Pittsburgh, USA.

Winship, I. R. (1995). Workbooks for information skills teaching at the University of Northumbria at Newcastle. *The New Review of Academic Librarianship*, *1*, 105-118.

Wurman, R.S. (2001). *Information Anxiety 2*. Indianapolis: Que.

Zondi L. E., (1992). Library use skills and information seeking patterns of first year students at the University of Zululand. *South African Journal of Library and Information Science*, *60*(4), 204–208.gn.

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Socio-Cognitive Analysis of Socratic Dialogue

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ABSTRACT

Our work involves close analysis of Socratic dialogue in Sokratiska and Paideia Seminars (Billings and Fitzgerald, 2002; Pihlgren, 2008), grounded in socio-cognitive theory. Similar to Socratic dialogue, The Sokratiska and Paideia Seminars are defined as "a collaborative, intellectual dialogue about ideas and values, based on a text, facilitated by open-ended questions, resulting in enhanced conceptual understanding" (Roberts and Billings, 2008). By examining both quantitative and qualitative aspects of thinking in dialogue, we have found important socio-cognitive patterns. In developing systems for analysis we have identified the following important features:

- Ratio of teacher to student talk (turns and time)
- Content of talk (textual ideas, personal connections)
- Use of gestures and various means of non-verbal communication
- Levels of cognition (recall to synthesis)

In addition, we have found a curious interpersonal cognitive processing which frequently occurs in seminar dialogue, prompting new individual and collective thinking. This, we believe, poses an important challenge to existing theory on thinking.

Keywords: Interpersonal processing, seminars, socio-cognitive theory, Socratic dialogue, thinking

INTRODUCTION

A growing body of literature suggests a strategic approach to measuring thinking, one that takes a socio-cognitive perspective. Briefly stated, a socio-cognitive view includes a "way of thinking and speaking" (Langer, 1987). It implies that we become more literate thinkers not just alone with a book or a pen but also in a social context. Indeed, Lev Vygotsky, a seminal thinker in the area of socio-cognitive theory, argued that all higher order thinking skills appear on two levels: First, on an *interpersonal* or social level, and then, and later, on an *intrapersonal* or individual level (Vygotsky, 1978). From this view, dialogue between teacher and students, and among students, is crucial in the development of broad literacy skills, as well as in the development of higher levels of thinking.

Our previous work has involved close analysis of Socratic dialogue in Sokratiska and Paideia Seminars (Billings and Fitzgerald, 2002; Pihlgren, 2008), grounded in socio-cognitive theory. The main purpose of the U.S. study (Billings and Fitzgerald, 2002) was to examine

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types of discussion in Paideia Seminars (a U.S. concept). The main results of this study show, that the observed discussions reflected the teacher's transitional status in conducting dialogic discussion, with some features of the "ideal" Paideia Seminar dialogue presented and some features of "teacher-fronted" discussion represented. The objective of the Swedish study (Pihlgren, 2008) was twofold: To analyze the intended rationales of educational seminars from different traditions using Socratic dialogue, and to examine how the stated positive effects of the dialogue were achieved in Sokratiska Seminars (a Swedish concept). The study showed that various Socratic traditions aim at helping participants to internalize intellectual and dialogical habits of mind. It also showed that the skilled participants shifted their interaction towards an inquiring dialogue over time and that intricate "silent" moves (gestures) helped maintain a productive and egalitarian dialogue culture. By examining both quantitative and qualitative aspects of thinking in dialogue, we have in both studies found important socio-cognitive patterns. In developing systems for analysis we have identified the following important features:

- Ratio of teacher to student talk (turns and time)
- Content of talk (textual ideas, personal connections)
- Use of gestures and various means of non-verbal communication
- Levels of cognition (recall to synthesis)

Our findings suggest correlations between Socratic dialogue practice and participants' ability to deal with conflicting ideas. On both the individual and collective levels, dealing with socio-cognitive *conflict*, or disagreement, helps discussants view and digest varying perspectives, and in turn to adjust or refine their own interpretation on an issue (Almasi 1995; Danielewicz, Roberts and Noblit, 1996).

LITERATURE REVIEW

The Paideia Seminar, evolving out of the work of American philosopher Mortimer Adler (1980), is defined as "a collaborative, intellectual dialogue about ideas and values, based on a text, facilitated by open-ended questions, resulting in enhanced conceptual understanding" (Roberts and Billings, 2008). Similarly, Socratic dialogue as an educational practice draws from a wide range of universal traditions, building critical thinking through a collaborative examination of paradoxical issues. The traditions of Leonard Nelson (1965) in Germany, and of Hans Larsson (1925) and Oscar Olsson (1911) in Sweden describe a set of methodological steps to attain similar objectives (Pihlgren, 2008). The Swedish tradition is almost identical to the Paideia Seminar as a method, and is here referred to as Sokratiska Seminars. Both types of seminars use an open, collaborating, interpreting and critically analyzing dialogue, a Socratic dialogue. All the Socratic traditions lean heavily on Aristotle's (1998) idea, that intellectual habits of mind can be trained, and that this training will result in the individual attaining intellectual virtues, which will later result in practical wisdom, i.e. to be able to make productive choices, when confronted with a multitude of (incongruent) ideas (Pihlgren, 2008).

The Paideia and the Sokratiska Seminar are a structured discussion focused on a text. By text here we mean a tangible document or artefact, it may or may not be a print document, it could be a work of art or a scientific diagram. The text serves as a common reference point and should include at least two or more key ideas or concepts. Participants are guided through a close reading of the text, often with note taking before the formal dialogue begins. Likewise, before a Paideia and a Sokratiska Seminar, participants are asked to reflect and focus on particular aspects of the dialogue process ("dialogical virtues", Lindström, 2000). There are commonly group and individual participation goals set (such as asking a genuine question, referring to the text, using others' names).

The facilitator of a Paideia and a Sokratiska Seminar poses both planned and spontaneous questions about the ideas and concepts in the text. Questions planned prior are designed to help participants move from a fairly simple thought process to a deeper and more sophisticated analysis. Throughout the Paideia and Sokratiska Seminar dialogue, the facilitator refrains from evaluating the comments of participants and instead nurtures a sense of comfort with intellectual risks. The kinds of discussions that occur within the seminar "are characterized by having open-ended questions, using textual references to support ideas, producing rigorous, intellectual dialogue, examining challenging and ambiguous texts, and fostering open participation" (Orellana, 2008). In this way, the seminars work as a process of taking participants from simple comprehension and recall, through analysis and synthesis, finally reaching a deeper understanding of the ideas through evaluation and creative thinking.

More specifically, the seminar "text" is used to facilitate taking a distance from the Self, when discussing the ideas. This tool reflects the Socratic *elenchus* as Popper (2007) describes: The cumulative refuting interpretation is a systematic and critical analysis of the ideas, sorting out those which do not pass the test. The adjusting part of refuting interpretation is a result of a creative, intuitive process, where new "bold" ideas are found and tested (Lindström, 2008). This is meant to apply both to the individual and to the group (see *Fig. 1*).

The interpersonal and intrapersonal processes are considered interdependent: the individual influences the group and vice versa (Pihlgren, 2007). The group actions will gradually be internalized by the individual: The interpersonal thinking modes will teach the individual a thinking disposition, a habit becoming a virtue and later part of character (cf. Aristotle). This "apprenticeship" seems to suggest the group as a "master", making use of "multiple zones of development" (Brown 1994; Kumpulainen and Mutanen, 1999). Someone in the group is always a bit further ahead in understanding. The dialogical virtues, trained by group and individual participation goals, function as a promoter of this internalization taking place by fostering an open atmosphere**.** The space created must be safe for taking intellectual risks.

RESEARCH ON SPECIFIC ASPECTS OF DIALOGUE THAT SUPPORT THINKING

Various research studies explicitly link the quality of questioning in a discussion with the intellectual quality of responses (Tobin, 1987; Nystrand, 2006). In particular, dialogic phenomena described as "maieutic frames" uncovers more fully how open-ended questions lead to cognitive conflicts within the seminars. Maieutic frames provide important scaffolding to guide participants to look for answers beyond the literal, to identify logical errors, and misinterpretations of the text. From there,

	Intrapersonal thinking process	Interpersonal, contextual thinking process
Cumulative interpretive process	Confirming and deepening OR refuting one's own idea or understanding	Group working together to find evidence and to confirm OR refute previous ideas or understandings
Creative adjustment interpretive process	Changing one's own idea or understanding as a result of a new idea found and tested by self or other participant	Group discussion leaves previous assumption, idea or understandings and builds further dialogue on a new idea being presented and tested by some participant

Fig. 1: Intellectual process in seminar

students built arguments in response to or as a rebuttal against other participants' claims, and in so doing, they used references as either data or backings to validate their arguments (Orellana, 2008). This dialogic event, emergent from quality questions, requires participants to assess alternative modes of looking at ideas, to think of hypothetical consequences, and to explore atypical causes (Orellana, 2008).

Another important aspect of dialogue revolves around the social language roles assumed by participants. Certainly, "what the teacher does and does not do, is pivotal" (Billings and Fitzgerald, 2002). In traditional classroom discussion, the teacher controls the discussion and the majority of students follow suit. However, as the teacher shares power and authority, students are invited to assume more active, even challenging roles where the level of cognitive engagement is wider spread. A third significant aspect of seminar dialogue is the rules of engagement. These include treating other participants with respect, to listen to what is said with interest, without interrupting, and with an interpretive mind, to stick to the subject, and to support one's arguments. How the dialogue unfolds is clearly related to what participants are able to accomplish intellectually: intellectual habits rely heavily on dialogical virtues. While playing the seminar game, skilled participants acted as one; and participants were able to cooperate to involve many participants (Pihlgren, 2008). Learning the rules of dialogue occurs in three stages: 1. understanding what the seminar game is about, 2. testing the game by focusing on the rules, and 3. focusing on the intellectual content.

These key studies on dialogue illuminate the impact of questions, socio-linguistic roles, and cultural rules on individual and collective cognition. It can be summarized that through these determining factors, Paideia and Sokratiska

TABLE 1
Paideia seminar transcript coding matrix

Paideia seminar transcript coding matrix					
Number	Source	Form	Relation	Cognitive process	Cognitive content
	Facilitator/ Participant	Statement/ Question	Stick / Roll	Clarify Analyze Speculate Synthesize Apply Evaluate Generalize Compare Affirm	Text Self Group Other topic Others/ the world Process
Total talk turns	Ratio of teacher: student talk	Ratio of statements: questions	Popcorn vs Continuity	Thinking levels	Focal point(s) Ideas Values
Balance in participant talk; Length of turns	Who is in control/ or leading	Questions that generate additional thinking	Building on others' comments	Close analysis to inform evaluation	Relationship to thinking levels

Seminars supports critical thinking, encourages growing in understanding and integrating new ideas into your own, it challenges what you think, and allows a flow of interaction from other students, reminding us of forgotten knowledge (Pihlgren, 2008, Robinson, 2006).

MATERIALS AND METHODS

In Sweden, 16 seminars with five to sixteen year old students were video taped over a three year period, three tapes on each group: In the beginning, in the middle and at the end of the period. The groups varied from 7-20 participants, in all 101 students. In the U.S. three seminars with eighteen tenth graders were video taped during a school year. In both studies, the facilitators of the seminars were the students' ordinary teachers. The video tapes were transcribed, the talk turns were numbered. In the Swedish study, the gestures and glances were also noted. In the U.S. study the transcripts were analyzed by coding and sorting according to socio-linguistic themes including questions, content of talk, and levels of thinking (Billings and Fitzgerald, 2002). The coding categories for examining the socio-cognitive aspects of classroom dialogue are presented in Table 1.

In the Swedish study, the participants' body language and group interaction were also analyzed closely through a phenomenological approach (Pihlgren, 2008). In this paper, we have attempted to merge both these analytical approaches by analyzing the same material, four excerpts from the Swedish study, and thereby highlight the intricate socio-cognitive moves and interpersonal cognitive processing that were found in our respective studies. The transcripts were chosen from the Swedish study, as this used transcription tools that could be used for the chosen analyses (the U.S. study did not include detailed gesture transcriptions). These four particular transcripts were chosen because they include features that were found typical in the original studies. They were also chosen to illustrate seminars in different age groups. More information on each particular seminar excerpt is given below. All the names used in the transcripts are pseudonyms.

RESULTS AND DISCUSSION

Included below are four examples of seminar transcript excerpts from Swedish classrooms. Following the transcripts we offer narrative analysis highlighting the dialogic features related to cognitive processing. Finally, we provide a summary table and discussion of the quantitative aspects of all four transcripts.

Sequence 1a: Five-Year-Olds Discussing "Pippi Longstocking"

The participants are discussing a children's book by the Swedish author Astrid Lindgren, "Pippi Longstocking". In this particular chapter, Pippi, who is the strongest girl in the world, dressed in funny clothes and with bright orange braids, has just moved to the little town and to impress the children living there she tells fantastic stories.

This sequence is filmed 2 minutes after the seminar has started and lasts for 43 seconds. Most of the children have participated in seminars before; however, it is Martin's first seminar. The facilitator has asked the opening question which is: "Would you like to have Pippi for a friend?" A girl (Saari) has answered the opening question by saying that you have to protect yourself against Pippi since she is the strongest girl in the world. After that, another girl (Anita) stated that she would like to have Pippi as a friend since she is the strongest girl in the world. There is then an interruption concerning seminar rules from one boy (Martin). There is a cut in the transcript for 1 ½ minute and the next part of the sequence lasts for 35 seconds. Tom has answered the opening question, saying he agrees with Martin that he doesn't want Pippi as a friend because she is a girl.

1. Saari: I think (?) it's a good
2. Facilitator: It's GOOD to be her friend
3. (6) /Facilitator writes on her note pad/
4. Martin: You forgot the D in the beginning /He leans forward, facilitator looks at him and then back at her notes/
5. Facilitator: m (.) d'you know (.) /She looks at Martin, shakes her head, raising her

eyebrows/ I'm just sitting here an' making kinda jotnotes /She waves her right hand, leans forward, shakes her head/ I'm not writing wholly fully just small (.) /She screws her eyes up, looks towards Johanna/ scribbling (.) /She "writes" in the air, smiles. Martin puts his hands to his face, wriggles his hands and puts them down/

6. Facilitator: Martin then why (.) /She nods, point with her pen towards Martin/ do you think would you like her as a friend? Or wouldn't you /She shakes her head/
7. Martin: Nope /He puts his hands to his face, shakes his head/
8. Facilitator: NO? /She shakes her head, writes on her note pad. Idun starts "writing" on the table/
9. Martin: Never
10. Facilitator: NEVER (.) why never
11. Martin: Becau:::se (.) she's a girl (↑) /He turns towards Tom, smiles. Tom looks alternately at Martin and facilitator/
12. Facilitator: But if she was a boy then /She nods a little/
13. Martin: ((giggles)) /He puts his hands to his mouth/
14. Facilitator: If it was a boy /Anita shakes her head/
15. Tom: No /He shakes his head/
16. Martin: No /He shakes his head a little/
17. Tom: Nope /He shakes his head/
18. Martin: No /He shakes his head a little/
19. Facilitator: NO (.) okay (.) OKAY /She nods and glances over the group/

Martin breaks the seminar rules by not keeping to the subject (4). After this happens, there is a pause of 6 seconds where the facilitator writes on her note pad and the group is concentrated on her writing, looking at the note pad, most of them leaning forward. Almost all glances are focused on the facilitator or her note pad during this part with only two quick glances from Anita and Saari on Martin. The facilitator looks at Martin, the note pad and at Johanna alternately, probably considering how to handle the situation. The facilitator then puts the seminar back on track with a question addressed to Martin about whether he would have wanted Pippi as a friend. Martin seems a bit uneasy even though his answer is a prompt no. He puts the hands to his face. When he answers that he will not, because Pippi is a girl, he turns to Tom (11). This seems to make Tom uneasy; he looks back and forth at the facilitator and Martin.

Here we now have the boys with opposing points of view as well as the earlier differences stated by the girls. Both intrapersonally and interpersonally, it seems these young children are considering various points of view while evaluating the ideas of strength and friendship.

Sequence 1b (Continuation of Sequence 1a, One and a Half Minute Later):

1. Facilitator: Would you like Pippi as your friend?
2. Tom: Nope /He shakes his head/
3. Facilitator: No? And why not? /She writes and turns her head towards Tom. Tom raises himself up in the chair/
4. Tom: She:'sa girl (↓)
5. Facilitator: No but (.) you have friends that are girls /Martin puts his hands to his mouth/
6. Tom: Mm sometimes yah (.) bu' not Pippi / He leans back and puts his hand to his neck/
7. Facilitator: Not Pippi, but if she was (.) boy then /She turns her hand to her neck, Tom shakes his head/
8. Tom: Not (.) no
9. Facilitator: But but is it really so Mart (.) eh Tom that you think so /She smiles and nods, raises her eyebrows/
10. Tom: Yes
11. Facilitator: You who usually play a lot with the girls

12. Tom: Mm atleast instead smaller boys it doesn't matta if it's a girl or a boy /He fingers on the microphone cord/
13. Facilitator: So it doesn't matter /She shakes her head/
14. Tom: Mm
15. Facilitator: Okay
16. Martin: Pippi (.) one orange 'air and (?) /He signs braids by his ears/
17. Johanna: TOM /Tom turns his head towards Johanna and back/
18. Facilitator: Yes
19. Martin: and braids standing right out
20. Johanna: **TOM**
21. Facilitator: but isn't that good then /Tom turns his head to Martin and back to facilitator/
22. Tom: No
23. Martin: GOD no:

Tom alters his idea about why he does not want to be Pippi's pal from saying that it is because she is a girl (4) to that it doesn't matter if she's a boy or a girl (12). This shift in the young boy's perspective, from both a social and a cognitive viewpoint is fascinating. Tom may be willing to take this new path because of learned confidence with the seminar process. He has had considerably more experience with the rules of dialogic discussion, whereas this was Martin's first seminar.

