



# REVIEW

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Learning &  
Growing  
Through  
Projects

ASSOCIATION FOR SUPERVISION AND  
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## **A Call for Articles...**

### **The ASCD (Singapore) REVIEW Committee seeks original articles on teaching and learning...**

Manuscripts should be between 2000-2500 words, typewritten (Microsoft Word document) and submitted in the form of a hard copy together with a 3½ inch diskette. Submissions may also be done via e-mail. Photographs would be appreciated. These visuals may also be e-mailed as jpg files. Contributions by regular mail may be addressed to:

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The themes for the forthcoming issues are:

**Vol. 11 No. 1: Helping the Underachievers**

Deadline for articles: 31<sup>st</sup> March 2002

**Vol. 11 No. 2: Beyond Class Time: Educating Citizens of Tomorrow**

Deadline for articles: 31<sup>st</sup> April 2002

This issue puts the focus on **Project Work**. Some of the articles specifically deal with how the students (in Nan Hua Primary, Crescent Girls' Secondary and Upper Serangoon Secondary) have been guided while working on projects, others discuss related issues like e-education and learning styles, as well as inter-disciplinary work as exemplified by EMAS, for pupils and teachers in Northland Primary. For the first time, we also feature two articles simultaneously presenting the perspectives of River Valley High and Bedok Town Secondary – the two schools involved in a joint e-tutoring project. Anderson Junior College shares with REVIEW readers some of the innovative projects that have been initiated by the Current Affairs Society.

As events unfold over the past year, educators and education policy makers worldwide have begun to ask with greater urgency – What do we teach our children about these events? How do we help to prepare them for the world of tomorrow? Are the three 'R's enough? Are our classrooms equipped to help our children deal with a fast changing world and yet keep them firmly grounded in their humanity? As we wholeheartedly embrace the bio-sciences and look to the next millennium, are we leaving anyone behind... The forthcoming issues will explore the themes of **Helping the Underachievers** (Vol.11 No 1) and **Beyond Class Time: Educating Citizens of Tomorrow** (Vol.11 No 2). We encourage all educators, locally and abroad, to share with REVIEW readers whatever thoughts and ideas they may have on these two themes. We hope to hear from you soon.

**Soo Kim Bee**  
Editor

# Learning & Growing Through Projects

Vol. 10 No. 3

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# Storyline Approach to Project Work: The Nan Hua Primary School Experience

Lee Mei Lien and Alicia Lim Ching May

## *The Storyline Method*

Early this year, the Ministry of Education, Project Work Unit organized a three-day Storyline Workshop. The speaker was Mr Steve Bell from Scotland. The workshop was fun and elucidating. It fired our enthusiasm to try out the approach with our respective classes. Three Primary Four classes in Nan Hua Primary School successfully used the Storyline Method in carrying out Project Work this year.

What is the Storyline Method? The Storyline Method is an innovative approach to curriculum integration. It creates a context for curriculum linkage and active learning. The essential elements of a Storyline are the place or setting, the time, the characters and problems to solve. Working in groups, pupils create and design their own settings and characters. They give their own characters personalities. Following this, they discuss and plan their stories based on the settings and characters. The unfolding narrative provides structure and logic to curricular connections. Different subjects like English, Mathematics, Music and Art can all come into play. The teacher asks key questions at appropriate stages and pupils learn by constructing their own knowledge. In addition, apart from the process of activity, reflection is also incorporated. Pupils learn to think for themselves and refine and extend their work

and skills. Basically, the Storyline Method creates a context for learning with the active involvement of pupils. It provides tasks that arise from the context that pupils see as significant and meaningful, giving pupils the opportunity to develop understanding and skills with the support of context.

What is the methodology? Children's prior knowledge and experience are tapped. Through action, discussion and experience, learners construct their own meaning. The Storyline creates a context for learning, making pupils' learning exciting and meaningful. Pupils are motivated and on task.



*Creating the setting and characters.*

Why does the Storyline Method make sense? It provides a process that meaningfully integrates curriculum. Sound learning theory and effective teaching strategies result in a user-friendly teaching model. Children find collaborative story-making exciting and challenging. Watching their own story unfold in visual form around the classroom, pupils feel a great sense of pride and achievement. The level of involvement and sense of ownership felt by pupils encourage them to take greater responsibility for their own learning.

Common features of the Storyline Method and Project Work include knowledge application, collaboration, communication, independent learning and learning through questioning. The Storyline Method was found to be complimentary to Project Work.

### **Implementation of the Storyline Method**

The theme that was chosen was 'Our Neighbourhood'. This particular theme was chosen because of curriculum linkages and the ease by which various subjects could be integrated. The inter-disciplinary nature of project work was clearly evident as pupils drew on their knowledge of various subjects. The table below summarises the subjects that were integrated into the project work.

