RAPPORT OR COMPLIANCE?

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Though there has been no conscious effort on the part of anyone to compile and compare the general aims of tertiary education across universities in different countries, "there was a substantial consensus about the importance of critical thinking" in higher education (Entwistle, 1984, p.4). As early as 1964, the Hale Report (1964) asserted that "an implicit aim of higher education is to encourage students to think for themselves." This aim is elaborated on by Gibbs:

The development of students' intellectual and imaginative powers, their understanding and judgement; their problem-solving skills; their ability to communicate; their ability to see relationships within what they have learned and to perceive their field of study in a broader perspective. The programme must aim to stimulate an enquiry, analytical and creative approach, encouraging independent judgement and critical self-awareness.

(Gibbs, 1990, p.1)

In 1990, Knapper summarised two studies at Monash University in Australia, and at the University of Alberta in Canada, that give support to the views of other academics across the years and continents. The Canadian and Australian academics agree with the following educational objectives:

- To teach students to analyse ideas or issues critically;
- To develop students' intellectual/thinking skills;
- To teach students to comprehend principles or generalizations.

RAPPORT AND DEEP LEARNING

But how can lecturers in Singapore and elsewhere bring about the fulfilment of these lofty aims through their teaching? In educational terms, how can we ensure that our tertiary students are deep learners who are concerned with a burning desire to learn and understand and who will read beyond the prescribed texts and articles in the pursuit of new knowledge? How do we go about kindling the fire of learning and enquiry in our tertiary students? While lifeless lecturing is not conducive to the development of understanding, neither is an entertaining presentation adequate for effective student learning. A "good" performance, not supported by solid information, is not necessarily good teaching. In fact, an "entertaining" lecturer rather than a "stimulating" lecturer may leave students with a sense of having been entertained, but with little advancement of learning. Serious and mature students are intellectually competent to differentiate effective teaching from distracting exhibition. (Ramsden, 1992)

Research indicates that Deep Approaches in learning are associated with certain specific characteristics of teaching. A Deep Approach in learning is characterized by an intrinsic interest and competence in particular academic subjects and a Deep Learner would read widely and seek relationships between concepts (Biggs, 1987). Teaching which is
perceived to combine human qualities with explanatory skills is most likely to promote deep approaches. The emotional aspect of the teacher-student relationship is much more important than what traditional advice on methods, styles or technique of lecturing would suggest (Ramsden, 1992). Examples can be drawn from both overseas studies and local surveys. The science students in Bliss and Ogborn's study (1977) reported that they were more likely to understand the concepts expounded in the lectures of lecturers who interacted with them in a way that encouraged involvement, commitment and interest. Various studies of student ratings of lecturers in higher education also identify a recurring factor labelled as "student-centredness", "respect for students", "individual guidance" or "lecturer-student rapport" among other aspects of effective teaching (Keller et al., 1991; Ramsden, 1988). Heichberger (1991) also found that high-quality teaching is most likely to occur where faculty members respect and trust people and behave in open communication. Students differ by gender, college status and grade-point average in their perceptions of the ideal professor. Light (1990) found that female students preferred an advisor who took time to get to know them personally and who shared their interest, whereas the male students wanted an advisor who made concrete and direct suggestions and knew the facts. According to Cashin (1979), the students' feelings about the teacher can be a significant help or hinderance to learning.

Do our local tertiary students view rapport as an important factor in effective teaching? Indeed, the remarks made by our students of master teachers in their tertiary institutions confirm the importance of rapport in tertiary teaching. "Empathy with students" was cited as an impressive trait of one popular science lecturer (Straits Times, 5 Nov. 1992, pp 19). "Being approachable" won another lecturer the gratitude and appreciation of his students (Straits Times, 19 May 1993, pp 19). There are many more examples of students who would immediately speak highly of the out-of-class behaviour of their favourite lecturers, indicating their interest in and concern for them. "He was one of the most approachable lecturers and that made us more willing to discuss our problems with her ....." (Straits Times, 13 July 1993, pp 20).