Martin, however, presents a completely new idea, that hasn't been considered in the seminar before – that he wouldn't consider having Pippi as a friend because of her looks (16, 19) and Tom agrees with him. These shifts and turns in a very short period of time suggest students consideration if not, integration of new perspectives. These adjusting ideas influence the rest of the dialogue.

Sequence 2: Grade 1 Discussing "Ronny and Julia"

This group of first graders discusses a chapter from a Swedish book for children (by Gahrton & Unenge). Ronny and Julia are friends, but the other boys tease Ronny, saying he has cooties (in Swedish "girl germs"). This makes Ronny sad and worried and he is not sure he wants to play with Julia anymore.

The sequence is filmed 25 minutes after the seminar has started and lasts for 1 minute 12 seconds. It is preceded by the facilitator asking if it's possible to know if someone is anxious. One boy (Christian) has been tapping the table with his eraser. The facilitator moves into questioning students to think about their discussion process and how they did with their personal goals.

1. Facilitator: D'youknow Christian you're diSTURBING the others theyhave think it's really to think an' /She shakes her head. Christian stops "stamping"/ (.) something else an' /Christian drops his eraser into the middle of table, leans over quickly and grabs it/
2. Diana: Christia:n
3. Christian: To thishere chickenPOX /All except Igor and David look at Christian/
4. Abel: ((giggles))
5. Otilia: ((giggles))
6. Facilitator: What'ya say /She leans forward/
7. Christian: Heas **CHICKEN**pox
8. Facilitator: Heas CHICKENpox
9. Abel: ((laughs))
10. Christian: eh have done
11. Facilitator: Can you get chickenpox 'cause you're worried /She and Kasper smiles/
12. Abel, Nancy, Kasper, Mickan, Markus: ((laughs)) /Otilia smiles/
13. Kasper: Nohooo

14. Christian: The eraser has got chickenpox
15. Facilitator: The ERASER has I thought it was Ronny ya meant who was all spotty /Nancy turns to Christian and smiles. Bella looks at the camera/
16. Mickan: ((laughs))
17. Markus: But then maybe it can infect you
18. Facilitator: But listen **if** you notice that a friend is this worried or sad or something like Ronny was whatcan you do then /Kasper nods/
19. Markus: Cheer'em up
20. Facilitator: What did'ya say
21. Markus: cheer them up can d
22. Facilitator: Cheer them up howdoyou do that
23. Markus: an' can give something orah (3)
24. Facilitator: What doyou think you should give then /Facilitator writes/
25. Markus: (1) a flower or whatever
26. Facilitator: Yea you think something a gift orsomething /She shakes her head/
27. Christian: A **DRAWING** /He leans over the table with his arms out. Facilitator nods once/
28. Facilitator: A drawing whatelse can you do
29. Christian: An **UGLY**
30. Facilitator: An ugly drawing /Carl looks at the camera/
31. Nancy: That wouldn't make you glad /She looks at Markus. Christian draws back/
32. Christian: B
33. (1)
34. Markus: If you make an UGLY drawing then you just had to daub an' then you getah /Carl nods/
35. Facilitator: An' that wouldn't make you glad what would you be /She nods and turns to Carl. Markus turns to David/
36. Carl: Yea but I (?)
37. Christian: Yea but if you are /He turns to facilitator and to Markus/
38. David: I daubed on my airplane
39. Facilitator: Some other come /She nods/
40. Carl: Yes /Christian's eraser taps twice/
41. David: Airplane /A tap is heard from Christians eraser/
42. Facilitator: Listen (.) I think we say like this (.) an' thanks very much for the conversation /She raises up in the chair. Nancy and Carl reaches for their pieces of paper. David puts down his piece of paper and Bella grabs her piece of paper with both her hands Christian drags his piece of paper towards his body. Otilia stretches out her hand over the table with her piece of paper. Diana puts down her piece of paper on table. Abel turns to Markus and then to Diana/
43. Christian: Yeaah
44. Diana: Now can we read out loud /She shakes her of piece of paper in front of her/
45. Facilitator: Those who want to (.) /She puts down her pencil and puts her hands together/
46. Diana: read out loud
47. Facilitator: can today can tell what they have /Markus raises his hand/
48. Carl: **OOPS**
49. Diana: I want to
50. Facilitator: on these noteshere instead
51. Carl: Right
52. Facilitator: Otilia would you like to tell
53. Carl: That you could do
54. Abel: One doesn't have to
55. Carl: I WANT to /He jumps off his chair and goes out to the left/

The facilitator corrects Christian about his disturbing the seminar by making noise and a student (Diana) supports this (2). Christian answers the next question by making a joke

that his eraser has chickenpox (3). Many others laugh and seem to appreciate the joke (4, 5, 9, 11, and 12) even though Bella looks at the camera (15) as if she is worried if this is appropriate. The facilitator then treats the utterance as if it was a new seminar idea presented by posing a new seminar question (18). They now go on to discuss how one can help a friend who feels worried or anxious. Christian suddenly presents an idea highly connected to the previous seminar discussion. He suggests giving away a drawing (27) but immediately seem to change his mind and provokes by specifying that it should be an **UGLY** drawing (29). This time no one seems to think it's a joke, although at least Carl seems aware that it is a provocation, he looks at the camera (30). The facilitator chooses to repeat the sentence in a neutral tone (30). Nancy (31), Markus and Carl (34) on the other hand refute the idea in accordance with seminar practice.

There is now some confusion as to how to go on (35-41). Nancy, Markus, Carl, David and the facilitator seem to try to encourage each other to help find the way to carry on by looking at each other but the verbal interaction is disrupted. Contrary to their usual behavior, someone here is looking at a person who doesn't speak and the person speaks almost immediately after this. Nancy in 31 looks at Markus who speaks in 35, facilitator in 35 looks at Carl who speaks in 36, Markus in 35 looks at David who speaks in 38. The rest of the participants either look at the speaker or at their piece of paper (except for Abel who looks alternately at Nancy and Markus). Christian is trying to get into the interaction both by speech (32, 37) and by looking at the facilitator and Markus (37) but with no success. The group seems to work together to correct Christian with actions, rather than with words. They also seem to try to get the seminar back on track after he has tried to disturb it, by using looks and gestures, encouraging each other to speak to protect the dialogue from collapsing.

The facilitator finally ends the seminar, which causes most of the participants to touch or move their pieces of papers with personal goals (42). Diana asks if they now can read their notes (44) and they go on discussing the procedures for this (47-55). As in earlier sequences of this seminar, the individual gestures and glances throughout the seminar show that participants are concentrated on their pieces of papers with personal goals, except when they find the verbal interaction interesting. For example, Otilia, who has been supporting the facilitator earlier, takes up her piece of paper in turn 16 and plays with it, glancing quickly back and forth to the facilitator for the rest of the sequence. Their gestures support the idea that they are trying to understand a new step of the seminar – goal-setting.

There is a range of questions posed by the facilitator, including management and coaching the social behavior for example: "D'you know Christian…?" (1). In addition, the facilitator poses thoughtful, open-ended questions like "- But listen **if** you notice that a friend is this worried or sad or something like Ronny was what can you do then" (18). Cognitively, some facilitator questions take the students to application and elaboration. "What do you think you should give then?" (24). likewise the facilitator asks an open and clarifying question: "What else can one do?" (28).

Christian is obviously trying to disturb the seminar and the other participants. Suddenly he lets himself be included into the dialogical interplay, by suggesting that a drawing might be given away (27). He seems to regret this, and returns to his former strategy by suggesting an ugly drawing (29). This, however, is treated by both the facilitator and the other participants as a new, adjusting idea and is analyzed and refuted according to seminar procedure (30-35). Before Christian presents the idea, the seminar is working rather slowly, one statement building on another cumulatively. This adjusting idea, even though it is refuted, brings new life to the dialogue at the end of the seminar.

Sequence 4: Grade 7 Discussing a Newspaper Article on Dress Code

The newspaper article discussed by this group of seventh graders includes interviews of a principal, who has prohibited certain clothes and jewellery at her school because she finds them

improper and provoking, and of students, who go to her school.

The sequence is filmed 50 minutes after the seminar has started and lasts for 1 minute 30 seconds. It is preceded by the group discussing how school differs from working life and Mattis refers to a recent class, stating that it is also important for young people to know how to express themselves. After this sequence, the facilitator reviews the discussion and they evaluate their group goal.

1. Facilitator: It's isn't it SOMEones (.) job to inform the youngstersin is still on their way to become grown-ups (.) it must be SOMEones job to tell you HOW you (?) /She hits her palm with the other hand, turns to Anna A and nods. Anna A turns out her hands and take them back/
2. Anna A: Yes (.) it could be school's job but
3. Facilitator: And the home or /She bows to one side, turns her hand out, moves her hands up and down/
4. Anna A: School should b yea but /She shakes her head/
5. Facilitator: But not forbid is that what you're getting at /She turns to Mattis, nods/
6. Anna A: ba exactly school should inform but not forbid /She shakes her head, turns to Jakob/
7. Mattis: M
8. Johnny: M
9. Facilitator: M okay
10. Jakob: It think it's more the parents job it yeait yeait's sorta both and /He turns to Anna A, waves his hand. Facilitator turns to Jakob and nods. Anna A shakes her head/
11. Facilitator: Yes yea
12. Anna A: yea THOUGH the parents CAN forbid /She takes up her paper and turns it around. Jakob starts to write or draw, facilitator turns her pen out towards him/
13. Facilitator: If the parents don't
14. Ruben: But if the parents don't bid () uh (.) ah (.) not care so ah
15. Facilitator: If the parents don't inform then it's the task of the school is that howit fee' /She turns to Jakob and raises her hand towards him/
16. Anna A: Yes the SCHOOL AND parents should inform but the school should not forbid the parents should do that /She rises her hands in front of her, shakes her head, points towards her other hand, puts both hands to her mouth and shakes her head. Facilitator turns down her hand and looks at Anna A/
17. Facilitator: No yea the parents can choose that AS THEY LIKE /She shakes her head and turns to Anna A/
18. Anna B: If they are /She turns to Anna A and nods/
19. Anna A: If they are /She turns to facilitator and then to Anna B/
20. Facilitator: If they are (.) exactly /She claps, holding her hands by the side of her head/
21. Anna A: Yeah it's likethis
22. Mattis: Yes but at the SAME TIME it feels like th (.) now (.) parents CARE about this (.) it feels like (2) there they shouldhave told this earlier /Facilitator nods/ without the TEACHER sorta telling /Anna A looks at the camera/ (.) if they /He moves his hands up and down/
23. Facilitator: It should have been done at home andifnot done at home it ought to /She nods/
24. Mattis: Yes
25. Ruben: Well I thinkthis principal seems to CARE about the STUDents STILL although: /Lisa and Lucy look at the camera. Ruben shakes his head. Mattis looks at his paper and then at Lisa/ (.) a a:h (.) although everyone seems to think she is sort (.) really evil but
26. Facilitator: M /She nods/

27. Mattis: M
28. Johnny: But I think she /Mattis looks at Lisa/
29. Ruben: look sheso wanna grade s talkin´about grades /He looks at facilitator and then at article. Jakob nods/
30. Johnny: I think she is contradicting herself
31. Mattis: N what does silent Lisa think / He looks at Lisa and smiles. Johnny turns towards Lisa/
32. Ruben: Really /Lisa stops writing and turns to Mattis. Facilitator, Susanne, Sofia, Ruben, Jakob, Jan turns to Lisa. Lucy looks at Lisa's paper. Mattis looks at Lisa smiling. Facilitator smiles/
33. Lisa: I think (1) wrong /She moves her body, leans back, moves her fingers through her hair. Facilitator leans back and looks at her watch/
34. Matti: What you think youcannot think wrong
35. Lisa: Mm yeahbu it /She turns quickly towards Lucy/
36. Facilitator: Let's see we really have to sto:::p he:re ((laughs)) /She leans over table with her arms out and smiles. Anna A turns to facilitator and then to the group, rises in chair and starts to write. Lisa turns out her hand and leans back. Lucy turns to Lisa and Ruben, leans back and smiles. Sofia moves her hand quickly over the table, "sweeping". Ruben leans back and smiles. Mattis turns his head to facilitator, nods and turns to Lisa. Johnny shakes his head and rises in chair. Jakob turns to Mattis and then to his paper. Jan turns to his paper and starts to write/draw/
37. Mattis: Mh typical
38. Lisa: M bu what does silent ja (.) m Janne (?)
39. Mattis: What?
40. Facilitator: Janne hasn't even been invited ONCE /Lisa nods and Mattis smiles/
41. Susanna: (?) /She smiles/
42. Lisa: Jack ((giggles))
43. Faclitator: (?)
44. Mattis: yeahbut Jacky has alr hasal already beenb in invited
45. Jakob: butyou youhave to talk for yourself then
46. Susanne: ((laughs))
47. Lucy: ((laughs, giggle in talk)) (?)

Anna A, Ruben, Mattis and the facilitator are the most verbally active in this sequence. In turns 2-21 the utterances are quick and with a lot of interruptions. Anna A is pressing her point that it's the parents' responsibility to foster the child but that school also has a role in informing. The quick conversation seems to end in consensus, Anna A, Anna B and the facilitator all agreeing almost simultaneously uttering the same words (18-20). However, Ruben has earlier tried to point out that their way of reasoning might fail if parents don't take their responsibility (14) although he expresses it vaguely. The point is partly taken by the facilitator (15) but is lost when Anna A restates her earlier point. Mattis however tries to elaborate Ruben's point (22) saying hesitatingly that the parents do not seem to have taken their responsibility. Ruben points out that the principal (who has forbidden jewelry and provoking clothes at her school) seems to act with good intentions (25, 29). Mattis abruptly interrupts this line of reasoning by asking what "silent Lisa" thinks (31). The question seems to surprise and offend Lisa (33), who reacts negatively both in speech and gestures and later by imitating Mattis' wording but direct them towards Jan, who has been silent during long parts of the seminar (38). The rest of the participants also seem to react strongly to Mattis utterance, chiefly by checking out how Lisa will take it by looking at her (32). He is breaking the rules, not by asking Lisa the question, but probably by calling her "silent", and also by interrupting the flow of the discussion. The same thing doesn't happen when Lisa directs the same

line towards Jan. Here, the participants all look at Lisa or Mattis and seem to take it as a joke (38). Lisa is probably not intending on commenting Jan, but is answering Mattis. Jan looks down on his article and makes no move showing that he has even heard it. When the facilitator ends the seminar (36) the group reacts by joking, laughing, and by gesturing, there seem to be an almost simultaneous move or shake out of the circle, as if a game is over.

Anna A, Susanne, Sofia, Ruben, Mattis and Lisa seem to look at most of the talkers intensely during most of the sequence and so does Lucy from turn 22, whereas Anna B, Jakob and Jan only look up from their papers around the "silent Lisa" passage and Jack only in turn 17 and 25. Anna A looks at the camera (22) when Mattis emphasis the word TEACHER, explaining that school might have an obligation and Lisa and Lucy look at the camera (25) when Ruben is defending the principal. It seems as if they are looking at the camera when school values are questioned or discussed. The facilitator in this sequence looks more intensely at the participants with very few glances at the article or the paper. When Jakob is trying to get into the discussion (10), she seems to want to encourage him in by glances and gestures (10-15). In turn 33 she checks the watch, almost immediately resulting in her closing the seminar.

We consider this a truly dialogic segment because of the ratio of teacher to student talk.

TABLE 2
Transcript summary matrix

	Sequence 1a	Sequence 1b	Sequence 2	Sequence 3
Total talk (Talk turns and time)	19 turns 43 seconds	23 turns 35 seconds	40 turns 62 seconds	36 turns 75 seconds
Source (Talk turns and %)				
Facilitator	8 42%	10 43%	15 37%	12 33%
Students	11 58%	13 57%	25 63%	24 67%
Form				
Statement	14	17	27	30
Question	5	6	13	6 (2 by student)
Relation				
Stick	17	22	36	33
Roll	2	1	4	4
Cognitive Process				
Clarify	Evaluate	Apply	Analyze	Evaluate
Analyze				
Speculate				
Synthesize			Apply	
Apply				
Evaluate				
Generalize	Apply	Evaluate	Evaluate	Apply
Compare				
Affirm				
Cognitive Content				
Text	Self	Self	Other	Others/ The world
Self				
Group				Text
Other topic	Group		Self	
Others/ the world				Process
Process			Other	

The actual questions posed show that the students have acquired sophisticated dialogic skills of thoughtful, shared inquiry. The cognitive levels of this discussion are primarily within evaluation and application. In addition, the students enjoy creative ownership of the process as illustrated by their inclusive thinking. The prevailing idea in the beginning of the sequence is that parents have the responsibility for children's upbringing, not school. Ruben has earlier tried refuting this idea, or at least elaborating it, by pointing out that this can't be the case if parents fail to take the responsibility. Mattis is trying to incorporate this idea into the discussion, which tends to display a cumulative group process, where Anna A, Anna B, and the facilitator are supporting, refining, and elaborating the previously presented ideas. Ruben makes a new attempt to challenge this cumulatively built idea, by presenting a completely new one: that the principal is forbidding the clothes because she cares about the students, an adjusting idea, that might have changed the line of discussion if it hadn't been lost. A summary of our socio-cognitive analysis of the transcripts are shown in Table 2.