#### **Inter-disciplinary Project Work**

##### **Art**

- create settings
- create characters

##### **English**

- write jingles
- write 'A Day in the Life of ...'
- make a storybook

##### **Mathematics**

- measure heights of characters

##### **Social Studies**

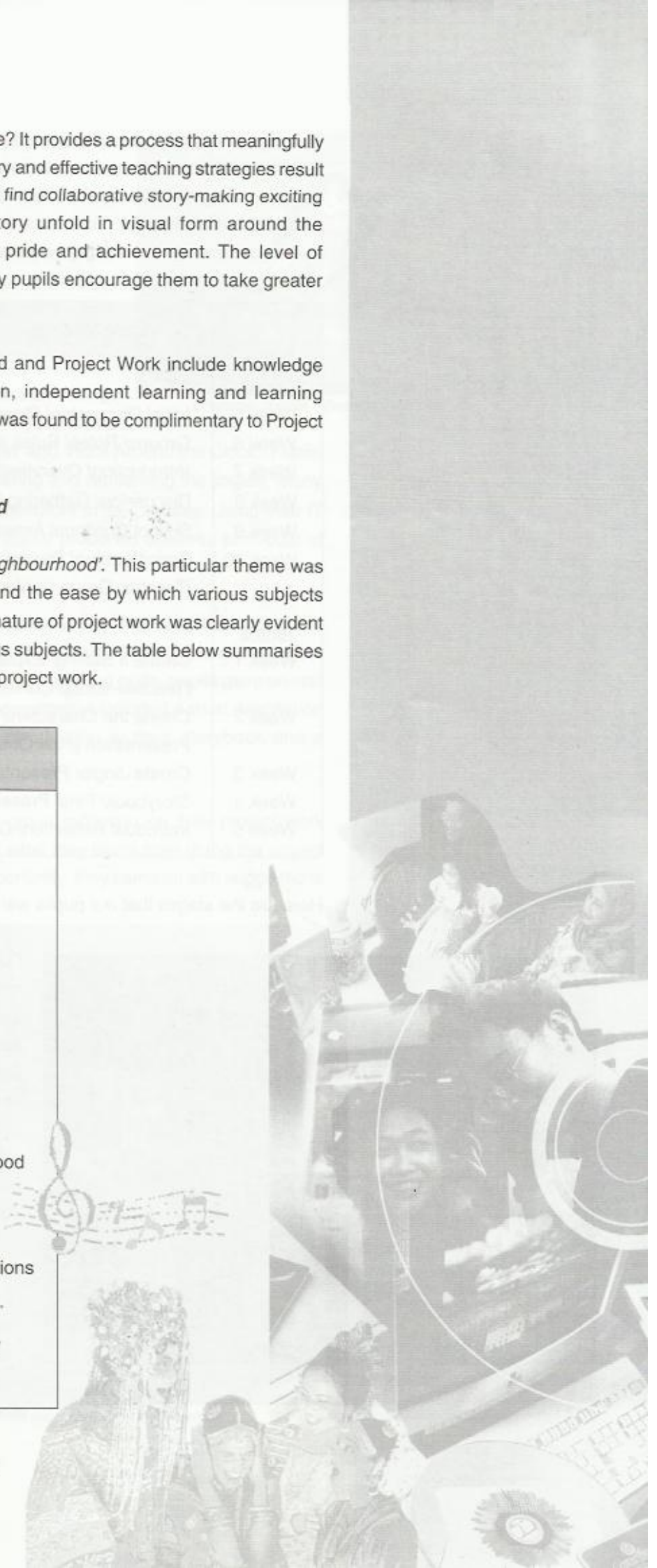
- apply knowledge of neighbourhood
- mapping skills

##### **Music**

- sing and present jingles with actions

##### **National Education**

- different races in our community
- harmonious living





The project work sessions were carried out on a weekly basis for a total of ten weeks. The first session was conducted during the fifth week of Term 1 and the last session during the fifth week of Term 2. Two to three periods of curriculum time were utilised each week. To ensure equity, all sessions were conducted during curriculum time. A schedule was drawn up as follows.

<i>Schedule for Project Work</i>	
<u>Term 1</u>	
Week 5	Initial Discussion/ Planning
Week 6	Groups/ Roles/ Rules and Expectations
Week 7	Introduction/ Overview/ Schedule
Week 8	Discussion/ Gathering Information
Week 9	School Continual Assessment 1
Week 10	Brainstorming/ Designs and Plans (Neighbourhood)/ Drafts [Teacher-Group Conferencing]
<u>Term 2</u>	
Week 1	Create a Setting/ Explanatory Brief/ Neighbourhood Plan [Teacher-Group Conferencing]
Week 2	Create the Characters/ Scale & Measurement/ Biography/ Presentation [First Observation]
Week 3	Create Jingle/ Presentation [Second Observation]
Week 4	Storybook/ Final Presentation (High Point) [Third Observation]
Week 5	Individual Reflection/ Group Reflection/ Overall Discussion

Here are the stages that our pupils went through:



*A completed setting – A Flower Shop.*

Pupils brainstormed in their respective groups and decided on a setting. Settings chosen included a flower shop, a hair salon, a neighbourhood police post, a fire station, a bakery and others. Thereafter, pupils designed and created their own settings and characters using to express their creativity and artistic talent. Pupils gave each character a personality and created biography cards for their own character.

The various groups were given the opportunity to present their setting and characters to the rest of the class. This was necessary to enable pupils to incorporate various settings and characters into their group stories at a later stage. Upon completion of their group stories,



pupils made miniature storybooks complete with illustrations. They were proud and happy to be the authors and illustrators of their original work.

Pupils also drew up appropriate neighbourhood plans using their map-reading skills learnt in Social Studies. They also used their mathematical knowledge in scale and measurement to gauge the height of their characters.

Pupils composed their own jingles to promote their setting. They came up with lyrics and actions set to familiar tunes like 'London Bridge', 'Popeye the Sailor Man' and 'Rock Around the Clock'. Pupils enjoyed themselves tremendously in preparing and rehearsing the jingles. Many pupils displayed leadership qualities and teamwork in the process. Using their IT skills in Microsoft Word and PowerPoint, pupils produced colourful print-outs of their jingles.

The entire process culminated in a final presentation that was viewed by the principal, vice-principal, supervisor and teacher-in-charge. Two officers of the Project Work Unit were also present. With much excitement and pride, pupils gave an oral presentation to show off their efforts. The presentation included a short description of their setting and characters, a brief introduction to their storybook and a performance of their well-rehearsed jingle.

Finally, pupils engaged in individual and group reflection on their project work experience. They were able to write about what they learnt from doing the project and what subjects were involved. More importantly, they came up with suggestions on what they might do differently the next time.

### ***Benefits of the Storyline Method in Project Work***

Upon careful reflection, adopting the Storyline Method was indeed beneficial to the whole project work experience in several ways. Firstly, it provided a process that meaningfully integrated various subjects in the curriculum. This is in line with the inter-disciplinary nature of project work.

Secondly, the experience of collaborative story-making was a great motivating factor for all the pupils involved. The pupils enjoyed creating




*Character puppet – Susie, a schoolgirl.*



*Final presentation by the "Firemen".*





their very own settings and characters. In addition they were presented with the opportunity to watch the entire project unfold as they worked towards fostering greater interaction

Thirdly, as the stories the pupils created unfolded, they were also able to see their ideas appearing in visual form around the classroom as seen in the puppets and settings that they made.