In quantitative terms, surveys carried out in local teaching institutions indicate that students across faculties are as concerned with lecturers' affective characteristics outside the lecture hall as they are with their explanation and organizational skills inside the lecture rooms. Lu (1994) found that 41% of his Final Year Engineering students ranked rapport as one of the top seven motivating factors in learning. Similarly, Chang (1993) and Ng et al (1994) concluded from their respective studies that Education and Engineering students ranked lecturers' treatment of students both inside and outside the lecture rooms above that of lecture organization and lecture content. Though most Education trainees are females while the Engineering students are males, their common need for lecturers who understand the needs of students, respect them and are approachable is not unexpected.

ARE OUR TERTIARY STUDENTS DEEP LEARNERS?

If our key objective in tertiary education is to mould our undergraduates into critical and reflective problem-solvers, we should be able to develop graduates into deep learners at the end of their stay in the universities. It is generally known that many of our primary and secondary students are rote learners who rely heavily on teachers' detailed notes, model answers and tuition. Hence it is not unreasonable to see some spillover of such traits into
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the early years at the university. But if a conscious effort is made to develop undergraduates into independent deep learners in their journey through the university, we should at least see the emergence of such deep learning characteristics in the third and final years of their university course.

Table 1 shows the results of surveys carried out in both universities and polytechnics in Singapore across disciplines and years. The findings are chilling and disturbing. Most surveys report that our undergraduates, irrespective of discipline and year, are Surface learners. This means that our undergraduates have only a superficial interest in their chosen programmes of study and are only keen to pass examinations, using the rote learning method. They are not likely to read extensively and seek alternative solutions to problems.

Their study habits have also not undergone any changes over the years in the university. Table 2 presents the findings on the learning styles of undergraduates across subjects and years. The surveys on engineering undergraduates by Ng (1993) and Lin (1994) were carried out in the same university from Year 1 to Year 4. The results indicate a trend of increasing dependency on lecturers for guidance and solutions. A comparison by Wee and Huan (1991) between Year 1 and Year 3 physics students seems to suggest increased dependency on lecturers and decreased independence in learning, too. Undergraduates in another engineering discipline (Zhao, 1994) and Polytechnic students (Quah, 1994) were no better.

The popularity of the Surface Approach towards learning and the increased dependency on lecturers are strongly related. Table 3 gives further evidence of our undergraduates' apathy in problem-solving and their passive approach to their learning. The most preferred tutorial style was "Tutor provides model answers and explain the solutions". Such a tutorial style appears to increase in popularity over the years. In the case of the engineering students, it has grown from a moderate 32.2% in Year 1 to 70% in Year 3.

Are we happy with these findings? Are we achieving our noble objective of producing thinking and problem-solving graduates? What about our national ambition of developing entrepreneurship in our young graduates? Our political leaders, especially SM Lee Kuan Yew, have spoken extensively on the need for young Singaporeans to be risk taking and to think globally. Though the surveys presented here are not extensive and comprehensive, they should serve as warning signals to us in tertiary education. Are we producing the graduates we want? Why are our undergraduates becoming increasingly dependent, ineffective and passive learners?

Rapport or Compliance?

Students learn according to the way they are taught and assessed. The methods we use to assess students are one of the most critical of all influences on their learning. If they know that they can score marks by just merely rote learning their detailed lecture and tutorial notes and tutorial, they would demand lecture notes and perfect solutions to tutorial problems. If non-routine problems and alternative solutions are expected in an examination, students will make an effort to be more critical and analytical (Chang, 1991). It is often the assessment tail that wags the learning dog!
Through close rapport with students, lecturers can exert a strong influence on students' learning habits. We know that many students will want the easy way out in the face of a heavy workload by demanding detailed notes (so that they can miss mass lectures) and solutions to the tutorial problems.

But should students get own their way? Students know that they have the appraisal weapon in their hands. It seems very strong to use the word "blackmailing" but students' feedback can become an ugly example of academic "blackmailing" in extreme cases.

Faculty's promotion, renewal of contract and tenure are in part dependent on students' feedback. Students' feedback is an important, though not the only means of assessing a faculty member's competence in the lecture room. Having knowledge of students' preference can help academics adapt their teaching and tutorial styles to improve their students' feedback ratings.