Talk and Source: Turns, Time, Teacher and Students

Overall, there is a simple pattern across the four seminar transcripts. The ratio of teacher to student talk time shifts with the age and experience of the group. The teacher facilitating dialogue with the younger students must talk and coach the process more actively. And with the older more experienced students, the teacher talks a smaller percentage of the time, showing that the students are more capable of controlling the discussion in a productive fashion.

Form: Statements and Questions

Our analysis of the talk form suggests subtle but important features. While the sequence with the first grade students illustrates more questions, the seventh grade segment includes two questions posed by students. Considering the importance of questioning in the thinking process, this is an important note. That is, when we see students beginning to ask questions to the group, we expect the thinking is moving toward more inclusion and sophistication.

Relation: Stick and Roll

The continuity of discussion topic may or may not correlate with thinking levels, but this is an interesting feature of dialogue to consider. We notice that the younger students seem content to stick with one topic for the discussion sequence. However, the older students tend to roll onto new topics more frequently.

Cognitive Process and Content

Across the transcript sequences, all students exhibited a blend of individual and collective thinking. We must credit the seminar process, the text and the questions with this outcome. In addition, we found patterns of increasingly broad content with the older students.

CONCLUSION

The actual sequence of events in the discussions is clearly related to increasing levels of cognitive engagement. Across the transcript sequences, the teacher and students display awareness to the rules of the game. This shared understanding provides a safe environment for intellectual risk-taking, even though this environment is threatened from time to time by participants (and by the teacher). The safe environment is built and maintained by the participants' and the seminar facilitator's use of gestures and glances, while the critical intellectual process is supported and maintained by verbal interaction.

Towards an Extended Theory of Group Thinking and Further Research

Our key findings begin with the fundamental realization that dialogic instruction, one with a discernable, progressive shape is correlated with critical and creative thinking. Our work, and resent research presented on the similar seminar activities, suggests a personal thinking

process contributing to what can be explained by theories of the socio-cognitive, collective process. The Aristotelian idea of training habits of mind, which will result in intellectual virtues and later in practical wisdom, seems to be a similar way to look at what is going on in the seminar dialogue. In both theories the group dialogue works as a "master" on an interpersonal level (cf. Vygotsky), showing the individual how to cope with differing ideas, how to analyze and sort these out, and how to choose the most productive ones and refute the others. This is later internalized as an intrapersonal, individual skill or virtue. This process can also explain some of the differences between the age groups. The younger students are more dependent on the grown-up for guidance (cf. Rogoff, 1990).

However, there are two modes of "group thinking" displayed in our seminar material. One is "cumulative", where one statement builds on the former statements, complementing, adding, and elaborating on the previously presented ideas. The other one mode is "adjusting", presenting new bold ideas, that haven't been heard before in the seminar. We believe that thinking gets "adjusting" instead of "cumulative" because of some single idea of a participant. This is shown in the above referred sequences at some specific points: Martin's idea of not wanting Pippi as a friend because of her looks (sequence 1), Christian's idea of presenting someone with an ugly drawing (sequence 2), and Ruben's idea that the principal is actually caring for the students by forbidding challenging clothes and jewellery. This presenting of adjusting ideas seems less bound to age.

The Aristotelian idea does not entirely give an answer to what is happening when the adjusting ideas occur. Neither does socio-cultural theory. Piaget (1971) introduces two modes of thinking: accommodating (similar to the cumulative) and adjusting. His theory implies that thinking is an internal process, with a series of developmental steps from concrete to abstract. This is contradicted in our research, where even the young individuals clearly learn from the group process and also presents adjusting ideas in the discussion. Research show that intellectual facilities like making assumptions matures at the age of four (Gärdenfors, 2000) and that skills of thinking and argumentation improved with training (Kuhn, 1991). This supports our idea that the age differences of the studied groups are due to differences in experience, rather than biological maturity.

But how do the adjusting ideas occur? Socio-cultural theory, as well as Aristotle's ideas, must be married with theories on intuition in thinking if we should be able to interpret these "bold ideas" coming up from (almost) nowhere in the discussion. We would have to refer to Popper (2007), Lindström (2008) and Larsson (1904), who claim that there is an irrational and emotional element in the thinking process: Creative intuition is an active part of discovering solutions. This is a continuous process in science, Popper states. Popper (2007) and Lindström (2008) conclude that this critical problem solving strategy is creative and is used by artists as well as by scientists. This comparison between the creativity of art and science is also made by Shlain (1991).

This calls for an extended theoretical approach when analyzing the thinking developing in Sokratiska or Paideia seminars. It's a challenge for future researchers on the Sokratiska and Paideia seminars, and on similar dialogical learning activities.

REFERENCES

Adler, M. J. (1982). *The Paideia Proposal. An Educational Manifesto, on Behalf of the Members of the Paideia Group*. New York; Collier Books, Macmillan Publishing Company.

Almasi, J. F. (1995). The nature of fourth graders' socio-cognitive conflicts in peer-led and teacher-led discussions of literature. *Reading Research Quarterly*, *30*, 314-351.

Aristotle. (1998). *Nicomachean Ethics*. New York: Dover Publications.

Billings, L. and Fitzgerald, J. (2002) Dialogic discussion and the Paideia seminar. *American Educational Research Journal*, *39*(4), 907-941.

Brown, A. L. (1994). The advancement of learning. *Educational Researcher*, *23*(8), 4-12.

Danielewicz, J. M., Rogers, D. and Noblit, G. (1996). Children's discourse patterns and power relations in teacher-led and child-led sharing time. *Qualitative Studies in Education*, *9*, 311-331.

Gärdenfors, P. (2000). *Hur Homo Blev Sapiens, Om Tänkandets Evolution.* Falun: Nya Doxa.

Haroutunian-Gordon, S. (1991). *Turning the Soul: Teacher through Conversation in the High School.* Chicago: University of Chicago, USA.

Kuhn, D. (1991). *The Skills of Argument*. New York: Cambridge University Press.

Kumpulainen, K. and Mutanen, M. (1999). The situated dynamics of peer group interaction: An introduction to an analytic framework. *Learning and Instruction*, *9*, 449-473.

Langer, J.A. (Ed.) (1987). *Language, Literacy, and Culture: Issues of Society and Schooling.* Norwood, NJ: Ablex.

Larsson, H. (1925). *Hans Larssons Samlade Skrifter.* Stockholm: Albert Bonniers förlag.

Larsson, H. (1904). *Intuition: Några Ord Om Diktning Och Vetenskap*. Stockholm: Albert Bonniers förlag.

Lindström, L. (2008). Intuitionens roll i estetiska läroprocesser. In L. Lindström and K. Borg (Eds.), *Slöjda för livet. En bok om pedagogisk slöjd.*

Lindström, L. (2000). Sokratiska samtal och reflekterande läsning. In M. Björk (Ed.), *Att växa med språk och litteratur* (pp. 75-89). Stockholm: Natur och kultur.

Nelson, L. (1965). *Socratic Method and Critical Philosophy. Selected Essays.* New York: Dover Publications.

Nystrand, M., Gamoran, A., Kachur. R. and Pendergast, C. (1997). *Opening Dialogue. Understanding the Dynamics of Language and Learning in the English Classroom.* New York: Teachers College Press.

Nystrand, M. (2006). Research on the role of classroom discourse as it affects reading comprehension. *Research in the Teaching of English*, *40*, 392-411.

Olsson, O. (1911). *Folkets Bildningsarbete – Erfarenheter Och Uppslag.* Stockholm: Svenska nykterhetsförlaget.

Orellana, P. (2008). Maieutic frame presence and quantity and quality of argumentation in a Paideia seminar. Doctoral Dissertation. University of North Carolina, USA.

Pihlgren, A. S. (2007). The features of socratic seminars. Peer reviewed papers presented at the *13th International Conference on Thinking*, 2007, www.thinkingconference.org.

Pihlgren, A. S. (2008). Socrates in the classroom – rationales and effects of philosophizing with children. Doctoral Dissertation. Stockholm University, Sweden: Department of Pedagogy.

Popper, K. (2007). *The Logic of Scientific Discovery*. New York: Routledge.

Roberts, T. and Billings, L (2008). *The Paideia Seminar: Sctive Thinking Through Dialogue* (2nd Ed.). The National Paideia Center: North Carolina, U.S. A.

Robinsson, D. (2006). The Paideia Seminar: Moving reading comprehension from transaction to transformation. Doctoral Dissertation. University of Massachusetts Lowell, USA: The Faculty of the Department of Language Arts and Literacy of the Graduate School of Education.

Rogoff, B. (1990). *Apprenticeship in Thinking. Cognitive Development in Social Context.* New York: Oxford University Press.

Tobin, K. (1987). The role of wait-time in higher cognitive learning. *Review of Educational Research*, *57*, 69-95.

Shlain, L. (1991). *Art & Physics, Parallel Visions in Space, Time and Light.* New York: Quill William Morrow.

Vygotsky, L.S. (1978). *Mind in Society, the Development of Higher Psychological Processes.* Massachusetts: Harvard University Press.

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Transdisciplinary Leadership: Dealing with Wicked Problems, A Case Study from Australia

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ABSTRACT

While addressing social problems, and planning in general, the notion of "wicked problems" (coined by Rittel and Webber, 1973) is also applicable to complex organisational and social change issues that are currently challenging business and community leaders. The relentless drive for solutions, coupled with the desire to 'get it right' the first time, is straining the traditional or rational approaches to problem solving and leadership. In an effort to address the above, concepts such as cross-disciplinary, inter-disciplinary, and multi-disciplinary teams or thinking have been developed and deployed. However, these have fallen short of expectations. The concept of transdisciplinary leadership is drawn from systems thinking transdisciplinarity. Using action research and case study methodology, transdisciplinary leadership has evolved through a range of "complex wicked problems". It also draws from in-depth interviews with a number of business and community leaders in Australia and USA who have successfully addressed "wicked problems". This paper suggests that developing leadership strategies based on transdisciplinary thinking can benefit leaders tasked with dealing with wicked problems. A transdisciplinary approach offers a more effective approach to building knowledge, consensus, making sense of the complexity of issues at stake and ultimately delivering results with wider support and agreement.

Keywords: Leadership, organizational change, problem solving, systems thinking, transdisciplinarity

INTRODUCTION

The media highlights daily the performance of national and global leaders as they are confronted by increasingly complex challenges, as the milieu within which leaders operate continues to undergo radical change. However, leadership research has, over the past 50 plus years, continued its focus on the relationships between tasks, roles, functions, contexts, and behaviours (Bass, 1990; Yukul, 1994; Zaccaro and Klimoski, 2001). An underpinning assumption is that leaders will adapt their leadership practices in response to the change in their milieu. Mounting evidence from decades of organisational, national and global crises would suggest that leaders do not readily or easily adapt their practices as they are confronted by these increasingly complex leadership challenges.

A philosophical question raised over 20 years ago during an early career discussion on leadership, was whether leadership is an "Art, Science or Practice". Clearly, there is no simple answer to this question. Of importance to the debate was the syntax of "practice"; that is "to practice" as a profession, or to "practice" as a musician or sportsperson, that is to expand, improve and enhance one's skills, knowledge, and performance in different contexts.

The challenge is that many leaders appear not to "practice" to improve their leadership

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performance, rather, they continued, holding onto a past paradigm of leadership thinking, despite being faced with overwhelming evidence of a radically changing milieu. This paper is written with my reference to my involvement as a participant, facilitator, and leader across a wide range of Australian and international projects, such as:

- Developing the approach for a major policy research project Future of Work 2020 (Fayed and Pearce, 2008),
- Developing the strategy framework and shared vision across stakeholders for new specialist health business unit for a multinational bank,
- Facilitating and team coaching multinational finance organisation's strategy: Carbon Neutral 2010, and
- Facilitating a think tank on Military Health Ethics (Pearce and Saul, 2006).

All these have clearly highlighted the fact that the dominant "why and how" of leadership thinking and practice has essentially remained unchanged over the past sixty years.

This is best demonstrated by the current systems of supporting and marketing leadership theories or concepts to the broader population. Researchers are asked to capture "what is leadership" based on existing leadership theories, and observation of a comparatively small population. Successful leaders of the day are identified and also asked to distil their thinking on leadership. This is then marketed through books, publications and courses to a wider audience. However leaders, when confronted by new complex challenges, are asked how they view these challenges and "how they think about the leadership strategies required to respond to these challenges" suggest that current mainstream thinking on leadership is not helpful.

Hambrick and Fukutomi (1991) support this observation in their study of a Chief Executive Officer's (CEO) tenure, where they suggest that a CEO exists within a current paradigm and that this is impacted by two elements, schema and repertoire. Schema is "pre existing knowledge systems a person brings to a job" (p.721). These systems are the personal givens, the conscious and unconscious preconceptions, beliefs, inferences, and expectations. They are derived from family experiences, culture, business experiences and networks, formal and informal education, and causal observation. Research indicates that a leader's values and belief systems have the strongest influence (Bass, 1990; Beck and Cowan, 1996; Montor et al., 1998; Yukl, 1994). Schema forms the perceptual and interpretive apparatus from which a manager or executive operates. This is the Art of Leadership.

This is balanced by a person's repertoire. Repertoire is the supply of skills, devices or expedients possessed by a person at any given time that is a person's "tool kit" (Hambrick and Fukutomi, 1991, p.721). This is the Science of Leadership. However, it is limited by the completeness or balance of the elements of the Science that a person considers either useful or not. Even though an element may be considered useful, a person may dismiss using it due to reasons such as lack of confidence or clarity of understanding. In some cases an element may be included within a repertoire however it may be totally avoided. So self-insight and related confidence will determine which elements of repertoire will be selected, used, improved, and new elements sought. This leads to the skills becoming the "tangible" ability of a person to apply their repertoire within a given context.

Clearly the interrelationship of these two elements, schema and repertoire, influences the practice of leadership, and feedback from the practice informs these elements. Any shortcoming in leadership paradigm thinking will critically limit a leader's ability to make sense of and identify with new, complex and at times unique challenges being presented in the current dynamic environment of the 21st century.

The aim of this paper is to add a perspective to leadership practice, specifically dealing with complex challenges, while being informed by the art (personal nuances, aesthetic judgement, and interpretations) and the science (theories,

models, and concepts drawn from different disciplines) of leadership. Specifically the focus is on leaders tasked with the strategic responsibility of leading complex challenges such as radical change, sustainability or building strategic capability and capacity (*see* Collins and Porras, 1994; Denison et al., 1995; Finkelstein and Hambrick, 1996; Jaques and Clement, 1994; Wheatly, 1992; Zaccaro and Klimoski, 2001).

WICKED PROBLEMS: 21ST CENTURY LEADERS' CHALLENGES

Leadership has been a multi-discipline and multi-paradigm field of study for some decades. Bass (1990) and Van Seters and Field (1990) present detailed evidence of this evolutionary development. Senge (1990) questioned traditional leadership theories and their approaches based on the assumption of "people's powerlessness, their lack of personal vision and inability to master the forces of change" (p.340). Yukl (1999) notes the limitations of many early leadership studies by using a two factor relationship such as task versus orientation or autocratic verus participative or transformational versus transactional. Yukl (1999) importantly argues that this approach is an over simplification of what is in essence a complex function, the processes involved in an effective leadership practice.

Additionally this extensive body of work on leadership in essence focuses on the elements of the organisation and so achievements at the functional element of a business or organisation. This is totally in line with the Newtonian reductionist principles applied to business, strategy and leadership. It is not intended as a criticism of the works, rather an observation that each represents the research paradigms and strategies of the period in which they were the focus and undertaken. Unfortunately these do not provide insight into dealing with wicked problems.

Drucker (1968), Schön (1971), Ackoff (1981), Nohria and Berkley (1994) and Stacey (1996) are representatives of the discussion on the need for management to the develop thinking and means, to better manage and cope with increasing discontinuities or complexity. One early landmark work that continues to hold relevance to understanding the challenges of leading, via their discussion of planning in environments of complexity, is Rittel and Weber (1973) and their notion of "wicked and tame" problems.

Rittel and Weber (1973) identified ten distinguishing properties of wicked problems. Of these, the problem has no definition, it is in essence unique, and as such has no single solution. The "right solution" may be not only misleading but also meaningless. It is important to highlight that these problems are complex, not complicated. These terms are often interchanged.

Complicated problems have an identifiable structure, which can be understood given time and expansive knowledge of all the interrelating disciplines that make up the parts. They represent a large-scale collection of many simple or tame problems; however, because of the nature of scale, they are not reducible to a simple problem. The structure, if any, is generally externally imposed and with a focus on one element of the total problem.

Whereas complex problems have no clear structure and in essence are difficult to understand. This structure is emergent, and can only be achieved given appropriate open interaction between the actors and elements of the total system. "There seems to be a growing realization that a weak strut in the professional's support system lies at the juncture where goal-formulation, problem-definition and equity issues meet." (Rittel and Weber, 1973, p.156).

A summary comparison of complicated and complex problems is in Table 1.