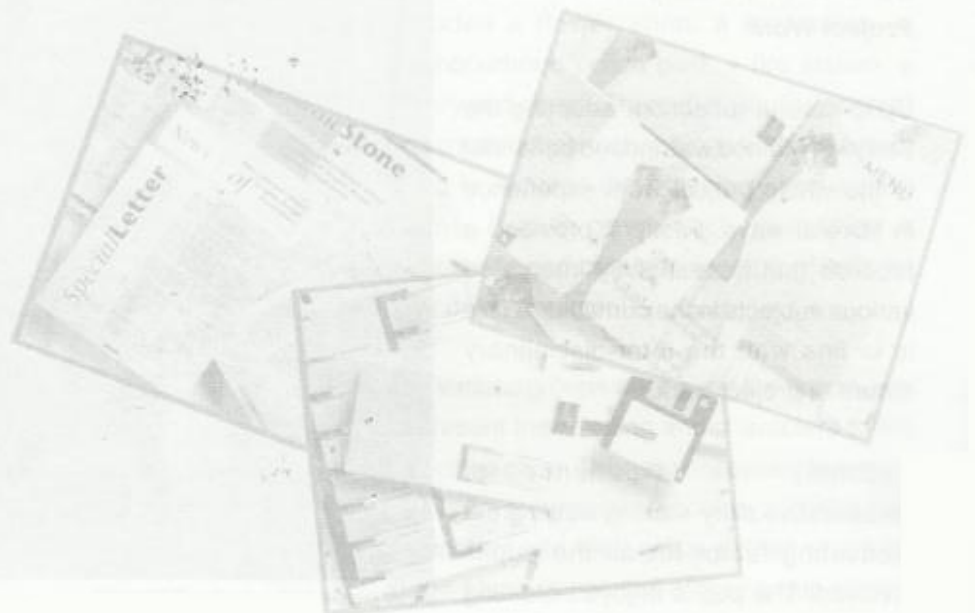
Lastly, all pupils in the three classes achieved a satisfactory level of involvement and a great sense of ownership over the products. Even from the very early stages, pupils were provided with necessary feedback on their co-operative and collaborative skills. This made them more aware of the need to work as a team. This is indeed a useful life skill that can be learnt through the project work experience. By the end of ten weeks, it was clearly evident that pupils had developed a sense of pride in their roles and tasks. This corresponds to the feature of project work which focuses on process rather than product.

In conclusion, the objectives of project work were met using the Storyline Method. Collaborative learning enabled pupils to improve their interpersonal skills. Self-directed inquiry provided pupils with the motivation to learn and helped them gain confidence and self-esteem. Pupils acquired creative and critical thinking skills, communication skills and a passion for lifelong learning. Best of all, the entire process was fun and engaging for one and all.

### References

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**Lee Mei Lien and Alicia Lim Ching May** are currently rounding off their second year of teaching at Nan Hua Primary School.



# Project Work using Problem-based Learning Approach in Crescent Girls' School

Neo Hee Swee and Ho Geok Lan

*This article shares how project work using the problem-based learning (PBL) approach was implemented at Crescent Girls' School. It was carried out with all the lower secondary students with teachers serving as mentors, resource personnel and assessors. The article describes how the school designed and implemented the different stages to facilitate the smooth implementation of the project and to foster collaboration amongst students. Useful tools and strategies on how to monitor students' progress and follow-up actions by supervising teachers are also illustrated.*

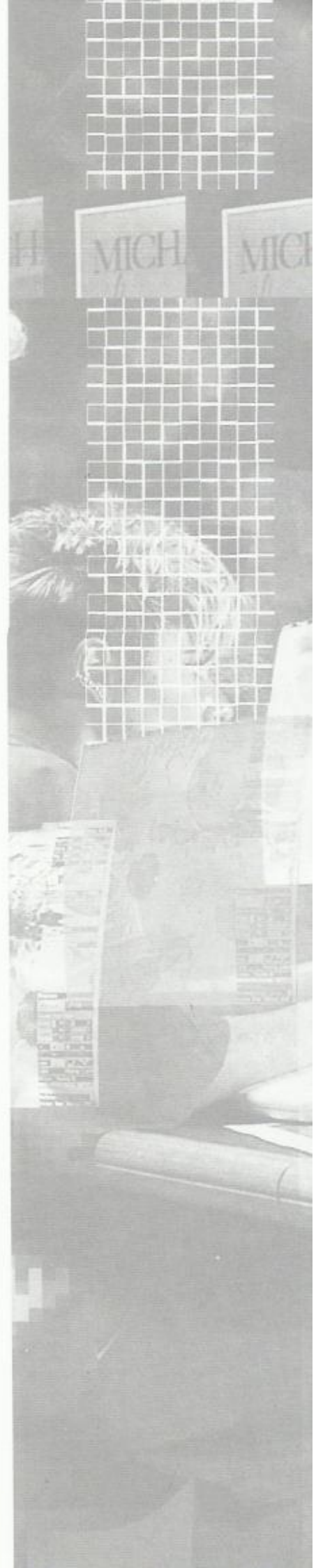
## Introduction

Crescent Girls' School has implemented inter-disciplinary project work for its students since 1997. In 2001, the school incorporated the problem-based learning (PBL) approach in its project and reaped positive benefits from the experience. The PBL approach involved structured teaching that started with a simulation of a real-life situation. Students were put into small groups to tackle the problem that arose from the situation. The use of a real-life situation engaged the learner and facilitated identifying and solving the problems in relation to the situation. Students were required to generate their own approaches for problem definition, information gathering and processing, and communicating ideas with others. In the process, students became self-directed and independent learners, acquiring lifelong learning, communication, critical thinking and decision making skills.

## Implementation

### (A) Pre-project Phase

Before the implementation of project work, several issues needed to be resolved to ensure the smooth running and effectiveness of the whole process. The involvement of the teachers and the support of the school administration were critical in deciding the key approaches to adopt. Table 1 reflects the planning and preparation involved in the pre-implementation phase for the project to be implemented in 2001.





**Table 1: Pre-project phase – Planning and Organising Project Work**

Time-frame	Activities
Nov 2000	<p>Resolving the issues on implementation of PBL into curriculum:</p> <p><b>Which groups/levels of students are to be involved?</b></p> <ul style="list-style-type: none"> <li>– All lower secondary students</li> </ul> <p><b>Which group of teachers is to be involved?</b></p> <ul style="list-style-type: none"> <li>– Appoint two PBL co-ordinators to oversee the implementation of the project.</li> <li>– All lower secondary teachers would be mentor teachers.</li> <li>– Different department teachers would serve as resource teachers.</li> </ul> <p><b>What types of training do students and teachers need?</b></p> <ul style="list-style-type: none"> <li>– Do research from the internet and attend conference on PBL.</li> <li>– Identify the core skills needed for students and teachers.</li> </ul> <p><b>What changes in the timetable need to be made to incorporate training for students and teachers and for consultation?</b></p> <ul style="list-style-type: none"> <li>– Set aside 2 periods of project work lessons into time-table every week for a total of 12 weeks from Jan 2001 – May 2001.</li> </ul>
Dec 2000	<p>Two PBL co-ordinators to attend conference on PBL.</p> <p>Preparation of training workshop for teachers.</p>
Jan 2001	<p>School-based workshop on Project Work implementation for teachers by mentors and resource teachers.</p> <p>Preparation of resources for training by PBL Co-ordinators, mentor and resource teachers</p>

**(B) Project Phase**

The activities planned by the mentor and resource teachers were carried out during the double periods set aside for project work lessons. All the lower secondary students were gathered once a week in the auditorium for their training as well as for the mentor teachers to monitor the progress of students in their class. The students were guided towards the completion of their project by following a given schedule with their mentor and resource teachers. Table 2 summarises the activities carried out for the project work over a period of eight months.