A top student has once told me that students' feedback is more a measure of a faculty member's popularity than his/her competency. Tired and bored students would prefer an entertaining "performance" rather than a solemn lecture packed with solid facts which require full concentration and comprehension. What are proper grounds for judging which lecturer is a better lecturer?

Compliance to students' preference for certain types of instruction may be a possible culprit in the growth of students' apathy and dependency in their learning at the university. Students' feedback is at best an invaluable source of information for lecturers to improve their teaching skills. But the inappropriate use of such feedback can turn it into a powerful double-edged sword.

My knowledge of evaluation tells me that comparison must be based on a common baseline. That is why raw scores of different curriculum subjects must be first standardized before comparisons can be made. In simple mathematical terms, we cannot add 10 apples and 10 oranges together to produce 20 hybrid fruits! Better educated and more mature students are also more critical and less emotional in their appraisal of lecturers (Keller et al, 1991). Comparing lecturers across different disciplines and programmes is hence unreliable and violates all evaluation principles!

Though all universities and polytechnics across the world claim to work towards the development of analytical and critical problem-solving, the question of whether a particular course has stimulated a student to think seldom appears in the annual appraisal forms that I have reviewed. Evaluation should be based on programme or course objectives. We can measure the effectiveness of a course and the competency of a lecturer by assessing the achievement of the goals set for a programme or a course. Are we doing that?

IMPLICATIONS FOR PRACTICES AND CONCLUSION

Why are we making such a fuss over a simple exercise of getting students to rate their lecturers on five or six criteria? Why don't we allow the win-win situation to prevail? Lecturers give in to what the students want badly in order to get their degrees and in turn, lecturers get favourable ratings in their annual appraisal.
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But some soul-searching will remind any academic of his mission in teaching young undergraduates. Should we compromise our professional beliefs in exchange for the mirage image of a popular academic? Are we masquerading as mind-builders and national architects when we are just filling empty minds with facts?

The acid test of the quality of any university and its staff will be the competency and creativity of its graduates in the workforce. A degree will open the door to employment but the professional skills and the ability for adaptation and prompt problem-solving will determine how far these graduates can go.

I firmly believe that all lecturers share the noble ideals of developing up-right, intelligent, diligent, reflective and critical graduates. They would also generally like to spend time to understand and help their students. But time constraints and the pragmatic need for self-preservation and advancement may cause some to allow the ideals to take a back seat to their own immediate personal needs. No academic would like to be put on the carpet for getting a poor rating because he had tried too hard to get students to think and solve their own problems!

What can we do to turn the tide and make deep learners out of our undergraduates? Here are some suggestions to be considered:

- Resist students' plea for detailed notes.
- Resist students' plea for model answers to tutorial problems.
- Set thinking and applied questions in examinations and tests (NOT from tutorial exercises).
- Adopt an interactive/discussive approach in teaching.
- Allow time for students to seek clarification on difficult concepts.
- Be kind and patient but firm.
- Have a more flexible form of staff appraisal to suit the different disciplines.
- Make constructive use of students' feedback on course and course lecturers.

Rapport or compliance is a problem which permeates most universities and is a very complex issue. Whose responsibility is it to create the ethos to instil intellectual accountability in our undergraduates? This is especially critical for Singaporeans as human resource is our own source of power and wealth.

Bibliography

1  Biggs, J.B. (1987). *Student Approaches to Learning and Studying*. Melbourne: ACER.


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IMPACT OF METALEARNING INTERVENTION ON PROBLEM-SOLVING AND ACHIEVEMENT IN MATHEMATICS, SCIENCE AND SOCIAL STUDIES

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ABSTRACT

The study attempted to investigate whether Primary Five pupils can be taught metalearning strategies through Mathematics, Science and Social Studies. Two neighbourhood government primary schools with a similar social economic background participated in the study. One was randomly chosen to be the Experimental School and the other the Control School. The form teachers of the two classes in the Experimental school became the experimenting teachers. The chosen subjects were pre- and post tested on a set of 13 metalearning tasks. The Experimental pupils did significantly better in the metalearning tasks after ten weeks of exposure to metalearning strategies. Their performance in Mathematics, Science and Social Studies in the Final Examination showed apparent improvement over their mid-year scores, especially in Mathematics. Experimental pupils who were interviewed were unanimous in their preference for the teaching approach using metalearning strategies. They felt that they were made to think more as a result of the activities underscroing metalearning.