A challenge confronting leaders of large organisations is that managers in general tend to build complication into business structures and operations. As the natural rate of change increases so does the complexity of the issues confronting the leader. Performance demands to present appropriate, relevant, and immediate solutions merely increases the leaders dilemmas. Schön (1971) and Stacey (1996) also highlight the glaring fact that as complexity increases,

TABLE 1
Characteristics of complicated and complex problems

Complicated problems	Complex problems
Have defined form or structure	Do not have well defined form or structure
Structures determine relationships	Structures and relationships are dynamic and interactive
Have clear dimensions and variables for which we have current knowledge	Dimensions and variables are not known due to lack of clarity of the problem
Have a high degree of certainty	Have uncertainty and ambiguity
Assume a static environment	Occur in dynamic environments
Understanding is based on convergent rational linear cause – effect thinking	Understanding requires divergent holistic systemic thinking
Have many "right" alternative solutions that can be determined through reduction and analysis and rationally linked	Have many possible solutions, none of ultimately right and they emerge through a process of divergent thinking and synthesis

predictability decreases, with the result that solutions and systems generate unknown and unintended consequences, and newer, more complex problems. The complexity of these so-called problems generates additional issues such as how to build consensus on agreed outcomes across different groups or stakeholders with the continual expression of we must get "it" (the solution) right. This notion of "rightness" raises the interpretation of what is ethical or fair, for each stakeholder group, further compounding the issue.

Supporting this practice for rightness is the observation by Shapiro (1988), who is perhaps the first person to suggest "clumsy institutions" in his argument that when institutions, or their leaders, are presented with complex problems they are also presented with opposing definitions and interpretations of the wicked problem and associated solutions. It is the expectation of having to choose one definition and solution that leads to this notion of clumsiness.

Ghoshal (2005) presents a landmark paper, in what has been a publicly muted debate, on the role bad management theory has played over the past fifty years. I would extend this to include leadership theory. It also provides insights into the notion of clumsiness with his critique on the influence of bad management theories, through the "pretence of knowledge" and "ideology penetrating disciplines" as leading to "excessive truth-claims based on partial analysis and unbalanced assumptions" which has been influencing the practice of mangers (pp. 76-77).

While Ghoshal was reflecting on the high profile demise of Enron, the continuing Global Financial Crisis perhaps amplifies his case a thousand fold. The role of "positivism" cannot be understated, as Ghoshal (2005) citing Milton Friedman perhaps best captures the management and leadership dilemma we currently find ourselves in:

> *Don't worry if the assumptions of our theories do not reflect reality; what matters is that these theories can accurately predict the outcomes. The theories are valid because of their explanatory and predictive power, irrespective of how absurd the assumptions may look from the perspective of common sense. (p. 80)*

Following on from the above view, is the underpinning assumption that leaders engaged in solving wicked problems are, and will continue, to be evaluated on their performance. That is their ability to present a solution. The solution's "rightness" appears to be driven by the underpinning views of the world held by the

different stakeholder groups, their timeframe, agendas, and apparent lack of due consideration of the downstream impacts these solutions will or may have.

The role of performance management is based on rational decision making thinking. It assumes a single linear predictive path of cause and effect. This rational predictive logic dictates that interventions are possible, trade-offs made and solutions with their results known.

Adding to the leader's dilemma is the use of vertical organisational structures and divisions that operate on single disciplinary thinking and often with a notion of controlling an element of the complex challenge that is within their specified domain. The clumsiness of rational cause and effect thinking with vertical organisational divisional structures influences leader behaviour and with short term market demands, requires leaders to present "the solution", so further blinding a leader's ability to see that they are increasingly being confronted by complex problems and that there are other possibilities or views of the world.

So what has influenced leaders thinking, and how have "bad management theories" evolved to dominate our understanding and thinking. The exchange between Ferraro et al. (2005) and Bazerman's (2005) coupled with Ghoshal (2005) provides great insight into how and why leaders of organisations have been influenced, over the past two or so decades, into seeking rapid short term solutions at the expense of a more balanced exploration of the issues. Clearly leaders cannot merely rely on theories and thinking that led to this situation as providing solutions to this wicked problem.

One initial observation of leaders engaged in wicked problems, was whether they resorted to attempting to control the solution by using a single line of thinking and action, or engages in understanding the problem through knowledge building and collaboration processes before acting. Clearly there is a time constraint; however, even in periods of near crisis, what I will term "effective complex challenge leaders" continued to use the latter approach.

So while wicked problems or complex challenges suggests a holistic approach to viewing an issue, management and leadership education and development presents a segmented reductionist approach, through individual subjects, theories and models as a trade off – one or the other. I am reminded here of my early training as a navigator and the debate between round earth and flat earth paradigms. We actually live with both; it depends on what we are doing as to which paradigm we draw from, global travel, building a bridge or a short trip across town. Why then do we persist with the notion that one paradigm is better or "in date" as compared to another?

This paper represents the emergence of a new paradigm, one that in Kuhn's (1962) terms is the blending of past multi-paradigms and has evolved into a new research and paradigm for leadership practice.

METHODOLOGY

The failures of cross-disciplinary and multi-disciplinary teams to address wicked problems led to the notion of transdisciplinary. The concept of Transdisciplinary Leadership evolved from a twenty-year longitudinal case study of personal experience of leading and facilitating complex change projects within a range of different industry, business and social settings as well as semi structured interviews with noted business and community leaders.

Action research and a single case study using multiple sources of evidence was used to investigate the phenomenon of leaders dealing with complex challenges in actual life settings and within a comparatively real time (Yin, 2003). Patton (2002) notes a single case study is suitable where the case represents a critical test of existing theory or where the case is a rare, unique test of existing theory or serves a revelatory purpose.

Multiple sources of data representing significant projects over the twenty-year period were collated to support the study's validity and reliability (Yin, 2003, p.21). Data collected included notes and reports from a sample of thirteen significant projects that involved unique

complex changes. I was engaged in all these projects as leader, consultant or facilitator. Examples of these projects include: being the lead internal staff officer for placing women at sea in the operational command of the Royal Australian Navy, for radical technological change for a book and news printing organisations, for project teams restructure and cultural diversity program for a multinational aeronautical manufacturer. In addition, I led a team in developing a framework of Military Health Ethics in response to allegations of health professionals being involved in the torture of prisoners of war and co-facilitator, and also was the team coach for a multinational finance organisation's strategy, Carbon Neutral 2010.

In addition to these projects, I conducted a number of in-depth and on-going semi-structured interviews with business and community leaders. This data collection and analysis process enabled for sense making, testing, and feedback of emerging ideas and finally the Transdisciplinary Leadership concept. Table 2 presents a summary of the research process.

TRANSDISCIPLINARY LEADERSHIP: AN EVOLVING THEME

The idea of transdisciplinary first emerged in early 2005 while working on the think tank for military health ethics. After reflection on a previous concept "macro leadership" failed to adequately address issues within projects where potential outcomes were either, watered down by tradeoffs between different actors unable to understand each other's position, or projects that failed, because belief structures failed to see alternatives. Involvement with the practice of forming multidisciplinary, cross-disciplinary or inter-disciplinary project or problem solving groups also failed in different ways to address the issue at hand.

Checkland (1981) noted the need for transdisciplinary concepts to unify knowledge so that it is applicable to areas that cut across traditional academic boundaries. He does note that interdisciplinary teams would not solve this issue. Drawing from the environmental movement who have engaged in transdisciplinary thinking, Funtowicz and Ravetz (1991) note the

TABLE 2
Data collection and method

Level of analysis	Unit of analysis	Sources	Criteria for interpretation
Macro – the complex problem	Researcher	Primary: documentation both archival and current Secondary: reflective notes and on-going testing and engagement of concept	Researcher's methods of enquiry, sense making and continuing motivation for further engagement with wicked or complex challenges
Meso	Client organisations	Primary: Observation and engagement with client groups Secondary: client internal reports and verbal feedback	Client culture, response to change and feedback
Individual	Business unit leaders, team members and identified leaders	Primary: semi-structured interviews and some questionnaires Secondary: observation and third party documents	Espoused views of the complex challenge bring confronted, mental models and views being expressed, feedback on change process

limitations of reductionist and mechanistic thinking and assumptions about the way this thinking presents relationships. They also note the normative effect of societal values and how they affect stakeholder inputs at one end and how there is an expectation that science will deliver certainty. The challenge we are confronted with is that we seek "science" to solve or explain all problems, however, as indicated by the notion of "wicked problems", not all problems can be solved by science, as they are not all caused by science, rather they are problems produced by the side effects of created systems and subsystems.

The International Center for Transdisciplinary Research, from their Moral Project (1987), describes transdiscplinarity as:

> *Transdisciplinarity is not concerned with the simple transfer of a model from one branch of knowledge to another, but rather with the study of isomorphisms between the different domains of knowledge. To put it another way, transdisciplinarity takes into account the consequences of a flow of information circulating between the various branches of knowledge, permitting the emergence of unity amidst the diversity and diversity through the unity. Its objective is to lay bare the nature and characteristics of this flow of information and its principal task is the elaboration of a new language, a new logic, and new concepts to permit the emergence of a real dialogue between the specialists in the different domains of knowledge. (www)*

Transdiscplinarity as a concept would appear to be still emerging and evolving.

TRANSDISCIPLINARY LEADERSHIP STRATEGIES: SENSEMAKING, EMERGENCE, FACILITATING

Unravelling the leadership required to deal with complex challenges is much like the "Blind men of Indostan" (Blind Men and the Elephant; John Godfrey Saxem, 1878), each vested actor or stakeholder gropes for truth and reality, each being right in that what they are describing, each being logical or plausible. However, attempts to improve, or provide a solution or resolve an issue, in isolation is flawed in that none actually sees or understands the entire system; the elephant. Solutions may be effective for their own areas, however the consequences to other areas of the system are unknown and not considered. People are rewarded for work that has the potential to destroy the system (see the cases of US finance organisations related to Global Financial Crisis, NAB trading losses, Bearing Bank, Enron, Toyota and Ford Vehicle Recalls and Ajax Fasteners Australia).

Transdisciplinary Leadership identified a framework of leadership strategies to guide a leader's practice. These strategies engage a fluid process of divergent to convergent thinking and action. The critical leadership challenge is recognising when to switch between these thinking and acting practices.

The underpinning success factor for this approach is that leaders and their associated stakeholder networks have a degree of clarity and agreement on what they aspire to be and, just as importantly, what they desire not to be.

Fig. 1 represents the Transdisciplinary Leadership strategy cycle. The preliminary identification and understanding of the complex challenge presents the starting point for a leader to determine the leadership strategies needed to build a systemic understanding of the challenge from the position of different actors or stakeholders. The ability to engage stakeholders is influenced by the capacity and capability of the different stakeholders and their existing mental models.

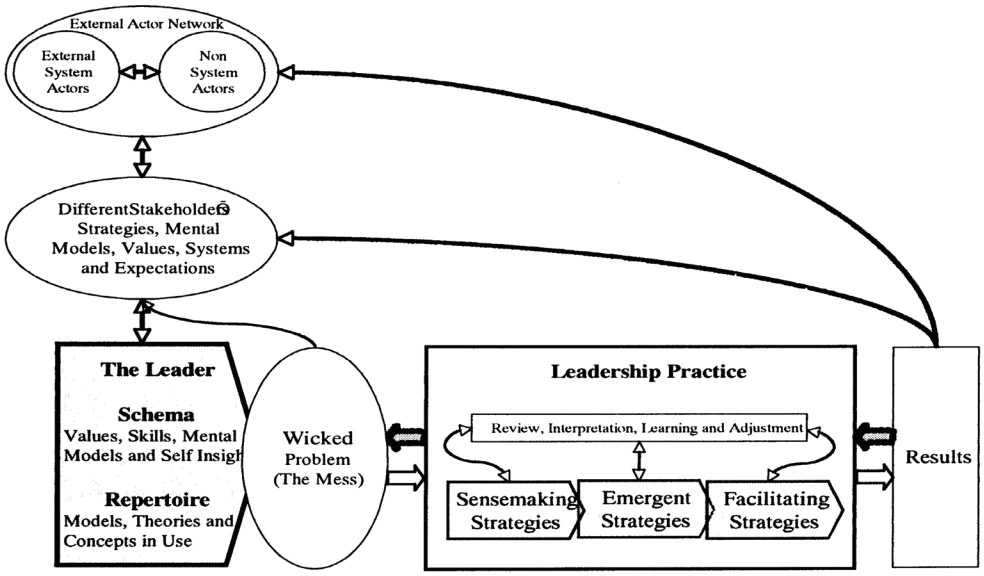

Fig. 1: Transdisciplinary Leadership Strategy Cycle

The Transdisciplinary Leadership approach is best described, as taking the complex challenge to a meta-level, a level that exists above the separation of the stakeholder disciplines. Leaders develop transdisciplinary leadership strategies through the use of a number of tools and techniques with the objective to cross the boundaries or borders created by single disciplines to produce understanding, insights and perhaps new knowledge relevant to the complex challenge and issues at hand.

Sense-making Strategies: Divergent Thinking

Sense-making is a paradigm, involving how to reduce ambiguity, to socially determine understanding and meaning of the wicked problem at hand. As indicated by Weick (1995) the strategy is about understanding how the different stakeholder groups construct meaning as data is converted into usable information and then knowledge.

How a leader engages with the total system is critical. This requires extensive periods of challenging all stakeholders to engage in "divergent thinking processes". This can be exceptionally challenging, if not virtually impossible, for disciplines skilled and rewarded for almost instant convergent solutions thinking. It focuses on open-ended future oriented questioning aimed at exploring, inquiring, examining, explaining, and enticing as diverse as possible views on the issues at hand that make up the wicked problem.

Sense-making has a number of objectives, however, these must be linked to the organisation's overarching strategic aspiration, or more simply put "to what purpose can we use this knowledge?" Essential elements within this process include:

- Understanding the nature of the wicked problem and associated issues from different perspectives.
- Understanding how the system is currently attempting to respond to the wicked problem.
- Understanding how the wicked problem arose based on the thinking or mental models in use within the system.

- As best as possible present clarity of sense of the issues as they impact on all stakeholders.
- Clarity of the current systems strategic capabilities to address the wicked problem.
- Maintain the tension created by the paradoxes present within the challenge.

A key element here is ensuring that leaders need to understand how meaning is ascribed and interpreted by different disciplines to wicked problem. Misunderstanding, confusion, and misinterpretation often occurs within organisations, cross-disciplinary teams or multi-stakeholder groups, when disciplinary jargon, acronyms, or unique meanings of terms are used. This requires extensive open conversations and workshops, mostly facilitated, to ensure clarity of message, understanding of the issues and most importantly trust to develop the next stage.

This demands an astute understanding by the leader of their personal capabilities and the capabilities leaders require from others to complement the leader's strengths to understand the problem and issues at hand. It is imperative that the leadership team and their critical stakeholders have significant levels of trust and agreement of future strategic aspirations. Failure to achieve this will ensure failure in any endeavours. It is also essential that the leadership team remain open to all ideas and suggestions; that is their thinking remains divergent.

To date this has been a facilitated process. Tool and techniques used in this process include:

- Featuring tools such as scenario development
- Strategic arena mapping
- Story telling
- Strategic conversations
- Semi structured interviews
- Open space workshops
- Appreciative inquiry
- Soft systems methodology

This is highly time-consuming for leaders. Experience suggests depending on the type of challenge being confronted and levels of trust between key stakeholders that these strategies will require between 50 to 80 percent of a leaders time actively engaging with stakeholders in different forums.

The most successful strategies have involved developing snap shot scenarios of possible futures supported by strategic arena maps and using these during one-on-one interview meetings with key leaders from each stakeholder group. This allows for a full discourse, building an understanding of the stakeholders' current mental model and aspirations, as well as establishing their initial position on your aspirations. It is the initial step in building trust.

As key leaders within different stakeholder groups are engaged, they need to become part of the broader leadership team so that the final leadership team has the greatest potential to make sense and build knowledge. This in reality is an ongoing strategy, as different leaders will be required at different stages to address the wicked problem.

This has proven to be the most critical phase, a phase that literally defines success or failure in responding to the problem in a meaningful way. One critical element has been the leader's ability to recognise and approach groups who are non-stakeholder actors, but have the power to derail positions taken by vested stakeholders. These can include activist groups, disenfranchised customers, competitor industry groups or even overseas groups. Early engagement with these non-stakeholder actors has proven successful in building and sustaining long term relationships and trust, which have paid unexpected benefits over the course of each relationship. For example in developing the issues paper and planning for the think tank for military health ethics we engaged via one on one interviews for the first time, all elements of the Australian Defence Force, different veterans units, department of Veterans Affairs, different health specialist groups, NGOs such as Red Cross and Médecins Sans Frontières

and key participants from Canada, UK and NZ who had experienced past military ethical problems. This led to clarity of actions needed by all stakeholders and built critical relationships where they had previously not existed.

These sense-making strategies perhaps identify the success or failure of successive actions. It must be an engaged and shared process.

Emergent Strategies

Whereas sense-making strategies focus on divergent thinking to build shared understanding and awareness, emergent strategies focus on an awareness of the new learning and understanding that is generated from the interactions of the different stakeholders. As described by Gladwell (2000), there is a time, a tipping point, where significant knowledge and understanding of the system has been built to explore possible solutions. This occurs when the initial leadership team engages a critical mass of stakeholders to build a new logic. This ideally should be a spontaneous positive event. However, experience demonstrates that some people go through periods of perturbation as they struggle with paradigms or mental models that do not provide the answers or understanding. This is perhaps best identified by the work of Clare W. Graves (Beck and Cowan, 1996) and his identification of the cycle through which people travel, where previous mental models or value thinking systems no longer present working solutions to the problems encountered.