**Table 2 : Project phase – Implementing and monitoring project work**

Time-frame	Lesson	Activities conducted by <i>teachers*</i> during Project Work Lessons	Student Progress
Jan 2001	1	Briefing for students to: • Explain rationale and aim of project work • Inform of the schedule and deadline for project • Emphasise the importance of teamwork	• Students form groups and take on roles • Team building • Draw learning contract
	2	• Stages of project work – PBL approach • Keeping a Project File • Showcasing projects from 2000 and 1999 cohort of students	• Start group project file • Brainstorm problem ideas
	3	• Meeting the Problem • Identifying learning issues and objectives	• Clarify and define problem focus • Refine problem statement • Identify learning objectives
Feb 2001	4	• Identifying learning issues and objectives • Keeping a Project Journal	• Validate problem and learning issues with mentor teachers
	5	• Webpages Designing • Research skills	• List possible sources of information • Plan schedule • Allocate duties among members
	6	• Solution Proposal • Project Planner	• Gather and process information • Teach, share and discuss content researched on • Feedback on teaching and sharing sessions • Reflect on the learning process
	7	• Conducting a survey / interview	• Consult mentor or resource teachers • Conduct surveys / interviews
Mar 2001	8	• Designing an Experiment	• Prepare solution proposal • Prepare Webpages
	9	• Statistical Tools	• Use statistical tools to analyse results
	10	• Evaluating Solutions	• Evaluate solutions and refine project
Apr 2001	11	• Writing a Report	• Begin writing the report • Reflect on the learning process
	12	• Preparing PowerPoint Presentation • Writing bibliography and Acknowledgement	• Prepare oral and PowerPoint presentation • Reflect on the learning process
May-Jun 2001	–	Teacher consultations	• Students work on final report and presentation
Jul 2001	–	–	• Submit report
Jul-Aug 2001	–	–	• Assess presentations

*\*Teachers involved are the PW coordinators, mentor and resource teachers.*



### **(C) Post-project Phase – Assessment**

After the students had submitted their projects in July, the mentor and resource teachers assessed the projects. Two weeks of the curriculum time were allocated for project work assessment. The students presented their projects orally using PowerPoint presentation in the morning and content assessment in the form of Webpages, in the afternoon. Other aspects of assessment included teacher observation, peer evaluation and IT skills were covered by the mentor, resource and IT teachers.

The assessment of the project work consists of six different components. It encompassed both the team and individual contributions. Table 3 shows a summary of the tools used for the assessment of students' project work.

**Table 3: Assessment of project work**

	<b>Component</b>	<b>Purpose</b>	<b>Assessor</b>
1	Webpages content (Team contribution)	Teachers assessed the content and problem-solving process of each group.	Mentor and resource teachers
2	Webpages design and layout (Team contribution)	Teachers assessed the creativity and IT skills of the Webpages design and layout.	IT teachers
3	Oral and PowerPoint presentations (Team contribution)	Teachers assessed the oral and PowerPoint presentations done by each group.	Mentor and resource teachers
4	Teacher observation (Individual contribution)	Mentor teacher observed the interactions and contributions by each student in a group.	Mentor teacher
5	Performance (Individual contribution)	This comprises student attendance and peer evaluation within each group.	Group
6	Teach/Share Feedback (Individual contribution)	This is the feedback given by members in each group during every Teach/Share session.	Group

When the assessment was completed, mentor teachers selected the best projects for uploading onto the school website ([www.crescent.edu.sg](http://www.crescent.edu.sg)) as part of the school's e-lesson gallery. All the teachers involved in the project assisted in the vetting and refining of these projects.

### **Monitoring Students' Progress**

A key determinant in ensuring the success of the implementation of project work is the use of effective strategies in monitoring of the students' progress over the eight months. The teachers used a number of tools to monitor students' progress in the project work. Some examples are given on the following page:

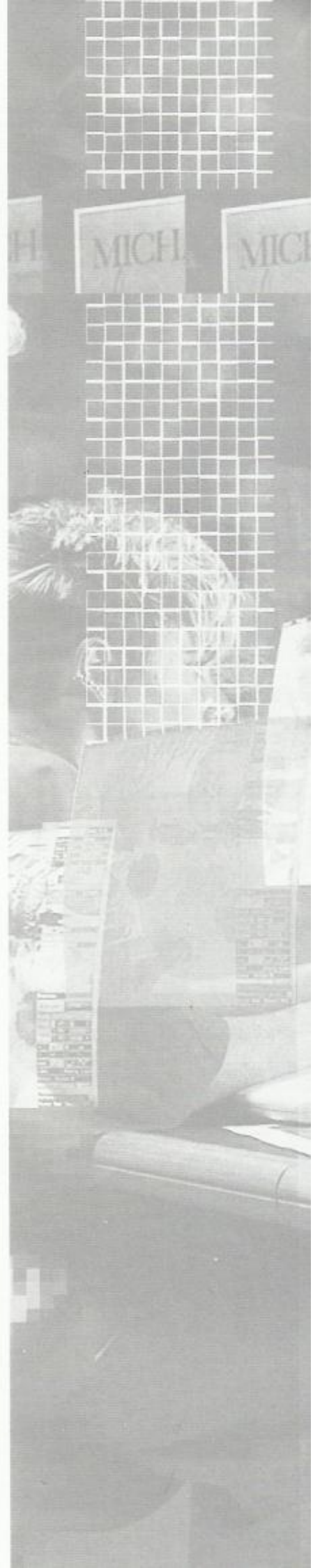
- a. **Learning contract** – Each group drew a learning contract where they set expectations and agreed upon the desirable behaviours by each member in the group.
- b. **Schedule of CCA/Remedial** – Each student in the group filled up the schedule of their CCA, remedial lessons or any other activities so that they could arrange their meeting time without clashes.
- c. **Project planner** – This helped them to manage their time and planned their project so that they could complete in time.
- d. **Record of meetings and consultation sessions** – This gave an account for the student attendance and recorded what the students had covered during consultation sessions.
- e. **Solution proposal** – This guided the students in the problem solving process and allowed the mentor teacher to give advice on their project before embarking on the actual project.
- f. **Individual Teach/Share form** – This provided feedback for each student in terms of her research and presentation skills. It was used as part of the individual assessment.
- g. **Individual project journals** – Each student kept records of her learning processes and reflections.