Keywords: primary pupils, metalearning, intervention, Mathematics, Science, Social Studies.

INTRODUCTION

Advances in cognitive science have encouraged educators to pay more attention to students' thinking and learning processes. Educators have come to realise that students will be better equipped for the future if they are good thinkers and effective learners. Learning in school is no longer regarded as merely the acquisition of facts.

The Singapore Education System has undergone changes over the years with the aim of producing citizens who are creative, adaptable and innovative in their outlook. Hence the new Singapore Primary Syllabus places a heavy emphasis on making every child a thinking learner.

In addition, there is increasing evidence to prove that academic underachievers exhibit metacognitive deficiencies at all levels of task performance. They are less adept at:

1) evaluating their ability to successfully undertake a task (Gerber and Hall, 1981); planning effective organisational schemes for approaching the task (Wong and Jones, 1982);
2) applying successful strategies (Gerber and Hall, 1981; Sullivan, 1978; Willows and Ryan, 1981); monitoring their progress or ongoing understanding of the task (Willows and Ryan, 1981; Wong and Jones, 1982);
3) identifying and correcting their errors or modifying their effort as they proceed (Garner and Reis, 1981; Wong and Jones, 1982) and evaluating their overall performance when finalised (Wong and Jones, 1982).

The above findings constitute evidence that for children to learn effectively, they need to be aware of their repertoire of cognitive skills and learning strategies, able to organise information, decide and select appropriate strategies, plan and sequence procedures, diagnose problems and mistakes and review results. However, little has been done in formal education to integrate the above metalearning skills with the teaching of classroom subjects, especially at the primary level.

There are not too many definitions of metalearning in the literature, in comparison to the numerous interpretations of metacognition. According to Biggs and Telfer (1987), when a student is aware of himself as an active agent in the process of learning, metacognition is said to have taken place. The student will be able to select the learning strategies to suit his motives and purposes. He will no longer be concerned with just WHAT to learn in order to achieve his educational goals. Once metacognitive strategies are part of his knowledge repertoire, he would be able to adopt or adapt and apply these strategies to any problem-solving situation beyond his school years. A metalearning activity includes the ability to:

1) estimate and monitor his competence in finishing a task;
2) plan and organise strategies to solve a problem;
3) select and apply appropriate strategies;
4) identify and correct his mistakes;
5) evaluate his overall performance on completing a task.

After careful examination of all documented discussions and definitions of metalearning, the Early Metalearning Research Team formulated the following definition of METALEARNING:

Metalearning involves the awareness of one's knowledge, understanding the requirement of the tasks, and the regulation and control of the processes in completing the tasks. The knowledge required in the solution of problems can be categorised into declarative knowledge (What), procedural knowledge (How), and situational knowledge (When). The regulation of processes in problem-solving includes selecting suitable strategies, planning and organising the sequence of steps in the solution, monitoring the on-going activity, setting the criteria of successful completion of the
tasks, viewing the progress of the tasks and making modifications when necessary. A very important characteristic of metacognition is the ability to transfer knowledge, skills and solutions to related situations (transituational).

The definition can be represented graphically in Figure 1.

Figure 1  A Model of Students' Metacognition Processes (Teh, 1993)

To address the issue of paucity of local information on teaching metacognition strategies to primary pupils, a two-year study on school-based instruction in metacognition was carried out by a group of NIE lecturers in collaboration with teachers in two neighbourhood government primary schools.

The study attempted to ascertain whether metacognitive skills can be taught to Primary Five pupils through lessons in Science, Mathematics and Social Studies.

Both Mathematics and Science subjects are examinable subjects in the PSLE while Social Studies is a non-examinable subject. It would be interesting to observe whether the status of a subject in an examination would elicit different teaching and learning reactions from the participants.

METHODOLOGY

In our study, we have used the direct methodology together with the interview technique to probe the presence of metacognition abilities in the pupils. In the use of direct methodology, the subject is actively engaged in a task. Concurrently or retrospectively he is asked to explain the principles employed and to report only on the strategies he has actually used to complete the task. The finalised metacognition test comprised 13 items. The items were chosen to test pupils on basic subject concepts, and the ability to plan, to reason, to hypothesise, to examine alternative solutions, to decide on suitable solutions and to check back on answers. The distribution of items is shown in Table 1.