The power of the leader at this stage is to recognise the emergence of new knowledge and understanding happens through sense-making interactions between stakeholders and actors over time. To date this has only been achieved during workshops, think tanks, round table meetings after significant research and engagement or open space processes. Tool and techniques used in this process include:

- Mind mapping / Pattern recognition
- Synthesis
- Feedback systems to test new knowledge and understanding (workshops, focus groups, workplace café meetings)
- Stacey (1996) What / How matrix

Facilitating Strategies

Facilitating results represents the convergence or agreement on action required to address the complex challenge as it is currently understood. Implementation is clearly the task of many, however, the role for transdisciplinary leaders is to maintain a strategic oversight of the systems and how the solutions are progressing. This is linked with ensuring the systems and organisational environment are conducive for success.

Leaders have the responsibility and accountability for the systems that in essence, control the organisation's operations. The dynamic nature of wicked problems and hence solutions often means that possible or plausible solutions in one operating context will not be plausible in another. The critical role of transdisciplinary leadership is to understand the often-subtle differences in context across organisations and their stakeholders and effectively adjust the systems as required. The leadership approach required here is one of innovation and experimentation. It is one of moving the resources to respond to the problem. Unlike environments that foster risk aversion or low risk where outcomes are expected within a predetermined set of boundaries, here outcomes will be more generic. The leadership approach and strategies are perhaps similar to testing or experimentation, especially if the problem is unique and therefore never seen, or experienced, by the leadership team. Critical here are the establishment of:

- meaningful metrics and modelling systems that provide as close as possible to real time feedback information;
- an "early warning system", one designed to pick up early indications of impending issues; and

- Systemic capability to change direction quickly or engage additional resources as required.

In part, this is the establishment of learning systems across the network, and also building a capacity and capability to deal with ambiguity and uncertainty. A further benefit of this approach is understanding how this approach has worked and building success stories to share across the network.

INSIGHTS FROM TRANSDISCIPLINARY LEADERSHIP APPROACH

The Transdisciplinary Leadership framework has been used in response to a number of complex organisational and social challenges, examples as noted above. It continues to be used and refined. The insights gained from this process to date include:

- Within the overall decision cycle time, greater emphasis and time is spent on divergent, sense-making activities. Early engagement with stakeholders has proven increased quality in decisions with greater buy in from all stakeholder groups. The process has achieved positive initial results in three to six months on complex problems that had been in a protracted state for some years;
- Non organisational actors can disrupt the process if not identified and engaged early;
- The need for clarity and understanding of stakeholder network relationships is critical;
- Building trust across the stakeholder network is critical, especially where significant mistrust exists especially over long time periods; and
- Where current capacity and capability to respond to the wicked problem is lacking, capacity and capability development time must be factored into the response. It is important to collaborate with strategic stakeholders who may include direct competitors.

FURTHER RESEARCH

Transdisciplinary leadership process has identified a number of additional areas for further research. These include:

- Application of systems thinking and complex problem awareness to leader development,
- Continued application of systems thinking within general leadership research,
- Engagement of transdisciplinary thinking in professions and disciplines that regularly interact with complex challenges,
- Understanding different tools and techniques to effectively engage leaders in complex problems.

CONCLUSION

This journey has been a voyage of discovery across a wide range of disciplines to gain an understanding of the views held by leaders and researchers of wicked problems confronting their discipline. It is interesting that the notion of wicked problems has transgressed across a number of disciplines and that they resonate with similar leadership issues. This paper is an attempt to distil these leadership issues and present a summary of leadership strategies based on experience in using transdisciplinary leadership approaches.

What is clear is that no one person can satisfactorily manage the process of confronting significant challenges alone. Transdisciplinary leaders need to have around them others who complement their abilities, provide diversity in thinking and discipline experience, and they can trust. It is claimed to be lonely at the top, but no one can remain effective as a leader if isolated from any source of support. Transdisciplinary leaders create strong networks and sounding boards as sources of sense-making and knowledge as they explore different perspectives on wicked problems.

Complex and wicked problems need a collaborative approach to understand the systemic issues. Failure to do so means leaders operating in isolation will continue to present

solutions that are biased and lead to extremes. The more this happens the more polarised people within any system will become.

Transdisciplinary leadership is a leadership paradigm focused on leadership practice that engages leaders to consider the dynamic nature of the system within which they are engaging. It is a framework of continuous learning:

What we have learned
Is like a handful of earth
What we have yet to learn
Is like the whole world.
(Hindu prophet Avvaiyar)

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REFERENCES

Ackoff, R. (1981). *Creating the Corporate Future: Plan or be Planned for*. New York: John Wiley.

Bass, B. M. (1990). *Bass & Stogdill's Handbook of Leadership* (3rd Ed.). New York: The Free Press.

Bazerman, M. H. (2005). Conducting influential research: The need for prescriptive implications. *Academy of Management Review*, *30*(1), 25–31.

Beck, D. and Cowan, C. (1996). *Spiral Dynamics: Mastering Values, Leadership and Change*. Oxford, UK: Blackwell Business.

Checkland, P. (1981). *Systems Thinking, Systems Practice.* New York: Wiley.

Collins, J. and Porras, J. (1994). *Built to Last Successful Habits of Visionary Companies*. New York: Harper Business.

Denison, D. R., Hooijberg, R. and Quinn, R.E. (1995). Paradox and performance: Toward a theory of behavioral complexity in managerial leadership. *Organization Science*, *6*(5), 524-540.

Drucker, P. F. (1968). *The Age of Discontinuity*. New York: Harper & Row.

Falsey, T.A. (1989). *Corporate Philosophies and Mission Statements: A Survey and Guide for Corporate Communicators and Management.* Westport Connecticut: Quorum Books.

Fayed, R. and Pearce, G. (2008). *The Future of Work 2020.* Sydney: IMIA Graduate School of Leadership.

Ferraro, F., Pfeffer, J. and Sutton, R. I. (2005). Economics language and assumptions: How theories can become self-fulfilling. *Academy of Management Review*, *30*(1), 8–24.

Finkelstein, S. and Hambrick, D. (1996). *Strategic Leadership: Top Executives and Their Influence on Organisations.* St. Paul, MN: West Publishing Company.

Funtowicz, S.O. and Ravetz, J. R. (1991). A new scientific methodology for global environmental issues. In R. Costanza (Ed.), *Ecological economics: The science and management of sustainability* (pp. 137–52). New York: Columbia University Press.

Ghoshal, S. (2005). Bad management theories are destroying good management practices. *Academy of Management Learning & Education, 4*(1), 75–91.

Gladwell, M. (2000). *The Tipping Point: How Little Things Can Make a Big Difference.* London: Little, Brown and Company.

Hambrick, D.C. and Fukutomi, G. (1991). The seasons of a CEO's tenure. *Academy of Management Review, 16*(4), 719-742.

International Center for Transdisciplinary Research (CIRET). Moral Project. (1987). Retrieved March 13, 2010 from http://nicol.club.fr/ciret/english/ projen.htm.

Jaques, E. and Clement S. D. (1994). *Executive leadership: A Practical Guide to Managing Complexity*. Cambridge, MA: Blackwell Publishing.

Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Montor, K., McNicholas, T. M., Ciotti, A.J., Hutchinson, T.H. and Wehmueller, J.E. (1998). *Naval Leadership Voices of Experience*. Maryland: Naval Institute Press.

Nohria, N. and Berkley, J. (1994). An action perspective: The crux of the new management. *California Management Review, 36*(4), 70-92

Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods* (3rd Ed.). California: Sage.

Pearce, G. and Saul, P. (2006). Towards a framework for Military Health Ethics: An issues paper examining possible health related ethical issues arising from Military Operations Centre for Military and Veteran's Health. In F. Allhoff (Ed.), (2008) *Physicians at war: The dual loyalties challenge*. Netherlands: Spinger.

Rittel, H. and Weber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*, 155-169.

Schön, D. (1971). *Beyond the Stable Stale*. New York: Random House.

Shapiro, M. H. (1988). Introduction: Judicial selection and the design of clumsy institutions. *Southern Californian Law Review*, *61*, 1555-1569.

Stacey, R. (1996). *Complexity and Creativity in Organizations*. London: Berrett-Koehler.

Van Seters, D.A. and Field, R.H.G. (1990). The evolution of leadership theory. *Journal of Organisational Change Management*, *3*(3), 29-45.

Weick, K. E. (1995). *Sensemaking in Organizations*. Thousand Oaks: Sage.

Wheatley, M. (1992). *Leadership and the New Science: Learning About Organization from an Orderly Universe*. San Francisco: Berrett-Koehler.

Yin, R. K. (2003). *Case Study Research: Design and Methods* (3rd Ed.). Thousand Oaks: Sage.

Yukl, G. (1999). An evaluative essay on current conceptions of effective leadership. *European Journal of Work and Organizational Psychology, 8*(1), 33-48.

Zaccaro, S. J. and Klimoski, R. J. (Eds.) (2001). *The Nature of Organizational Leadership: Understanding the Performance Imperatives Confronting Today's Leaders.* San Francisco, CA: Jossey-Bass.

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Teachers' Beliefs and Perceptions of Integration and Elicitation of Human Values in Water Education in Some Southeast Asian Countries

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ABSTRACT

Asian countries and other nations are developing new strategies for improving water quality. This paper proposes a model, Human Values Integrated Instructional model, that has the potential to make significant changes to existing conflicts over water, environmental degradation, and social inequity. This model is used for education in human values in mainstream school subjects, and human values based water, sanitation and hygiene education (HVWSHE) including environmental education, in parts of Southeast Asia. This paper presents teachers' beliefs regarding the integration and the elicitation of human values in water, sanitation, and hygiene education in some Southeast Asian countries in 2009. A mixed method was used to investigate teachers' beliefs through questionnaire administration and indepth interviews. Teachers surveyed were from Indonesia, Thailand and Lao PDR, while teachers interviewed were from Thailand and Indonesia. Data analysis includes descriptive and qualitative analysis for the questionnaire and qualitative coding procedures for the interviews.The results reveal that the teachers believed that the selected principles of integrating and eliciting human values in the lessons could have a positive impact on students' ethical attitudes and behaviours, but only if teachers use student -centred methods in their teaching approaches and they incorporate both affective and cognitive domains in their teaching. Teachers from one of the samples need more support and teacher modelling to have a better conceptual understanding of HVWSHE.

Keywords: Human values education, teachers'beliefs, human- values- based water, sanitation and hygiene education

INTRODUCTION

This study explored teachers' beliefs and perceptions about a specific underlying principle of the Human Values Integrated Instructional Model (HVIIM), which aims to integrate and elicit human values about water usage in mainstream school lessons. The teaching and learning process of HVWSHE is based on the HVIIM model (UNHABITAT, 2006) used for water education in parts of Southeast Asia.

The HVIIM was developed by Jumsai (2003), Director of the Society for Preservation of Water, a human values educationist who implemented education in human values (EHV) in the Sathya Sai School in Thailand in 1992. Education in human values originated from India with the work of Sathya Saibaba, an educationist and the current Chancellor of the Sri Sathya Sai University in Andhra Pradesh, India (Sri Sathya Sai World Foundation, 2007). Education in human values is also supported by policies in

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education departments in a number of countries, including India, Thailand, and specific parts of the United Kingdom (Taplin et al., 2005). Sathya Saibaba conceptualised the five human values: love, truth, peace, non-violence, and right conduct (Sri Sathya Sai World Foundation, 2007), which were later integrated into the formal curriculum in selected Indian schools. In recent years, a particular focus of education in human values has been on reminding people about important human values associated with water usage.

It has become an urgent issue in Southeast Asia to bring water education to the mainstream education because of issues related to water. According to the report three billion people in the developing world are unable to gain access to adequate sanitation systems (Gleick, 2000). As a result, fourteen to thirty thousand people, both elderly and young children, die from diseases caused by polluted water (Gleick, 2000).

According to the report of the Regional Consultations on Values-based Water Education for the Asia and Pacific, the poor from urban sectors pay a heavy price to have access to safe water (United Nations Human Settlements Programme, 2003). In addition, it was reported that water and sanitation are both a public health and an environmental issue.

The United Nations Human Settlements Programme (UNHABITAT) adopted the HVIIM in order to raise awareness in students and reinforce good character, morality, and ethics to promote more equitable and better use of water and sanitation. UNHABITAT considers human values to be an "essential element of our human nature and positive qualities that are shared among people throughout the world" (UNHABITAT, 2006, p. 16).

The HVIIM used a concept known as integrated learning concept. This concept was developed by Jumsai (1997). The details provided hereafter are aspects of Jumsai's model. The integrated learning concept (see *Fig. 1*) recognises three different aspects of the mind: namely the conscious mind, the subconscious mind and the super-conscious mind. The mind of the learner is engaged in a constant dynamic interaction with the conscious and subconscious mind and the environment. According to Jumsai, when human values are integrated into the learning process the learner will be inspired and his or her awareness increases. A detailed review of the integrated learning concept is provided in

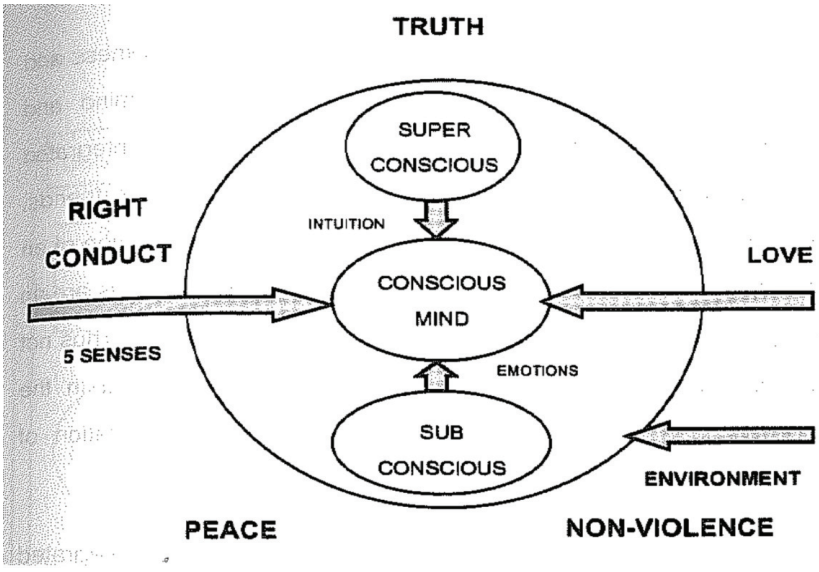


Fig. 1: The human values integrated learning concept (Jumsai, 2003, p.55)

Jumsai (2003). *Fig. 1* shows the learning process and how awareness takes place in the learner.

Jumsai (2003) stated that when we work at the subconscious level, our actions depend on the information installed there because of our memory of past actions and the emotions are attached to them. When we receive stimuli from the conscious mind through the five senses, the stimuli have to be interpreted meaningfully. When learners process information as they learn they have to be able to apply positive values to action. In order to do this, the information stored in their memory has to be positive. Thus the subconscious mind, according to Jumsai, has to store positive information. When human values integration is applied, the conscious mind becomes aware and understands the stimuli received. Awareness increases and this understanding is stored in the subconscious mind. Human values thus become a part of the memory stored along with information received from the learning process. The conscious mind will be able to interpret the stimuli with a more positive attitude if the information in the subconscious mind has positive values.

According to Jumsai, when the conscious mind is raised through awareness, the learner is in touch with the super-conscious mind. Intuition then takes place, which is above the normal thought processes. For this to happen, the mind has to be calm. The intuitive faculty however, is not discussed in this study for practical purposes.

Education in human values is important for the affective domain because when human values are integrated and elicited during the teaching and learning process students are reinforced with positive values which provide meaningful learning experiences. The elicitation helps in clarifying values regarding issues under discussion. Students' understanding of the environment around them becomes more positive and this helps transform their attitudes so that they can develop ethical attitudes and translate them into ethical behaviours. The result of this is that the conscious mind becomes able to not react emotionally, but rather to respond to the stimuli without agitation or confusion. The conscious mind is able to distinguish what is right from wrong because it is able to pick up the stimuli from the subconscious mind and to realise that the response from the subconscious mind could be right or wrong depending on the past information stored in it. This practice of discrimination helps in calming the conscious mind (Jumsai, 2003).

TEACHER'S ROLE IN THE TRANSFORMATION PROCESS

The teacher helps in the transfer of the learning process. The main aim of the human values integrated instruction is to help inspire the learner so that he or she transforms. The teacher has to be a role model where he or she emulates the five values in his/her own actions. The teachers' countenance and his or her speech must coincide with the meta-message, according to Jumsai (2003). According to Jumsai, the teacher has to have a unity of word, thought and action which helps inspire the learner to have an inner transformation. The student has to be calm so that he or she gains the maximum benefit. The components of the model are provided below.

Human Values Integrated Instructional Model for Education in Human Values and Human Values Based Water, Sanitation and Hygiene Education

Jumsai (2003) developed the Human Values Integrated Instructional Model as in *Fig. 2* which adopted the integrated learning concept model as a major component. The model incorporates the five human values, the integrated learning concept, teaching principles and teaching processes using interactive methods/pedagogies. This model has been used for education in human values in the Sathya Sai School in Thailand since 2003 and was implemented for HVWSHE education officially in 2007 for water education. The HVIIM conceptualised by Jumsai integrated three important components. They are: the Integrated Learning Concept, the principles and the processes. The principles are: cooperative learning, integration and elicitation of human values and role modelling. The

teaching processes are provided in *Fig. 2*. This study focuses on teachers' beliefs regarding the principle of Educare, which means to elicit and to integrate human values during teaching and learning sessions. Sathya Sai contends that the term education has its origin in the Latin word 'educare', which means 'to elicit'.