### **Review**

After completion of the project work, surveys were administered to the students and teachers to gather feedback. Problems encountered were addressed and suggestions to improve on the processes were taken seriously. The teachers found it satisfying that their students had benefited from doing the project work using the PBL approach. 92% of the students agreed that it encouraged them to think critically and creatively. 85% of the students learnt new knowledge and ideas to solve problems. They also found that it was meaningful and interesting to use the PBL approach in carrying out their project.

### **Conclusion**

Implementing project work was a challenging experience for both the teachers and students. Both teachers and students found the experience rewarding as they had gleaned tremendous benefits from this new mode of learning and assessment.







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<http://www.imsa.edu/team/cpbl/center/brochure.html>

<http://www.mcli.dist.maricopa.edu/pbl/problem.html>

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# Enhancing the Standard of Project Work in Primary Science

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Boo Hong Kwen and Daniel Tan Kim Chwee

## **Introduction**

This article suggests two main ways of enhancing the standard of project work in primary science. The first way is for teachers to view project work as a significant learning strategy for pupils; a means of discovering the natural world first-hand and not vicariously via the experiences of others. This implies that there is a need to change the way project work is perceived by many pupils. Many pupils view project work in science as a form of assessment of how much scientific knowledge or scientific skills and processes they have acquired or as a form of competition, where prizes are given to top projects. There is a need to help pupils view project work as an adventure, a journey of discovery of the mysteries and marvels of the natural world around them.

The second way is to scrutinize tasks set in school examination papers (as well as homework and class assignments) to ensure that they exemplify good experimental techniques. The argument here is that poor techniques for science investigations and project work may be consciously or subconsciously assimilated by pupils through their exposure to poorly set science tasks, in particular, those aimed at assessing their acquisition of science skills and processes.

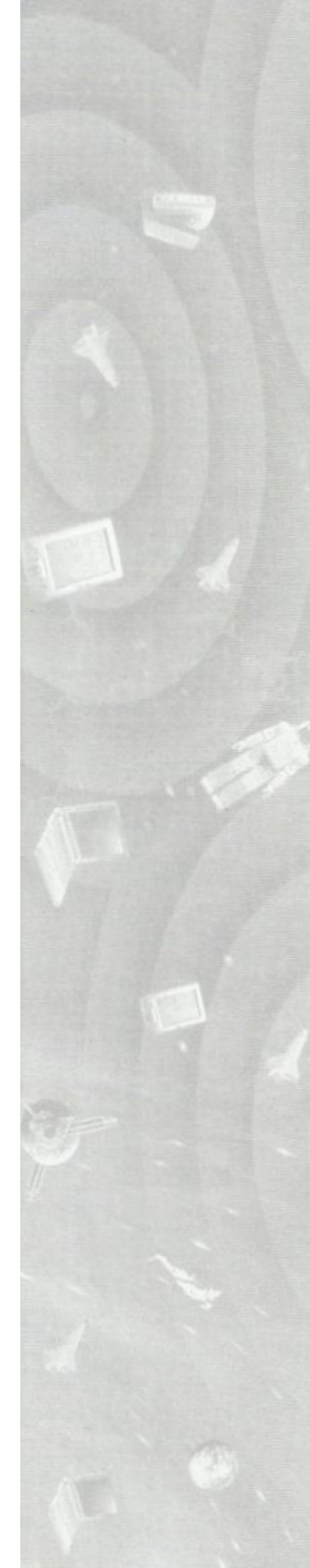
## **The nature of science**

Everyone in modern society has some views on the nature of science. The 'man in the street' generally views science as a subject in the school curriculum or as a body of knowledge to be learned. This view of science emphasizes science as a product.

Some science education journal articles and textbooks emphasize the process view of science, as for example, the article entitled "*Science is about not knowing but trying to find out*" (Manganus, Rotkamp & Koch, 1999). Esler and Esler (1996, p6) declare that "*science is not a set of facts*". Instead, they define science as a process of "*asking questions about the world around us and searching for 'best' answers*". Gilbert (1991) defines science as "*a process of constructing predictive conceptual models*".

It can be seen therefore that science can be viewed as both a product as well as a process. As a product, science is a vast body of knowledge which is changing and





increasing and is described by physical, mathematical, and conceptual models. As a process, science can be viewed as man's (man the scientist) systematic investigation of the attributes and behavior of the physical world. Scientists engage in skills and processes of investigation to generate knowledge about the natural world. Pupils in schools need to acquire the knowledge generated by scientists as well as the skills and processes of investigation. Engaging in science project work is a good means of acquiring the skills and processes of scientific investigations.

### ***View project work as a means of discovering the physical world***

Project work can be defined as an extended piece of assignment carried over a period of a few days or a few weeks (Teng and Lim, 1997). As such, it offers pupils a means of learning the skills and processes of investigations and scientific knowledge as well.

Youngsters of all ages, particularly those in the primary school are naturally curious and love to investigate. If project work is seen less in terms of assessment of their mastery of the skills and processes of investigation but more in terms of discovering the natural world around them, then the pupils' natural sense of curiosity and wonder are more likely to be stimulated. Hence, they will become intrinsically motivated in carrying out their project work.

Pupils, working in small cooperative groups, should be encouraged to raise their own questions about aspects of their physical world and should be encouraged to do carry out literature and/or media research (including the exploration of internet resources) on their topic of interests. They should be encouraged to formulate their own hypotheses and generate alternative ideas/methods of testing out their hypotheses. Teachers could guide by helping to clarify pupils thinking through listening, probing and questioning.

Pupils should be encouraged to practise the various process skills such as communicating, generating, analyzing, evaluating, problem solving and decision making. More specifically, as pupils are generating ideas about different ways of attacking the problem, they could be guided through the process of weighing the merits and demerits of each way, and selecting the best line of attack (using the integrated process of decision making) and planning the investigation. As the investigation is executed, observations and measurements are taken, and answers to the problem will be suggested. This should lead to evaluation of the investigation and a modification of the method, if necessary. In so doing, students would be practising creative problem solving processes and at the same time, broadening their understanding of scientific ideas underlying different approaches or methods.