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Table 1  Distribution of Items According to Subject

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>NO. OF ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>6</td>
</tr>
<tr>
<td>Science</td>
<td>4</td>
</tr>
<tr>
<td>Social Studies</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
</tr>
</tbody>
</table>

The choice of Mathematics and Science as intervention subjects would be quite obvious. Opportunities for problem-solving, analysis, hypothesis formulation abound in the two subjects.

Based on the interviews with teachers, project members were divided into two teams to work on the intervention metacognition strategies.

One team dealt with Mathematics and Science metacognition strategies, while the other team focused on Social Studies.

Both teams worked with the two experimenting teachers separately on the metacognition strategies for each target subject. For Mathematics, the following metacognition strategies were identified:

1) Instructing pupils to define problems in their own ways.
2) Showing pupils how to identify patterns or cues to solutions to problems.
3) Using questioning techniques to encourage pupils to think aloud in planning steps to problem solving and to get alternative solutions to problems.
4) Getting pupils to check their own answers and to correct their own mistakes.

The Science metacognition strategies recommended were:

1) Using advance organisers or concept maps to introduce and develop lessons, to link related concepts, and to summarise lessons;
2) Encouraging pupils to ask operational questions;
3) Using predicting questions to stimulate thinking and to promote application, analysis and synthesis;
4) Using a reflective technique to monitor pupils' understanding and to get alternative solutions to problems.

In the case of Social Studies, the experimenting teachers were advised to use metacognition processes like
1) generating questions and formulating hypotheses on an identified issue or problem;  
2) gathering and grouping relevant data to facilitate the drawing of conclusions;  
3) using maps to think through and structure related key concepts;  
4) comparing and contrasting data and alternatives;  
5) consciously choosing a solution and evaluating its effectiveness in the given context;  
6) summarising and concluding a particular subject.

The teachers were given reading materials on the suggested strategies and encouraged to implement the strategies one week before the commencement of the intervention. Project members met with the experimenting teachers to ascertain whether they had understood the metacognitive strategies recommended. It was heartening to find that the teachers had actually tried out some of the strategies such as concept mapping with their pupils. The outcomes were promising.

INTERVENTION

Two neighbourhood government primary schools were invited to participate in the Project. The principals and teachers were enthusiastic and cooperative. More importantly, the sample of pupils was representative of the Singapore primary pupil population as a whole. Hence findings could be justifiably generalised.

The selected Level was Primary 5 as pupils were not pressurised by major examinations and were also mature enough to respond to one-to-one testing and interview.

Table 2 Design of Study

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>TREATING CLASSES</th>
<th>ASSESSMENT</th>
</tr>
</thead>
</table>
| School X | Control | 1. Pre-test on Metalearning task  
2. Post-test on Metalearning task  
3. School Mid-year examination  
4. School final examination |
| School Y | Intervention in Mathematics, Science and Social Studies by teachers for 10 weeks | 1. Pre-test on Metalearning task  
2. Post-test on Metalearning task  
3. School Mid-year examination  
4. School final examination |

The intervention spanned the last five weeks of Term 2 and the first five weeks of Term 3. During the intervention period, the classes undergoing intervention were observed by project members to monitor pupils' responses to and use of metacognitive strategies.

RESULTS AND DISCUSSION

Comparison between Experimental and Control Groups

Table 3 shows that the Control subjects did better than the Experimental subjects at the Metalearning Pre-test (C=78.28; E=64.75). The difference is statistically significant at the .003 level. After 10 weeks of Metalearning Intervention, the subjects were tested again on the same items. While the Control Group regressed from 78.28 (Pretest) to 73.09, the Experimental Group showed impressive improvement, from the pretest score of 64.75 to the Posttest score of 99.18 (Maximum = 177). The difference between the Posttest scores is statistically significant at the .0001 level (Table 4). A t-test was further carried out on the differences between the Metalearning Pretest and Posttest mean scores of the Experimental and Control Groups (Table 5). Predictably, the difference (t=7.07) is significant at the 0.0001 level. These preliminary findings seem to indicate that the Metalearning Intervention has generally helped the Experimental Subjects in bettering their performance on the Metalearning tasks.