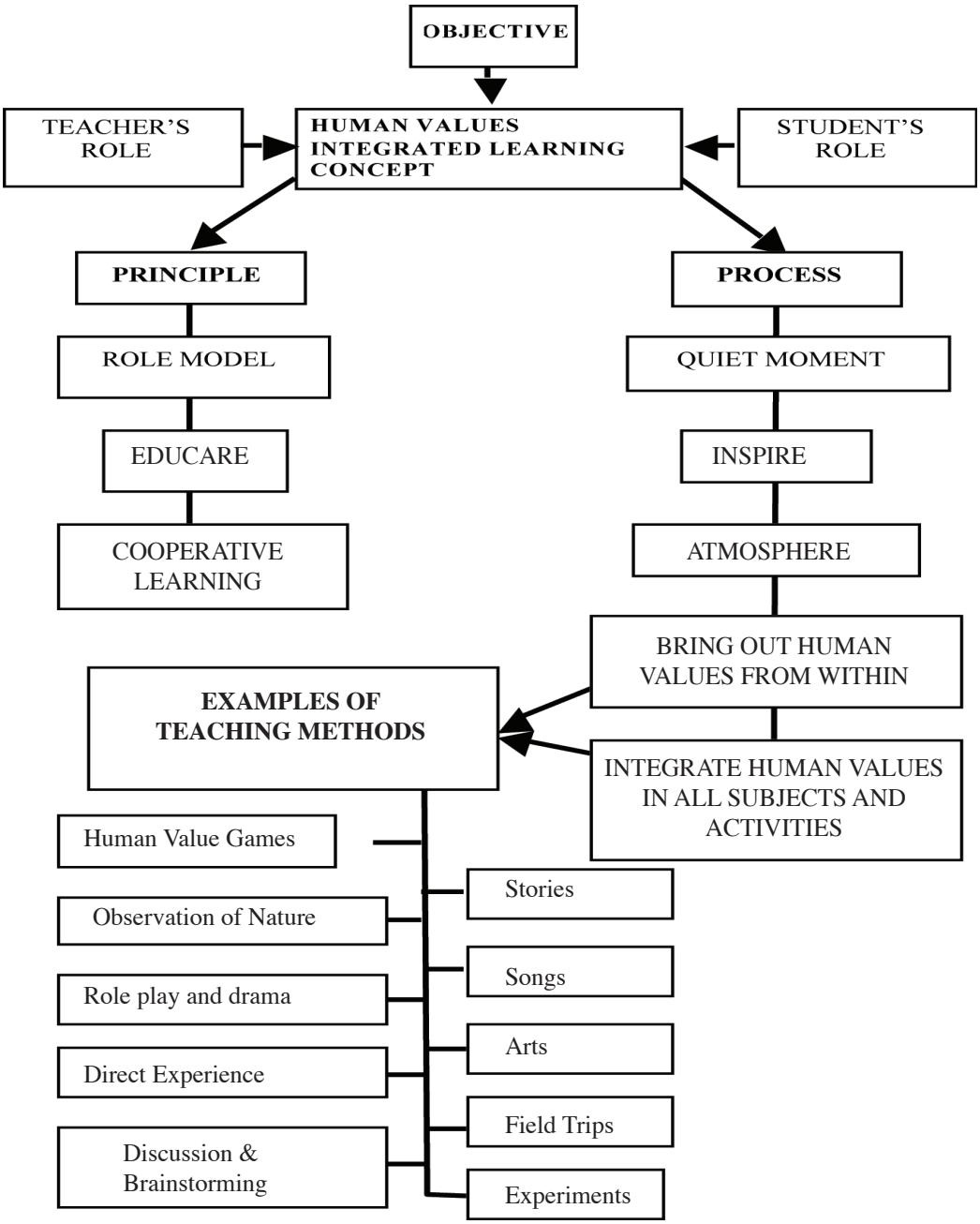


Fig. 2: Human values integrated instructional model (Jumsai, 2003; Chulalongkorn University, 2003)

Educare and Teaching Pedagogies for HVWSHE

The main aim of human values integration into regular subjects as well as water education both for formal and non -formal sectors is to help students be aware of ethical conduct, norms and moral procedures for the social process. The aim of the teaching pedagogies (silent sitting, prayers, music, story telling, and music) is to develop ethical behaviours and attitudes. Rogers (1980, pp. 271-273) reflected that the foundation for values has to be discovered from within, instead of, from the material world.

Integration and elicitation of positive values cannot be implemented unless students have contexts to discuss about. In Education in Human Values, the teaching pedagogies are important. Specific teaching pedagogies such as prayers, silent sitting, music, and story telling have been used in Sathya Sai Education in human values (Sri Sathya Sai World Foundation, 2007).

In Sathya Sai schools, in several parts of the world the above mentioned pedagogies are incorporated during the teaching and learning sessions to help in transformational learning. Story telling broadens students' imaginations as well as engages students in meaningful and personal learning. Prayer instils positive attitudes in students' minds, according to the authors, as students retain noble ideals in their minds. Music elevates students' minds and stimulates students (Sri Sathya Sai World Foundation, 2007).

Significance of the Teaching Pedagogies for the Educare Process

A review of present literature on values education emphasized that that effective teaching for values education depends on how teachers have to go beyond facts and knowledge, from information to transformation. Lovat and Clements (2008) emphasised on supportive interventional practices for values education. Lovat and Clement pointed out that quality teaching has to extend beyond factual teaching. They stated that effective teaching for values education includes facts and information for intellectual competence, social skills, development of the affective domains, and self reflection (Lovat and Clement, 2008).Without teachers engaging with self -reflective practices, students may not be able to challenge their own values.

When teachers' teaching practises include pedagogies such as music they impact students' minds. According to Walker (2007), who reviewed the value of music in his book, stated that music education is valuable and essential. International research, according to Walker, reflects the notion that music education significantly impacts emotional, physical, social and cognitive growth of students. Added to the developmental benefits, Walker stated that music also support aesthetic learning outcomes and develops cultural heritage and values.

CONTEXT OF THE STUDY

The concept of human values was recently introduced in water education by the Society for Preservation of Water (S.P.W) in Thailand termed as human values based water, sanitation and hygiene education (HVWSHE) (UNHABITAT & SEAMEO, 2007). The Society for Preservation of Water (S.P.W) in Lamnarai, Thailand has been training teachers from several Southeast Asian countries since 2007.

RESEARCH FOCUS

The current study focuses on teachers' beliefs regarding water education on the teaching and learning processes in classrooms. Clark (2005) reviewed the Values Based Water Education (VBWE), component of the Managing Water for African Cities Programme, established in 1997 as part of the United Nations initiative in Africa. The report stated that despite intensive workshop training many teachers "had not fully internalised the VBWE philosophy and practice" and that "the process of internalising is more complex than may be readily understood by the newcomer" (Clark, 2005, pp. 37-38). He concluded that, as well as requiring more administrative and financial support, the project required pedagogic support and "continuous

academic guidance from groups and individuals such as those who have pioneered VBWE" (Clark, 2005, pp. 37-38).

These difficulties are not unique to HVWSHE when implemented in parts of Southeast Asia. As with the introduction of any new educational program, problems have been encountered with the implementation of HVWSHE. Some of the problems that were encountered during the early phases of implementing Education in Human Values (EHV) in Southeast Asian countries are explained below, and are relevant as the problems with implementing EHV were similar to those encountered implementing HVWSHE. It can be difficult, for example, for many teachers to develop a conceptual understanding of these processes, particularly when they are constrained by large class sizes, time constraints, pressure to cover the syllabus and pressure to achieve high results in examinations (Taplin et al., 2005). Taplin et al. (2005) recommended that the kind of understanding required needs to be developed over time and with structured support systems.

Teachers' personal experiences integrating human values in education in a regular curriculum were found to have an impact on students as well as teachers as they implemented the pedagogies in a regular curriculum (Taplin et al., 2005). Integration of values, according to the researchers, was accompanied by teaching pedagogies such as music, story telling, silent sitting and prayers. Taplin et al. (2005) reported positive student feedback while integrating human values education and teachers' own self transformation while teaching.

According to Taplin et al.'s report, teachers began to understand the differences between the new information and old interpretations of what integration of human values is. According to Taplin et al. the conceptual understanding was better when teachers were supported to develop their own understanding of the appropriate content and pedagogical content knowledge, and experienced evidence that it was having positive effects on their pupils' behaviour and even academic results. Although these studies give some evidence of the integration of human values in the classroom teaching processes, there is very limited evidence on teachers' beliefs of the educare process in their classroom practices.

This study aims at exploring teachers' beliefs regarding the 'educare' process where teachers integrate and elicit values during teaching and learning. Although Education in Human Values has now been successfully implemented in several parts of Southeast Asia (Sri Sathya Sai World Foundation, 2007) there are limited studies that have tested teachers' beliefs in classroom teaching and learning contexts (Jumsai, 2003; Taplin et al., 2005). Other studies by Toh and associates have explored the implementation of Values Based Water Education (VBWE) practices in teaching science and geography (Toh et al., 2005) although the teaching principles and processes from the HVIIM, crucial for the valuing aspect of reflective learning, have not been investigated from the teachers' perspective.

From a review of past literature related to HVWSHE the following constraints were noted during the workshops for HVWSHE:

- A lack of depth in teachers' understanding of the HVWSHE approach (Clark, 2005).
- Teachers' failure to see the need to accommodate the affective domain in the objectives of their lesson plans (UNHABITAT & SEAMEO, 2007)
- Lack of skills required to integrate human values for the affective domain (UNHABITAT & SEAMEO, 2007).

A study by Toh, Ng, Yeap and Isma (2007) revealed that values education when implemented in water education proved to be effective. The study by Toh et al. (2007) used a collaborative action research approach by teachers by integrating human values into the curricular content required for HVWSHE in both science and social curricula in Penang, Malaysia. The sample reported by Toh et al. consisted of 49 students from form two classes. The researchers included cooperative learning approaches included group poster presentations, summary of the discussions and a survey using the Water Attitude scale. Their research was focused on how values based curricula can be

delivered through cross - curricular teaching approaches and how to monitor student learning in values based curriculum. The study by Toh et al. included data collection from a Water Attitude Scale (WAS) triangulated with qualitative analysis of group poster presentations and discussions. The results of Toh et al's study showed significant post-treatment improvements in the students' attitudes to human values and water usage, for example one of the students stated they would like to participate in a water saving campaign (Toh et al., 2007).

In the above mentioned cross curricular study, 24 male students were surveyed using the WAS (water attitude scale). The findings revealed that the students showed significant improvement (with 95% confidence interval of the difference) in item No.12: "I would like to participate in a water saving campaign' when it was compared to a pre (with mean score 3.17) and post test (with mean score 3.46). The researchers concluded that there was evidence of a general positive attitude change and awareness of water conservation and sustainable water ethic after the input of the HVWSHE curriculum. The quantitative analysis revealed that 4 out of 29 items from the Water Attitude Scale (WAS) showed significant difference from the administered pre and post tests in student responses.

To provide triangulation of the quantitative data, analyses were also done of student responses to different assessments. One comment (May 23rd, 2007) from the group 1 poster presentation by students is given below. Students were asked to fill in the answers for the statements below.

"Right conduct is ……."

"……sue the irresponsible people (If we want to enjoy sea scenery, stop polluting)".

".....Let's take care of our water… "

"Keep river clean; ……."

"Taking care not to throw rubbish into the river....."

"Build a barrier to trap the flow of rubbish in ....."

The above study implies that interdisciplinary approaches and the integration of human values are beneficial for developing human values in students. In addition, students' critical thinking skills are also enhanced. According to the study, teachers should be equipped with innovative teaching pedagogies because they found that HVWSHE was more effective when implemented in an intra-disciplinary mode (Toh et al., 2007).

However, there are problems that constrain teachers from implementing values education. Brooks and Brooks (1993) stated that teachers who use traditional methods may find it difficult to change their ways because of the differences in approaches compared to constructivist teaching. Application of constructivist approaches were found to be problematic in some parts of Southeast Asia (Teo, 2008; Chen, 2008) because of the constraints of using wrong teaching approaches. With constructivist approaches, teachers and students require discussion and time to reflect and this is found to be impractical as many Southeast Asian teachers believe that their first priority is to convey a pre-set amount of knowledge within the lesson timeframe.

The success of HVWSHE from the above studies depends on teaching approaches and the teaching pedagogies teachers use for the integration and elicitation of human values. In Toh et al. (2007)'s study of HVWSHE, the methods they used for water education was collaborative as well as cross-curricular. In Taplin et al.'s (2005) study, the integration of human values as well as teacher support was seen as crucial to the success of implementation of education in human values in the curriculum. A review of teachers' beliefs has shown that beliefs have an impact on how teachers teach in classrooms, and their understanding has an impact on reform implementation.

Teachers' Beliefs

As seen in many studies, the personal experiences that teachers face in classrooms have an impact on teachers' beliefs because according to Fang (1996), personal experiences have an impact on shaping teachers' beliefs. The section below elaborates on teachers' beliefs and its impact on classroom teaching.

Understanding teachers' beliefs are important during their teaching practices. Abelson (1979) noted that belief systems are not simply structured, and they are not easily understood. According to Abelson, belief studies on affective processes and personal experiences will help understand belief systems better. According to Nespor (1987), investigating teachers' beliefs can help teachers to be more self-reflective and aware of their own beliefs, although problems with beliefs, such as how they came into being, or how they are supported and how people change their beliefs, are unknown. Pajares (1992) stated that beliefs cannot be changed easily and they are complex. Pejares thus highlighted the importance for educational research of studying belief systems. He suggested that it is necessary to explore both personal beliefs and the context of educational beliefs to explain the nature of beliefs. Fang (1996) reviewed studies of teacher beliefs of the previous fifteen years and advocated the use of narrative studies of teachers' "construction and reconstruction of their practical knowledge" to help school reform, since their thoughts about their personal experiences may shape their beliefs (Fang, 1996, p. 59).

Teachers' beliefs can have an impact on the success of education in human values. If teachers do not adopt the right practices they impact the implementation either due to no in depth knowledge or practices. Teaching about human values relates to the affective domain (UNHABITAT & SEAMEO, 2007), it is necessary here to explore more about the theory of teaching for this domain. The teaching level of transmission of facts involves analysis of facts and ideas but if the valuing level is not included then students' moments of gaining personal meaning is lost. According to Punsalan, it is at the valuing level where students make resolutions which make 'personal meaning meaning' understood at the conceptual level (cited in UNHABITAT & SEAMEO, 2007, p. 31).

RESEARCH OBJECTIVE

The aim of the study is to explore teachers' beliefs regarding their experiences with the teaching principle from the Human Values Integrated Instructional Model. The objective of the present study was to explore teachers' beliefs and perceptions about the principles of integrating and eliciting human values for water, sanitation and hygiene education. This study used a mixed method through a questionnaire followed by interviews. The research question for both the survey and the interview is: What are teachers' beliefs and perceptions about the principle of educare, that is the integration and elicitation of human values from the HVIIM model for HVWSHE?

This question explores teachers' beliefs regarding educare in the classroom. The process of educare includes both integration and elicitation of human values during teaching and learning from the lessons. The research question focuses on teachers' classroom experiences.

RESEARCH DESIGN

The study used a mixed design (Tashakkori and Teddlie, 2003) which consisted of both survey and interview. This type of design is exploratory and confirmatory because it confirms or eliminates certain findings from the surveys and interviews. In addition, the mixed design helps to explore the weaknesses and strengths through both quantitative and qualitative studies.

Sampling

A heterogeneity purposive non-probability sampling was chosen for this study. Heterogenity purposive non probability sampling includes all opinions or views of participants. The study does

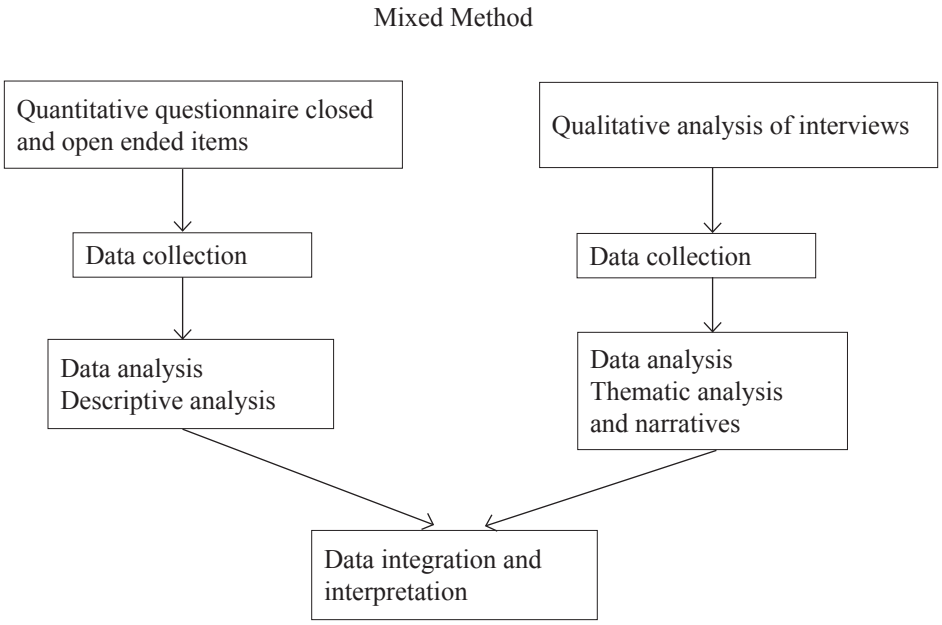


Fig. 3: Mixed method

not intent to represent views proportionately but in getting a broad spectrum of ideas. HVWSHE is implemented in countries which have different contexts and this study intends to look at all possibilities of different perspectives including 'outlier' or unusual ideas. This sampling is opposite to modal instance sampling.