### ***Ensure and exemplify good experimental techniques***

Another important means of enhancing the standard of science projects, and in particular, investigative projects, is to ensure that tasks set in school tests and

examination papers (as well as in homework and class assignments) exemplify good experimental techniques. The argument here is that poor techniques for science investigations and project work may be consciously or subconsciously assimilated by pupils through their exposure to poor science tasks, in particular, those aimed at assessing their acquisition of science skills and processes.

To illustrate this point, two specific test items, both taken from recent primary six preliminary examination papers of two different schools are discussed in the following section.

**Example 1: A test question that *does not* exemplify good experimental design**

Janet carried out an experiment in her living room with 4 stalks of flowers cut from the same plant. She recorded the results of her experiment in a table as shown below.

VASE	A	B	C	D
Number of stalks of flowers	1	1	1	1
Type of chemicals	P	Q	R	S
Amount of water (ml)	500	500	500	500
Number of days flowers stayed fresh	7	5	6	3

- (a) What was Janet trying to find out from her experiment? [1]  
(b) Besides using similar vases in size and quality, state 2 other variables which she must keep the same for the experiment. [2]

**Comments on weaknesses/flaws in Example 1 (test item)**

It should be noted that in experiments dealing with organisms (whether plant or animal) a sample of one (1) is not acceptable. Unlike physical science experiments where non-living things are involved, and where relationships between variables can often be described unambiguously ("proportional to", "inversely proportional" or defined in terms of an equation) living things such as flower stalks incorporate many uncontrollable variables and their behavior cannot be reliably predicted.

Thus, the exploration of possible relationships between causes and supposed effects is not as straightforward as physical science experiments. Correlational reasoning is the process used to assess the strength of relationships between variables, and a sample size for each condition investigated should be as large as is feasible. A sample size of one (1) for each condition of the experiment is unacceptable. The improved version of this test item suggested below has the sample size increased from one (1) to ten (10) and a very minor modification made to the last row of data where instead of "Number of days flowers stayed fresh" it was changed to "Number of flowers stayed fresh after 10 days".



### Improved version of test item

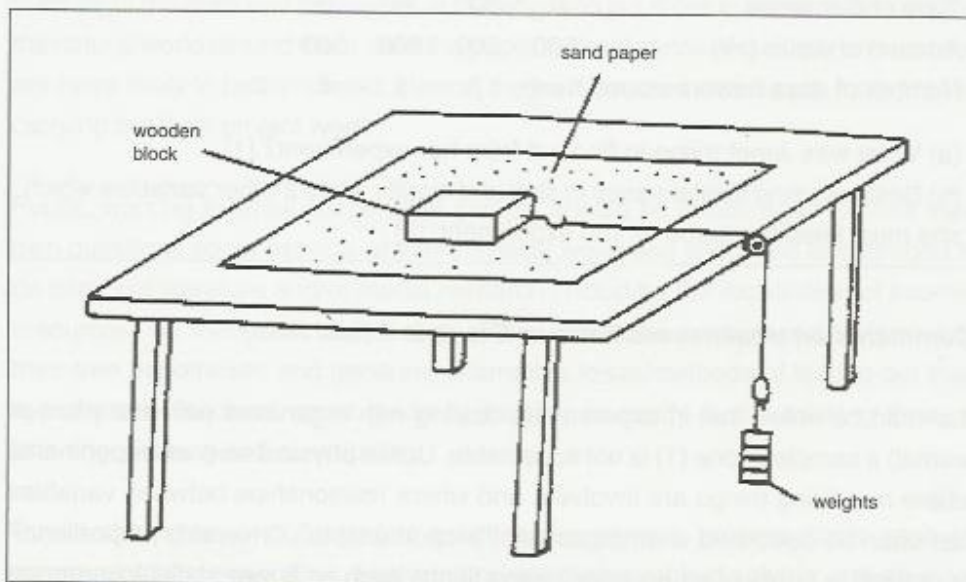
Janet carried out an experiment in her living room with 40 stalks of the same kind of cut flowers. She recorded the results of her experiment in a table as shown below.

VASE	A	B	C	D
Number of stalks of flowers	10	10	10	10
Type of chemicals	P	Q	R	S
Amount of water (ml)	500	500	500	500
Number of flowers stayed fresh after 10 days	7	5	6	3

(a) What was Janet trying to find out from her experiment? [1]

(b) Besides using similar vases in size and quality, state 2 other variables which she must keep the same for the experiment. [2]

Example 2: A question that does not exemplify good experimental procedure.



In the experiment shown above, weights were added until the wooden block began to move over the sandpaper.

The experiment was repeated by replacing the sandpaper with the following surfaces: carpet, wood and glass.

The results are shown in the table below:

Type of surface	Sandpaper	carpet	wood	glass
Force required	190g	180g	160g	135g

What was the purpose of this experiment? [2marks]

It was to find out \_\_\_\_\_  
 \_\_\_\_\_

### **Comments on weaknesses/flaws in Example 2 (test item)**

The most obvious flaw in this test item is that an incorrect unit for force has been used. Instead of using the unit “g” which represents “gramme” and which is a unit for mass, a scalar quantity, the unit for the force required, ought to have been stated as “gwt” which stands for “gramme weight” a unit for force, which is a vector quantity. Repetition of the unit for force required could have been avoided by stating the unit in the first column, row 2 of the data table (see improved version below).

Unlike the previous example, this test item involves non-living things. While non-living things are more predictable, in any physical science experiment, there are various uncertainties or errors associated with each trial of the experiment. These uncertainties can be minimized by carrying out repeated trials for each type of surface used. Thus, the test item as it stands, does not exemplify good experimental procedure. A more acceptable format of the table of data is suggested below.

### **Improved version of table of data**

Type of surface		sandpaper	carpet	wood	glass
Force required (gwt)	Trial I	189	184	161	136
	Trial II	185	183	157	137
	Trial III	187	185	163	133
<b>Average force required (gwt)</b>		187	184	160	135

### **Conclusion**

Project work is a natural and meaningful way for primary school pupils to learn the skills and processes of science as well as the products of science. We need to downplay the assessment and competition aspects of project work and to foster a sense of curiosity and wonder about the natural world among our pupils. We need to check tasks set on our examination papers (as well as homework and class assignments) to ensure that they exemplify good experiment design and procedure. Our pupils will then be acquainted with good experimental techniques which they could emulate in their inquiry about nature and produce better projects.