Table 3 Comparison of Metalearning Pretest scores between Experimental and Control Subjects

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>44</td>
<td>64.75</td>
<td>2.6</td>
<td>-3.86</td>
<td>.003</td>
</tr>
<tr>
<td>Control</td>
<td>21</td>
<td>78.28</td>
<td>2.2</td>
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Table 4 Comparison of Metalearning Posttest scores between Experimental and Control Subjects

<table>
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<th>SCHOOL</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
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</thead>
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<tr>
<td>Experimental</td>
<td>44</td>
<td>99.18</td>
<td>14.05</td>
<td>5.70</td>
<td>.0001</td>
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<tr>
<td>Control</td>
<td>21</td>
<td>73.09</td>
<td>21.88</td>
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</table>

Table 5 T-Test on Difference between Metalearning Pretest and Posttest Mean Scores of Experimental and Control Subjects

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>N</th>
<th>Mean</th>
<th>t</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>44</td>
<td>34.43</td>
<td>7.0666</td>
<td>0.0001</td>
</tr>
<tr>
<td>Control</td>
<td>21</td>
<td>-5.19</td>
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</table>
A Two-Way Anova with a repeated measure was carried out to test the hypotheses for between subject effects (Table 6). The result shows that the time lapses between the Pre- and Posttests did not contribute to the variance in the Posttest results between the Experimental and Control Groups ($F=1.26$, $p=0.076$).

The Two-Way Anova to test within subject effects reveals that significant changes took place within the two groups over time between the two task administrations (Table 7). The $F$-value of 71.51 for Time (within Subject Effects) is significant at the 0.0001 level. A statistically significant interaction between Time and School is also evident ($F=52.48$, $p<0.0001$). Fig 2 will further illustrate the Time and School interaction. Fig 2 clearly shows that the Experimental Group improved with time while the Control Group regressed after 10 weeks.

### Table 6 Two-Way Anova with a REPEATED Measure to test Hypotheses for between Subject Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>F-Value</th>
<th>$p$</th>
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<tbody>
<tr>
<td>School</td>
<td>1</td>
<td>3.26</td>
<td>0.076</td>
</tr>
<tr>
<td>Error</td>
<td>63</td>
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<td></td>
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</table>

### Table 7 Two-Way Anova with a REPEATED Measure to test Hypotheses for within Subject Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>F-Value</th>
<th>$p$</th>
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</thead>
<tbody>
<tr>
<td>Time</td>
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<td>71.51</td>
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<tr>
<td>Time &amp; School</td>
<td>1</td>
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</tr>
<tr>
<td>Error</td>
<td>63</td>
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<td></td>
</tr>
</tbody>
</table>

Figure 2 Interaction between Time and School (Refer to Table 1 and 2)

It is evident that the experimental subjects in both classes improved in their Posttest performances on the Science and Mathematics tasks. Not only were they able to suggest more alternative methods in solving the problems at the posttest, they were also better able to decide on the relative effectiveness of the different solutions and give justifications for their choice of a better solution. The better class had an edge over the weaker class in terms of their Mathematics scores. However, the weaker class appeared to perform better on the Social Studies tasks. Pupils scored better on tasks based on familiar topics like Fish in Tank (Task 1), Squares and Triangles (Task 4), Metal Containers (Task 7) and Dog on Leash (Task 10). Non-routine tasks like Rusting Nails (Task 2), Water Displacement (Task 5) and Birthday Quiz (Task 8) did not elicit answers as good as those for the more familiar topics. While the improvement in posttest scores for Task 2 and Task 5 is considerable, there is no evidence of a breakthrough for Task 8. Task 8 requires the pupils to solve the problem-solving to start with a hypothesis on the possible date of the birthday. Unfortunately, hypothesis testing is not a very common strategy taught to pupils in the primary classes. Results for the Social Studies tasks are rather erratic and perplexing. These are signs of regression in some sub-items. Social Studies being a non-examinable subject has not been given the same amount of attention during the intervention as Mathematics and Science.