Participating Countries and Response Rate for the Questionnaire

A total of 22 surveys were sent out. Sixteen surveys were received between 10 March 2009 and 18 April 2009. The response rate was 70%. The details of participating countries are provided in Table 1. For teacher demographics, please see Appendix 1.

The eight participants from Thailand comprised two males and six females. Their ages ranged from 24 to 64. The participants had implemented HVWSHE for a period of 6 to 9 months. Three participants were teacher trainers from Thailand who were also teachers. Of the six teachers from Indonesia, one was male and five were females. All of them were English teachers and their ages ranged from 34 to 56 years. There wasno teacher trainer in this group. Teachers from Indonesia had training sessions in HVWSHE for about six to ten days. The teachers from Lao PDR who participated in the survey were both male, aged 27 and 28. Both were English teachers, and both had training sessions for about one to two weeks.

Questionnaire

The questionnaire consisted of closed and open-ended questions which helped investigate teachers' beliefs about the process of educare for HVWSHE. A 5-point Likert questionnaire (where 5 represented "strongly agree" and 1 "strongly disagree") was used to gather the teachers' beliefs about the principles used in HVWSHE as well as the impact of HVWSHE on students' attitudes and behaviours. The study used the Delphi method (Skulmoski, Hartman and Krahnet, 2007) to construct the survey questionnaire on teachers' beliefs and perceptions using a panel of experts.

TABLE 1
Details of participating countries for the questionnaire

No	Countries	Number of participants	Number of surveys returned	% of response rate
1	Laos	2	2	100
2	Thailand	10	8	80%
3	Indonesia	10	6	60% Total return rate = 72%

Data Analysis

The questionnaire was tested using descriptive statistics (frequencies and percentages), while the open-ended items were analysed using Nvivo 8. All the open ended responses for the questions related to the principle of educare were combined together and the responses were categorised using Nvivo8.

Teachers' in-depth interview responses were analysed by using a strategy by Eddlie and Tashakkori (2009, p. 25) termed as "contextualising' strategy". Contextualising (holistic) strategies according to Teddlie and Tasshakori (2009) helps interpret the data obtained from narratives "in the context of a coherent whole "text" that includes interconnections among the narrative elements" (p.25).

RESULTS

The findings for teachers' beliefs of integration and elicitation of human values in their reaching and learning process are provided below. The first section presents findings for the mixed survey followed by the findings from the qualitative method.

Teachers generally agreed that the integration of human values is important. For Item 6: *'It is easy to integrate human values into all academic subjects,'* one participant disagreed strongly. Eight out of sixteen teachers gave neutral responses to Item 6, which indicated that some faced difficulty in integrating human values in some lessons. With regards to Item 10: '*Lesson plans must stress students' inter-connectedness with the environment*,' most teachers agreed that this is significant for human values water education. For Item 15: two of the sixteen teachers believed that they did not have enough time to integrate and elicit human values. Regarding Item 22: '*Integrating water-based cultural practices into HVWSHE increases students' respect for the environment,'* fifteen out of sixteen teachers agreed with the statement.

Qualitative Data

The major categories and subthemes from the analysis using Nvivo 8 helped to isolate rich and thick description to convey the findings. To help alleviate researcher bias, the categories from the open-ended items and from interviews were compared and contrasted by a peer reviewer. The inter-rater reliability was 80.5%. The rest of the items were then compared and contrasted and an agreement was made to remove them because of the lack of consensus.

From the open-ended items, six teachers stated that integrating human values in the subjects is very important because it helps students develop pro-environmental behaviours as well as contribute to society. Four of the teachers mentioned that integrating human values helps students improve their character and behaviours. Regarding teachers' confidence to integrate human values, most teachers felt that they have the confidence to integrate human values into their teaching. However, few faced constraints while implementing because of the lack of time and the academic stress they faced (*see* Appendix 3).

Sample for the Interviews

Participants from Thailand and Indonesia took part in the follow-up interview (*see* Appendix 2). Eight participants from Thailand and six participants from Indonesia were interviewed. Table 2 provides details of participating countries for the interview. To ensure validity, the sample also satisfied the criteria of purposive sampling strategy. Purposive type of sampling helps to produce in-depth information that can be obtained from individual respondents (Teddlie and Tasshakori, 2009).

To ensure validity, the sample also satisfied the criteria of a purposive sampling strategy. Purposive sampling helps to produce in depth information that can be obtained from individual respondents (Teddlie and Tasshakori, 2009). The section below presents the findings of teachers' beliefs from Thailand and Indonesia. Teachers from Thailand were referred to as T 1, 2, 3 etc while teachers from Indonesia were referred to as I 1, 2, 3 etc.

Teachers' Responses Regarding Integrating and Eliciting Human Values in Thailand

Teacher T4 stated:

> *We use themes...the main emphasis is for teachers to bring out the values and when we do training we always ask them what are the values they learn… so they can use the same kind of methodology…we use a lot…like biology combining with geography and social studies …we teach children, not to teach, how to teach the world better, how to teach specifically with water… this is really very important working with a group…has an advantage as teachers. I did a project with one class where they planned out a conservation plan for the school, and one of the things they came up with themselves is …like leakages…in pipes…we combine mathematics and domestic science... with the older children, we got them to do statistics on how much water is needed, for instance to grow a pound of grain versus producing a pound of meat…producing meat requires about 10 times more water. We have to think about so many changes, even changes in diet…these kinds of things, if the children do it themselves, if they find out for themselves, it has so much more meaning than if the teacher just gave them the statistics...one of the things we try to do here is get the children to do research, get them to think for themselves and...it's a very different learning process. The problem with education today is that it is just a process of giving information...there's not much learning…what we want is teach children how to learn, how to find out.*

Teacher T1 indicated that teachers shared their experiences as she related her colleague's experience during his teaching and learning session. She was motivated by students' feedback as she related her colleague's experiences through her belief statements. She stated that:

TABLE 2
Details of participating countries and respondents for the interviews

No	Countries	Number of participants	Number of participants for the interview	Percentage of response rate
1	Thailand	10	8	80
2	Indonesia	10	6	60 70%

The biology teacher ...he tells about his class…but his group is about biodiesel…we use recycled oil from the kitchen ...it's a project in our school… after that we try to calculate its profit or loss…and we found there was only little profit…the budget is very high to buy material ...he asked the student "what did you learn from this project" and then he said, he expected responses like only "save the environment"… but the student said even if we have just small profit we should go on… carry on because it is good not just for our school to save, not for the environment…but for everything.

Teacher T3, a primary teacher from Thailand, explained her experience with Grade Two students in Thailand regarding integration and elicitation of human values. She explained how she used her teaching to instill good behaviors in students:

I use water education for Grade 2. We have activity…when we learn about litres or millilitres in mathematics you must try to change the behaviour for saving the water… and I use the institute museum and take them to walk and learn about the basics in that room. After that I ask them how do you feel or what knowledge have they gained from their learning… they talk about their activity or unity or sharing… about the idea how we can save water and after that we can save energy, not only water and we ask them about education in human values..."this group they say that we have unity, sharing", they are happy to learn and happy to have activity ...they tell me ...time is not enough for them.

Teacher T3 believed that cooperative learning involves the concepts of knowledge as well as using the teaching situation to help students change their behaviors. She also emphasized the response she received from students and their interests in activities.

Teacher T5 talked about the importance of reinforcing good values in children. She was confident of the change in students and her belief statements revealed that she did not have difficulty with time. She stated that:

It's always nice to integrate values in the classroom that gives positive attitudes to children. If it's value oriented you always use good values in the subconscious mind, only good values go into children…sometimes yes, some children you can see change in them… even the parents come and say that ...Integrating values in water education ...yes it's not tough, it's just the way you manage the class ... I don't think it takes extra time to integrate values…I will say ninety per cent of students respond faster.

A few teachers found it quite difficult to integrate values for certain topics. A secondary school mathematics teacher, T13, stated the following:

Mathematics ...some contents are difficult to integrate, some contents are difficult to use human values…like statistics…

Another teacher, T6, a mathematics teacher, stated that when they use topics related to water from science or in mathematics, students are more interested. T6 also stated that listening to students is important because their feedback provides new ideas. She stated how she combined knowledge and facts in mathematics with real life situations regarding water issues:

When we use water from science and mathematical aspects the students are more interested in those topics…for example…in mathematical class when

I teach them logarithm, I can talk about logarithm and water.

Teachers' Responses Regarding Integrating and Eliciting Human Values in Indonesia

Teachers' responses regarding integrating human values in Indonesia are provided below. When asked about integrating values, one of the teachers, I2 mentioned that academic stress was an obstacle. She stated the following:

Not often, sometimes …once a month … because …we don't get time to make a group because in Jakarta …we should finish materials for the subject…so we don't have any time to make the game or anything …sometimes I take our students to study in the park…

Actually when I'm teaching I didn't… it's difficult to say … I teach fourth grade and twelfth grade...my work is to prepare them for the final exams… In my teaching method I didn't put the value of water in my teaching. But when I talk to them I told them about my experience in Thailand and I told them about the students in the Sathya Sai School and about the teachers and they were very interested. In my stories, they keep asking me about my experience in Thailand…

Teacher I3 responded on her classroom experiences:

Sometimes I have listening comprehension …I tell them about how important water is. How without water we cannot be alive. Water is important. We may not waste water… because not all Indonesians have good water. Because there are some places where people need water…in Jakarta the green became real estate... like town…so…in my home town for the first time when I came in 1980 there are still small rivers on the side of the road but now there is no water anymore… government has set a rule that we should have a green environment… our school has become a green school ..but now .we aim for a green school for Jakarta…now we must compete with the five districts in Jakarta … south Jakarta…north Jakarta…central Jakarta…then east Jakarta and also environment should be clean… like place plastic or anything in the right place.

In Teacher I3's belief statements there was no evidence of values integration or elicitation among students. Teacher I3 used a didactic approach to teaching. Teacher I5 stressed the use of water. She responded as follows:

Usually in Indonesia, we use water for housing…and the students study about water sometimes they don't realize, you know, it is very important…it is very, very important to be efficient …to be efficient…in using water in Indonesia… there are many uses…like for sports sometimes and for making plants, fish, for irrigation and for plan like electric power.

When she was probed on her experiences her response was as follows:

It is very useful for human…many benefits …many profits for the human beings …without water, human beings …cant live…That's right…so I often told students about many uses of water …in Jakarta, the people must feel the crisis of water now.

Teacher I8 from Indonesia stated the following:

I get from Thailand, is real…the value show up we can feel how it is…

really wonderful…it is like diamond… it is human character…about the development of human person…in integrating values…I didn't…when I get there…it's not theoretical...it is applicable… people use it…value and respect everything in our life…nature, human being and then situation in … surrounding area

There were differences in the teachers' responses between Thailand and Indonesia. Teachers from Thailand related that they integrate human values in their lessons. Thai teachers' belief statements also revealed that they received responses from students. Teachers from Indonesia did not explain or relate to students' experiences. Indonesian teachers also complained of the stress regarding their work.

Teachers from Indonesia were motivated by the program and felt it was important for students. The responded from Indonesian teachers' open-ended items revealed that they understood the significance of implementing the integration and elicitation of human values. However, their belief statements did not complement the narratives.

Teachers from Thailand reported several instances of students' feedback. They generally agreed that integrating human values is important and they received help from their peers. There was evidence of peer discussion of classroom experiences and observation of students' behaviours. However, few teachers mentioned the problems they faced while integrating human values in certain subjects like mathematics, and a lack of time.

Teachers from Lao PDR were in agreement that integration and elicitation helped develop students' pro-environment behaviours. They stated that students know how to save water and protect the environment. One of the significant statements they made was that students have the ability to provide solutions because they have creative ideas and they come from different environments. Both participants did not take part in the interviews, and this is a limitation for this study.

Important Differences between Indonesian and Thai Groups

There were some differences between teachers' responses between Thailand and Indonesia and in their teaching approaches. The teachers from Thailand reported on students' responses, but they were positive that the integration of values works. The teachers from Indonesia did not explain or relate to students experiences. They complained of the stress regarding their work.

Teachers' from Indonesia have not taken this experiential approach in the classroom either because of their teaching approaches they use and /or because they had not implemented water education as a whole of school approach. Teachers from Indonesia responded that they face heavy workload and a lack of time. It was understood from teachers' beliefs that assessment procedures are more exam oriented. In Thailand education in human values is embedded in the curriculum through the integrated classes which teachers mentioned frequently.

If water education is to take an integrated approach then teaching approaches have to move from a rigid structured program to a more intra-disciplinary view. Teachers have to move from teacher -centred to meaningful student- centred learning. This has to include information as well as transformation. Integrating values in the classroom is a complex approach. According to Greeno (1997, p. 11), "Learning to learn through the activities of inquiry involving discourse that includes formulating and evaluating questions and problems, as well as solutions and conclusions, and proposing and criticizing explanations, arguments, and examples is crucial to meaningful participation in the activities of our society". Teachers from Thailand provided some evidence of implementation of these teaching processes regarding water issues using a problem based approach and values approach. Prawat (1992) highlighted the fact that changing from traditional approaches to a constructivist approach requires teachers to discuss and reflect and take into account their own conceptual change. These changes, according to Prawat, cannot occur unless there is a whole of school approach.

Regarding the integration and elicitation of human values in the curriculum, there was not much emphasis relating to water education from teachers' belief responses in Indonesia. There was no evidence of discussions or using an integrated approach or theme teaching in their schools.

According to teachers' belief responses, teachers from Thailand had used the integrated approach by combining both the cognitive and affective objectives when they conducted lessons. These approaches were missing from responses in the Indonesian group. Teaching approaches, according to the belief responses from Indonesia, also revealed that they were more teacher centred and this would cause an obstacle for values education.

Implications of Teacher-Centred Teaching Approaches and Learner-Centred Teaching Approaches

Teachers in Thailand have administrative support and this has helped curricular changes as well as implementation of the reform itself, facilitating student-centred learning. The curriculum has incorporated a flexible mode of teaching, i.e theme teaching as well as an integrated approach, which enables teacher support as well as intra-disciplinary teaching. If HVWSHE has to be implemented using the principle of integration and elicitation in classrooms the teaching approaches have to change and teachers may need to use reflective practices in Indonesia.

DISCUSSION

The results of this study suggested some differences in teachers' understanding and beliefs about HVWSHE between the groups from Thailand and Indonesia. From the first phase, the analysis indicated that most of the teachers were positive about implementing values education. The qualitative analysis revealed that most teachers were motivated by the program. The teachers from Indonesia appeared to a have low conceptual understanding of HVWSHE principles and processes although they were motivated by the program. Teachers' belief responses from Indonesia regarding HVWSHE reflect that even if teachers were motivated and understood the underpinning philosophical ideas of HVWSHE, teachers may not be able to implement the reforms as they are intended. Teacher professional development in HVWSHE may then need to include several teaching experiences on how to integrate values through an integrated approach and interdisciplinary teaching approaches. Administrative support is also needed to support teachers through teacher modelling of effective teaching methods using knowledge and skills to integrate and elicit human values from lessons related to water education.

SIGNIFICANCE OF THE STUDY

This study contributed to understanding how teachers conceptualised and applied the principles of Educare and processes using the teaching pedagogies from the HVIIM in their classroom practices in some Southeast Asian countries. An overview of teachers' beliefs regarding their use of the teaching processes helped teacher educators to modify or adapt their practices in these regions. They can also be part of a larger model for both HVWSHE and environmental education throughout the parts of the world which have similar issues with water.

LIMITATIONS

The sample for this study was small and results cannot be generalised for schools in Southeast Asian countries. Furthermore, the interviews did not cover the aspect of integration and elicitation of human values in depth. Nevertheless, the study has made a useful contribution in understanding teachers' beliefs regarding their personal classroom practices in terms of water education and has implications for environmental education as a whole.

CONCLUSION

While teachers have agreed that water education and a human values approach to its implementation are important, teachers may

need support through classroom modelling to understand how student -centred approaches actually impact HVWSHE when compared to traditional approaches. This study has given some insights into teachers' beliefs about HVWSHE which can be incorporated into future professional development to further enhance the development of student learning as well as ethical behaviours and attitudes related to water education.

REFERENCES

Abelson, R. (1979). Differences between belief systems and knowledge systems. *Cognitive Science*, *3*, 355-366.

Brooks, J. and Brooks, M. (1993). In search of understanding: The case for constructivist classrooms. *Association for Supervision and Curriculum Development*.

Clark, N. (2005). *Water for African cities -phase 2: Strategic planning workshop for implementation of phase 2*. Libreville,Gabon: United Nations Human Settlements Programme (UN-HABITAT) and The African Institute of Sathya Sai Education (TAISSE).

Chen, C. H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research*, *102*(69), 65-75.

Chulalongkorn University. (2003). *Human Values Integrated Instructional Model*. Faculty of Education, Thailand: Bangkok

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research Volume*, *38*(1), 47-65.