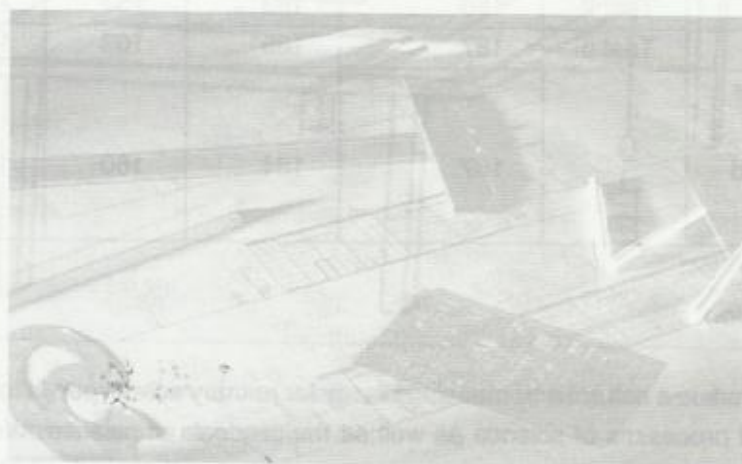
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# Learning Styles for Teacher Researchers

Yeap Lay Leng and Low Guat Tin

## Introduction

*In recent years, there has been a move to encourage teachers to do research to impact their practice. Arends (2001) remarked that one of the higher attributes of an effective teacher is to be able to '...diagnose situations and adapt and use their professional knowledge appropriately to enhance student learning and to improve schools' (p. 18).*

One of the main concerns of education has been on the individual differences of students. Researchers have focused their attention on different domains, namely intelligent quotient (IQ), creativity, and aptitude. Recent interests have been on learners' differences in terms of learning styles, cognitive styles, brain functioning, information processing, and a learner-centered environment where learners' aptitudes, abilities, and learning modalities are given importance.

Learner analysis and objectives are forefront considerations in all instructional models. Together with curriculum and instruction, the learner is one of the three important considerations in the learning process. Constructs of individuality are crucial in determining the selection of appropriate teaching strategies and learning resources. The information technology age, the 'thinking school and learning nation' concept in Singapore revived and accelerated the popularity of learning styles, cognitive styles, brain functioning, information seeking and information processing.

Learning style differences or cognitive diversity is a non-threatening and non-traditional approach of individuality. Contrary to the traditional cognitive measurement by intelligence quotient (IQ), there exists a horizontal dimension which focuses on cognitive dominance, namely the learners' strengths, weaknesses and preferences of information processing.

We write this article to give a broad overview of the basic curriculum of learning styles that individuals can use to prepare themselves prior to embarking on learning style research in the schools. What prompted us to write this paper is the number of times we have been asked about doing research in this area. Some teachers have even approached us after they have collected the data to check if the instruments used are appropriate; others have already determined the instruments and are not sure about which domains of learning styles the instruments measure; and yet there are others who have gone ahead to collect the data only to end up

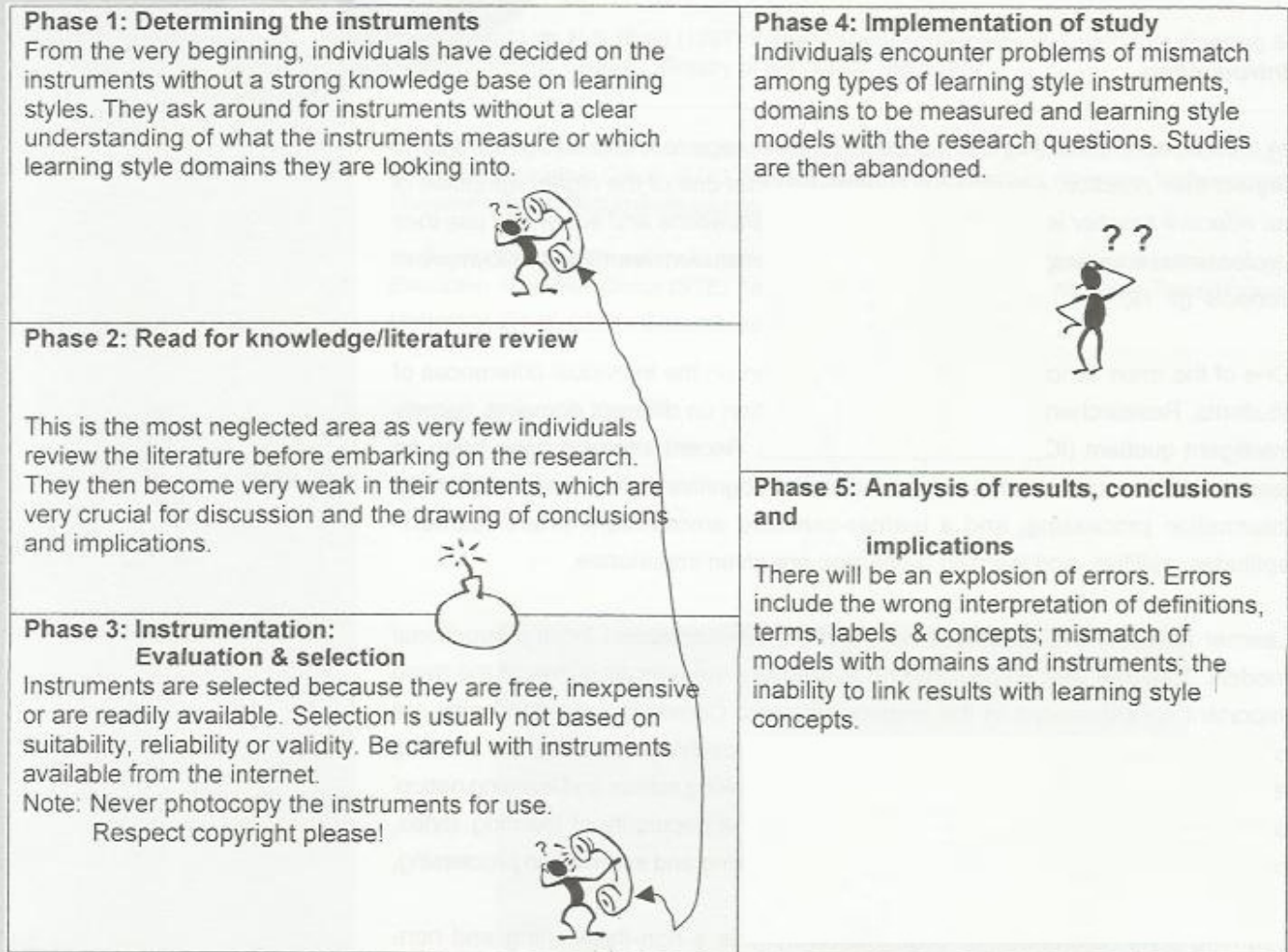




not knowing how to relate the data with learning styles concepts. We present two scenarios of learning style research practices. Scenario one though commonly practised is discouraged.