The Mid-Year and Final examination scores of English, Mathematics, Science and Social Studies of the Experimental and Control classes are presented in Table 3.7. As the number of subjects in each class is very small, no t-tests were carried out as the values would not be stable.

As English was not a target for intervention, the scores were recorded as language is considered an important factor in cognitive processing. There is evidence of improvement in the English scores for the experimental subjects, though not exceptionally high ($r^2=1.5$; $r^2=8.3$). The Science results are not exceptional. $r^2$ has only advanced in the final examination by 0.5 mark while $r^2$ actually fell by 5.3 marks. A simple explanation is that the cognitive demands of the tasks in the examinations were quite different from the metalearning tasks. While the intervention focused on cognitive processes and concept linkages and reasoning skills, Primary Science items are largely recall comprehension items. There is no need for subjects to use their newly acquired skills on organisation and concept-mapping.

Both experimental classes showed impressive improvement in their Final Examination for Mathematics ($r^2=15.9$; $r^2=19.2$). This is very encouraging after the disappointment in the Science scores. After some reflection on the observations made of Mathematics lessons, it is quite clear that the Metalearning Strategies taught to subjects could easily be used during their daily classwork and examinations. Pattern identification is one metalearning strategy which could be transferred to any Mathematical topic and situation. Seeking alternative solutions to a problem also has helped pupils to explore more effective ways of reaching a solution. All these have contributed to fostering metalearning skills in mathematical problem-solving. The Social Studies scores are quite respectable but the experimenters do not want to attribute the better results to the benefits of metalearning strategies. There was no conscious effort to work on the subject.
These skills were used none too frequently during class Mathematics, Science and Social Studies lessons. Concept-mapping was attempted by the pupils in class but they did not use this strategy in their own studies or revision. The assessment mode determines the use or neglect of any strategy. If most assessment items tested recall of facts, then the new metalearning skills learned would not be reflected in their achievement scores. Despite some improvement shown in the Science metalearning tasks after the intervention, the Science Final Examination results were not exciting. These was obviously a mismatch between the cognitive demands of the two sets of assessment.

The experimenters confessed that not much was attempted during the Social Studies lessons as the subject is non-examinable. This neglect was reflected in the poor Social Studies metalearning scores at the posttest. There was even a decline in the scores for the better experimental class though the pupils did quite well in the school Final Examination. The cognitive demands of the metalearning tasks were high, requiring decision-making, the formulation of hypotheses and justification of choice. There were skills not introduced and not required during their class lesson and school examination.

Though the results for Science and Social Studies were not satisfactory, they provided evidence and proof that primary pupils need to be exposed to metalearning strategies and the opportunities to practise the strategies during class and examinations. It is futile to teach children cognitive skills which will not be required of them during lessons, revisions and examinations. Children are examination cue-conscious and will only learn what is expected of and demanded from them.

CONCLUSION

The results are very encouraging to the experimenters and Project members. There is a strong indication that upper primary pupils can benefit from metalearning strategies taught to them through the curriculum subjects in school. But the strength of the impact depends very much on the frequency of usage during class activities.

Mathematics lessons naturally affect many opportunities for alternative solutions, justification of steps taken in problemsolving, generation of related problems, hypothesis formulation, pattern identification, identification of clues to problemsolving. Hence the posttest results for the Mathematics metalearning tasks as well the Mathematics Final Examination Scores were very impressive. Even then, the non-introduction of hypothesis formulation and testing by the experimenting teachers has shown up in Task 8 which requires pupils to formulate a hypothesis on the birth date. Pupils did not perform well at both the pretest and posttest on Task 8.

Extra effort has to be put into Science lessons to get pupils to practise the metalearning strategies taught. The range of metalearning skills for Science is very comprehensive but teachers would have to spend time to plan the integration of such skills into the lesson. The temptation to get through the facts of a lesson without getting pupils to relate, reflect and analyse is very strong. Skilful questioning, requiring pupils to relate previous knowledge to new information and posing a prediction questions, would challenge pupils to think.

Table 8

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</table>

M = Mid-Year
F = Final

The results are very encouraging to the experimenters and Project members. There is a strong indication that upper primary pupils can benefit from metalearning strategies taught to them through the curriculum subjects in school. But the strength of the impact depends very much on the frequency of usage during class activities.