Gleick, H. (2000). *The World's Water Report 2000-2001: The Bi-ennal Report on Freshwater Resources, California*. Washington: 2010 Island Press 1718 Connecticut Avenue NW, Suite 300 Washington DC.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher, 26*(5).

Jumsai, A. (1997). *The Five Human Excellence*. Thailand: Bangkok: Institute of Sathya Sai Education.

Jumsai, A. (2003). *A Development of the Human Values Integrated Instructional Model Based on Intuitive Learning Concept*: Chulalongkorn University: Thailand.

Lovat, T. and Clement, N. (2008). The pedagogical imperative of values education. *Journal of Beliefs & Values*, *29*(3), 273-285.

Mahoney, S. (1997). Sample indepth interview guide Retrieved from http://www.nsf.gov/pubs/1997/nsf97153/.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, *19*(4), 317-328.

Pajares, R. (1992). Teachers beliefs and educational research: Cleaning up a messy construct. *Research of Educational Research*, *62*(3), 307-332.

Prawat, R. S. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. *American Journal of Education*, *100*(3), 354-395.

Rogers, C. (1980). *A Way of Being.* Boston: Houghton Mifflin Company.

Saibaba, S. (2000). Strengthening values education. Paper presented at the *Strengthening Values Education*, Andhra Pradesh, India.

Skulmoski, G. J., Hartman, F. T. and Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education*, *6*.

Sri Sathya Sai World Foundation. (2007). *Global Overview of Sathya Sai Education*. Sri Sathya Sai World Foundation: California: U.S.A.

Taplin, M., Huang, F. and Ng, D. (2005). Implementing values education in the regular curriculum: A problem solving approach to challenge and support teacher growth. In L. Barnes, (Ed.), *Contemporary teaching and teaching issues* (pp. 141-174).

Tashakkori, A. and Teddlie, C. (2003). *Handbooks of Mixed Methods in Social & Behavioural Research.* Sage Publications: Thousand Oaks.

Teddlie, C. and Tasshakori, A. (2009). *Foundations of Mixed Methods Research*. Los Angeles: Sage Publications.

Teo, T., Lee, C.B., Hung, D. and Beng, L. (2008). Beliefs about teaching and uses of technology among pre-service teachers. *Asia-Pacific Journal of Teacher Education*, *36*(2), 163-174.

Toh, L., Yeap, C.H., Ng, K. T. and Isma, I. (2007, November). Cross curricular teaching incorporating human values: A collaborative research by reflective practitioners. *Learning Science and Mathematics*, *2*, 9-31.

United Nations Human Settlements Programme, & The Asian Development Bank. (2003). Report of the regional consultations on Values-based water education for Asia and the Pacific, Philippines: Manila. United Nations Human Settlements Programme (UNHABITAT).

UNHABITAT. (2006). *Facilitators & Trainers Guidebook*. Nairobi United Nations Human Settlements Program.

UNHABITAT & SEAMEO. (2007). *SEAMEO Resource Package: Human Values-based Water,Sanitation and Hygiene Education* Indonesia: SEAMEO Regional Open Learning Center (SEAMEOLEC).

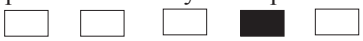
Walker, R. (2007). *Music Education: Cultural Values, Social Change and Innovation*. Sydney: Australia: Charles C Thomas Publisher Ltd.

APPENDIX 1
TEACHERS' BELIEFES AND PERCEPTION SURVEY

You are requested to indicate the extent of your agreement or disagreement.
Please write down clearly what you feel about implementing HVWSHE in your classroom.

Section A

Instructions: Use a blue/black pen or pencil and mark your response as shown



Please answer each question to the best of your ability

1. Gender Male ☐ Female ☐

2. Age : ……

3. Country: ……

4. How many years have you been teaching? ……

5. What grade levels do you teach? ……

6. How long was your training period? ……..

7. For how many months have you implemented HVWSHE? ……

8. In which subjects do you implement HVWSHE? Please fill in the number of hours per week you implement HVWSHE in each of the subjects you teach in the check box.

……. ☐

……. ☐

…….. ☐

……... ☐

…….. ☐

…….. ☐

9. Are you a trainer of teachers (TOT)/Teacher Educator?
(Trainer of teachers and teacher educator implies that you train teachers)
Yes: ☐ No: ☐

For each item below, please indicate the extent to which you Agree or Disagree with the statement, using the scale provided. Please use the space below each question to give reasons for your rating.

1. I believe that it is important to integrate Human values into my lesson plans.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……....

2. I have the confidence to integrate human values when teaching about the environment.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……....
……

3. I believe that teachers can draw positive values during interactions with students in HVWSHE.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……....
……

4. Human values are easy to integrate into all academic streams.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

5. It is possible to motivate students to practice human values for developing pro-environmental behaviours.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

6. Students are motivated to help one another when values such as unity, peace and love are drawn from lessons taught in classrooms.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

7. Lesson plans must stress students' interconnectedness with the environment.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

8. Facilitation of human values in classroom promotes self–control in students so that do not waste water.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

9. It is possible to draw out human values from students during the teaching sessions.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

10. Integrating water-based cultural practices into HVWSHE increases students' respect for the environment.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
☐	☐	☐	☐	☐

Please explain the reasons for your rating

……
……

APPENDIX 2
SAMPLE IN-DEPTH INTERVIEW GUIDE

Name of Interviewer_____
Date_____
Name of Interviewee_____
Staff Position_____

"Good morning. I am _____ (introduce self).

This interview is being conducted to get your input about the teaching processes in your classroom with regards to human values-based water education which you have been, conducting/involved in. I am especially interested in your views with regards to the program".

"If it is okay with you, I will be tape recording our conversation. The purpose of this is so that I can get all the details but at the same time be able to carry on an attentive conversation with you. I assure you that all your comments will remain confidential. I will be compiling a report, which will contain all staff comments without any reference to individuals. If you agree to this interview and the tape recording, please sign this consent form."

"I'd like to start by having you briefly describe your responsibilities and involvement thus far with the HVWSHE " *(Note to interviewer: You may need to probe to gather the information you need)*.

"I'm now going to ask you some questions that I would like you to answer to the best of your ability. If you do not know the answer, please say so."

HVWSHE

Teaching processes; Integrating human values in the lesson plans c) Drawing out human values from the students.

Questions will be probed in detail on the above aspects as given below,

"What are your experiences during classroom teaching regarding integration of human values in your lessons?"

"Do you observe any changes with students with regards to their habits when they use water"?

"Can you elaborate more on that"?

"What other problems are you aware of?" *(Note to interviewer: You may need to probe to gather the information you need)* "What do you think about HVWSHE at this point?" *(Note to interviewer: You may need to probe to gather the information you need - e.g., "I'd like to know more about what your thinking is on that issue")*

"Is there any other information about the impact of the program that you think would be useful for me to know?" *(Note to interviewer: If so, you may need to probe to gather the information you need)*

http://www.nsf.gov/pubs/1997/nsf97153/c3app_b.htm…(Mahoney, 1997)

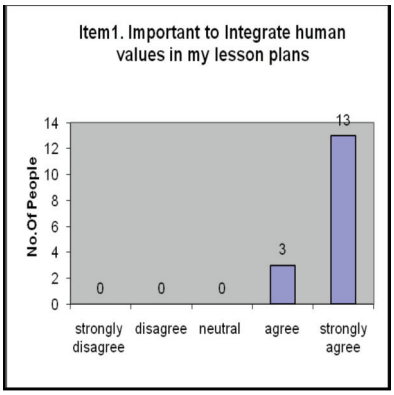
APPENDIX 3

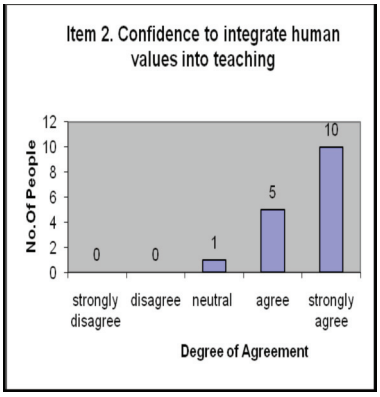
TEACHERS' BELIEFS REGARDING INTEGRATING AND ELICITATION OF HUMAN VALUES

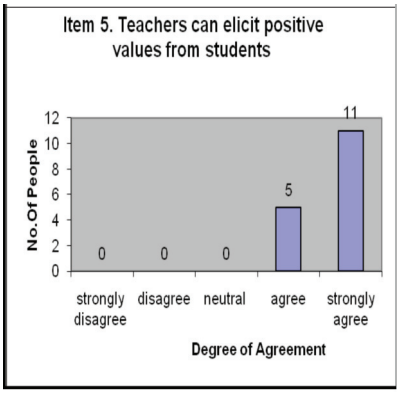
Statements	strongly disagree	disagree	neutral	agree	strongly agree
Item 1: It is important to integrate human values in my lesson plans	0	0	0	3	13
Item 2: I have the confidence to integrate human values in my teaching about the environment	0	0	1	5	10
Item 5. I believe that teachers can elicit positive values from students using HVWSHE	0	0	0	5	11
Item 6: It is easy to integrate human values into all academic subjects	1	0	8	4	3
Item 7: It is possible to motivate students to practice human values by developing pro- environmental behaviours	0	0	0	8	8
Item 8: Students are motivated to help one another when values, such as unity, peace and love are integrated into the lessons	0	0	2	3	11
Item 10: Lesson plans must stress students' inter-connectedness with the environment	0	0	1	12	3
Item 12: Human values education promotes self control so that students do not waste water	0	0	1	11	4
Item 14: It is possible to elicit human values from students during class	0	0	1	7	8
Item 22: Integrating water based cultural practices into HVWSHE increases students' respect for the environment	0	0	1	10	5

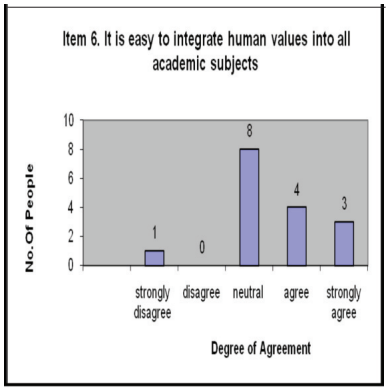
APPENDIX 4
INTEGRATION AND ELICITATION OF HUMAN VALUES

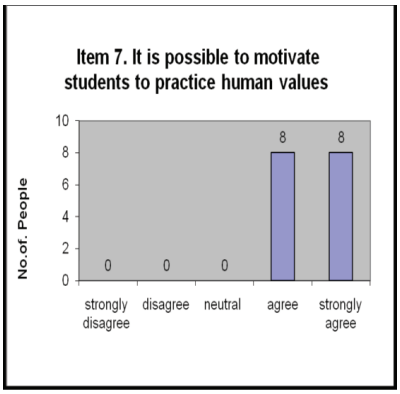
The teachers' rate of agreement regarding the second principle, integration and elicitation of human values, is provided in the figures below.

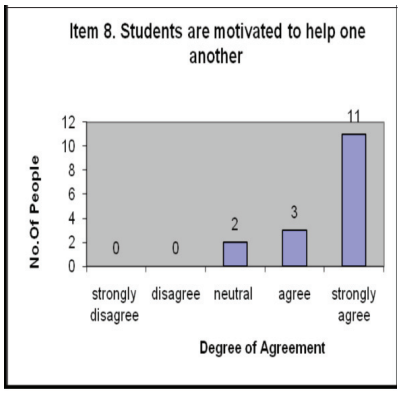


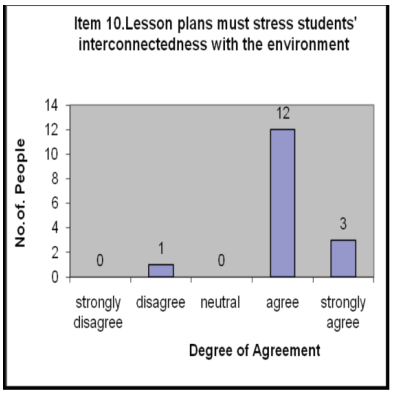


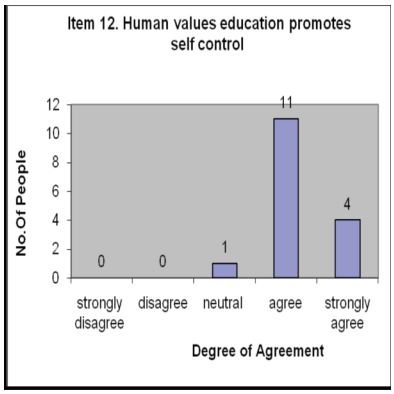


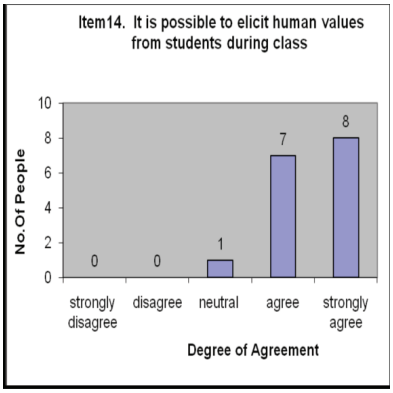


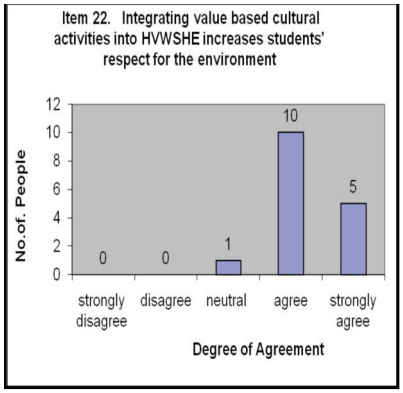





Item 10.Lesson plans must stress students' interconnectedness with the environment
No.of. People
14
12
10
8
6
4
2
0
0
1
0
12
3
strongly disagree
disagree
neutral
agree
strongly agree
Degree of Agreement


Item 12. Human values education promotes self control
No.Of People
12
10
8
6
4
2
0
0
0
1
11
4
strongly disagree
disagree
neutral
agree
strongly agree
Degree of Agreement


Item14. It is possible to elicit human values from students during class
No.Of People
10
8
6
4
2
0
0
0
1
7
8
strongly disagree
disagree
neutral
agree
strongly agree
Degree of Agreement


Item 22. Integrating value based cultural activities into HVWSHE increases students' respect for the environment
No.of. People
12
10
8
6
4
2
0
0
0
1
10
5
strongly disagree
disagree
neutral
agree
strongly agree
Degree of Agreement

Journal of Social Sciences and Humanities

INSTRUCTIONS TO AUTHORS
(Manuscript Preparation & Submission Guidelines)

Revised January 2010

We aim for excellence, sustained by a responsible and professional approach to journal publishing.
We value and support our authors in the research community.

Please read the guidelines and follow these instructions carefully; doing so will ensure that the publication of your manuscript is as rapid and efficient as possible. The Editorial Board reserves the right to return manuscripts that are not prepared in accordance with these guidelines.

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Pertanika is an international peer-reviewed journal devoted to the publication of original papers, and it serves as a forum for practical approaches to improving quality in issues pertaining to tropical agriculture and its related fields. *Pertanika* began publication in 1978 as Journal of Tropical Agricultural Science. In 1992, a decision was made to streamline *Pertanika* into three journals to meet the need for specialised journals in areas of study aligned with the interdisciplinary strengths of the university. The revamped Journal of Social Sciences & Humanities (JSSH) aims to develop as a pioneer journal for the Social Sciences with a focus on emerging issues pertaining to the social and behavioural sciences as well as the humanities, particularly in the Asia Pacific region. Other *Pertanika* series include Journal of Tropical Agricultural Science (JTAS); and Journal of Science and Technology (JST).

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    - **Page 2: Author(s) and Corresponding author information.** This page should contain the full title of your paper with name(s) of all the authors, institutions and corresponding author's name, institution and full address (Street address, telephone number (including extension), hand phone number, fax number and e-mail address) for editorial correspondence. The names of the authors must be abbreviated following the international naming convention. e.g. Salleh, A.B., Tan, S.G., or Sapuan, S.M.

      Authors' addresses. Multiple authors with different addresses must indicate their respective addresses separately by superscript numbers:

      George Swan[1] and Nayan Kanwal[2]

[1]Department of Biology, Faculty of Science, Duke University, Durham, North Carolina, USA.
[2]Research Management Centre, Universiti Putra Malaysia, Serdang, Malaysia.

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   Swan and Kanwal (2007) reported that …
   The results have been interpreted (Kanwal et al. 2009).

   - References should be listed in alphabetical order, by the authors' last names. For the same author, or for the same set of authors, references should be arranged chronologically. If there is more than one publication in the same year for the same author(s), the letters 'a', 'b', etc., should be added to the year.
   - When the authors are more than 11, list 5 authors and then et al.
   - Do not use indentations in typing References. Use one line of space to separate each reference. The name of the journal should be written in full. For example:
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     - Hawe, P. (2005). Capturing the meaning of "community" in community intervention evaluation: Some contributions from community psychology. *Health Promotion International, 9,*199-210.
     - Braconier, H. and Ekholm, K. (2006). Swedish multinationals and competition from high and low wage location. *Review of International Economics, 8,* 448-461.
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   - ***Proceedings***: Amir Awang. (2006). Counseling, human resources development and counseling services. In Sulaiman M. Yassin, Yahya Mat Hassan, Kamariah Abu Bakar, Esah Munji and Sabariah Mohd. Rashid (Eds.), *Proceedings of Asia Pacific Conference on Human Development* (p. 243-246). Serdang: Universiti Putra Malaysia.

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