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BIBLIOGRAPHY

TRIALS AND TRIBULATIONS OF EXPERIMENTERS
IN THE METALEARNING INTERVENTION STUDY

by

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ABSTRACT

The experimenters took some time to get acquainted with the
metalearning strategies and integrate them into their teaching.
Pupils found concept-mapping most helpful in the learning of
science. In Mathematics, the checking of answers, self-
questioning techniques and setting problem sums were found to be
most useful and enjoyable. There was less time for Social
Studies and the experimenters were not too confident about the
strategies. Hence pupils only responded well to questioning
techniques. The experimenters felt that metalearning strategies
should be taught to Primary pupils as early as Primary 3 or
Primary 4. Time constraint was the greatest setback in the
intervention.

Keywords: Primary pupils, metalearning, Mathematics, Science,
Social Studies, concept-mapping, self-questioning techniques
answer-checking, problem sum setting.

INTRODUCTION

The paper is presented in a dialogue format. Questions were
posed to the experimenters and their answers were then recorded.
Their answers will reflect the anxiety and apprehension
experienced during the initial period of the intervention. Most
importantly, they have identified the strategies which have
worked well with their pupils.

Presented below are the experimenters’ responses to the
feedback questions posed to them at the end of the intervention
study.

TRIALS AND TRIBULATIONS

Q1. What are some of the problems encountered in learning the
new metalearning strategies before the intervention?

A1. At the start of the experiment, various terms used, such as
metalearning, concept maps etc. sounded rather foreign to
us and we were rather apprehensive about it.

Q2. What are some of the problems encountered in integrating
the metalearning strategies into the lesson?

A2. In Mathematics and Science, it was easier to understand the
various strategies and to try to integrate into our
teaching. It was much harder to implement the strategies
in Social Studies as we were not too clear as to what and
how we should go about it. We felt as if we were groping
in the dark.

Q3. Do you have to reorientate yourself in your approach to
teaching Mathematics, Science and Social Studies to
accommodate the new strategies?

A3. Definitely.

Q4. Do your pupils respond well to the strategies? In all
subjects? Some subjects?

A4. Pupils enjoy concept mapping and they find it useful in
learning science. In Mathematics, they enjoy self-
questioning technique and the checking of their work. The
better class enjoys writing problem sums. In Social
Studies, we were not too clear about the strategies, hence
resulting in pupils responding well to questioning
techniques only.

Q5. What strategies do you find most relevant in the teaching
of Mathematics, Science and Social Studies? Give reasons
for the strategies useful for each subject?

A5. In Science, concept mapping was the most useful strategy.
It helps the pupils to visualize and link up all the
concepts as a whole under a particular topic. In
Mathematics, the checking of their answers enables pupils
to correct themselves and to gain confidence in working out
Mathematics problems. They were able to tackle problems in
a logical manner once they grasp the self-questioning
technique - which step they must work out before arriving
at the required answer. For the better class, they find
the writing of the problem sums very useful - "I can set
the questions, I can solve them". It helps them to
understand the questions better.

Q6. Mathematics seems to benefit most from the intervention.
Why? Social Studies benefits the least. Why?

A6. Mathematics is an examination subject whereas Social
Studies is non-examination. There is more time for
Mathematics and hence pupils are exposed to strategies for
a longer period than for Social Studies. Mathematics
results are measurable whereas Social Studies is rather
subjective.
Q7. At what level should the metalearning strategies be introduced to pupils to stimulate their thinking and develop their problem-solving skills?

A7. As early as P3 or P4.

Q8. Should in-service training be conducted for primary teachers to initiate them into the art of developing metalearning skills in their pupils?

A8. Yes, proper training should be given.

Q9. What are your greatest fears in carrying out the intervention?

A9. Time constraint was the greatest fear. The pupils' responses to the various strategies, as well as the many observations add to our fear.

Q10. What have you found out about yourself and your pupils during the intervention?

A10. We have so much more to learn about the strategies in Metalearning and how to integrate into our teaching. The pupils have mixed reactions to the implemented strategies - some enjoy working in groups and some do not.