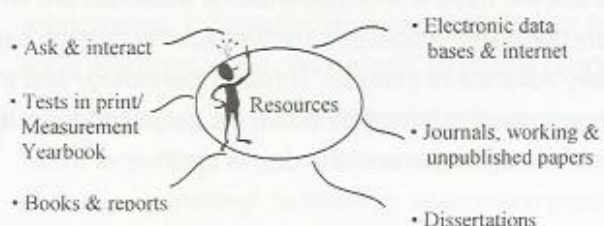
### **Scenarios of learning style research in schools**

**Scenario 1:** A scenario commonly practised in learning style research



**Scenario 1** is a commonly practised scenario of conducting learning style research in the schools. Teacher researchers move directly from phase one (deciding on the instrument) into phase three (instrumentation) and four (implementation of study). They skip phase two (read for knowledge). Some studies are abandoned in phase four. Or they get stuck at phase five (analysis of results) as they do not know how to relate the data with learning styles concepts. Instruments are selected based on convenience, cost, and availability and not on suitability. Scenario 2 as shown below is the one we recommend.

**Scenario 2: A recommended scenario for learning style research**  
(Yeap's model, 2000)

<p><b>Phase 1: Zero into tentative areas of interests</b> <u>Examples</u></p> <ul style="list-style-type: none"> <li>• The diagnosis of learning style / cognitive profiling</li> <li>• Accommodating learning styles/matching teaching &amp; learning styles</li> <li>• Brain functioning studies</li> </ul>	<p><b>Phase 4: Read for knowledge on learning styles</b> <u>Examples</u></p> <ul style="list-style-type: none"> <li>• distinguish learning style definitions, terms &amp; labels</li> <li>• familiarise with names of learning style advocates</li> <li>• associate learning style domains with names</li> <li>• differentiate among learning style models</li> <li>• familiarise with the range of instruments</li> <li>• match instruments with learning style domains</li> <li>• keep abreast with research trends &amp; issues</li> <li>• relate learning styles with pedagogy</li> </ul>
<p><b>Phase 2: Locate, retrieve, manage &amp; organize information</b></p> 	<p><b>Phase 5: Evaluate &amp; select instruments</b></p> <ul style="list-style-type: none"> <li>• Re-examine phases 2 to 4</li> </ul> <p><b>Phase 6: Implement study</b></p> <p><b>Phase 7: Analyse &amp; discuss results</b></p> <p><b>Phase 8: Draw conclusions &amp; implications</b></p>
<p><b>Phase 3: Firm up objectives &amp; research questions</b></p>	<p><b>Phase 9: Develop intervention strategies</b></p>

**Scenario 2** is a recommended scenario for learning style research. Teacher researchers need to move systematically through the nine phases without skipping any in order to build up different forms of knowledge base. Phases 1-5 are 'musts' before implementing the study.

What follows is a fundamental and simplified curriculum on learning styles that teacher researchers can examine to prepare themselves prior to embarking into learning style research. The reason why we recommend an initial mastery of a content loaded curriculum on learning styles is to enable teacher researchers to have a better insight into and to be in control over learning style information that they will be dealing with later. 'The future belongs to countries whose people make the most productive use of information, knowledge and technology, ....' (Goh, 1994, p. 3).

In the following section, we list various steps which teacher researchers need to be aware of whilst doing research on learning styles.





## **1. Locate and retrieve resources**

'How you gather, manage, and use information will determine whether you win or lose ....', (Gates & Hemingway, 1999). Knowing how to retrieve information from the libraries, internet, and electronic databases for more current and worldwide information sources is a must for teacher researchers who want to carry out learning style research. Nowadays, one needs the technology to cope with information explosion and to stay above the latest development of things. Technology has provided the speed, accuracy, flexibility, versatility and the ease of retrieving information to cope with the over whelming and intricate mazes of huge amounts of global materials.

Individuals are prepared for lifelong learning if they know how information can be found, organised and used. Information sources through the internet is available in most homes and places of work. Most institutions subscribe to electronic databases in their library network. Gone are the days where searches for materials are time consuming and tedious. Rarely do search processes involve plowing through card catalog and the thick and heavy volumes of indexes. Through technology and the use of subject, author or title entries, the information can be accessed from the comfort of one's office or home and at any time of the day or night.

Electronic databases are one of the primary sources for research reports, working papers, journal articles, research studies, conference papers and dissertations related to many areas of interests. Useful electronic databases that have abundant information on learning styles include Education Resources Information Center (ERIC) which consists of useful files like the Current Index of Journal in Education (CIJE) and Resources in Education (RIE). Other useful electronic databases consist of International ERIC and the Dissertation Abstracts. Special mention should be given to references like Tests in Print/Measurement Yearbook.

## **2. Rationalise pedagogical importance of learning styles**

The researchers need to know the importance of learning styles and in the paragraphs below we attempt to highlight the significance.

- a) Learning styles or cognitive styles are related to the psychology of different abilities and individual differences expounded in J. P. Guilford's 'faces of intellect', Howard Gardner's theory of 'multiple intelligences', and Robert Sternberg's 'triarchic theory of intelligence' (Woolfolk, 1998). These three theories discuss separate primary mental abilities and how individuals differ in different abilities.
- b) Learner analysis together with objectives are foremost considerations in all the instructional design models. Together with 'curriculum' and 'teacher', learner analysis is one of the three important considerations in the learning process. Learner analysis is the process of seeking and transmitting information about the learners for decision-making. Learner analysis determines instructional



decisions pertaining to the selection of appropriate resources, and instructional intervention for optimal learning.

- c) An ageless question in education is: How do individuals learn, acquire knowledge, think, perceive and process information? These unobservable mental activities are associated with the brain — the organ that manipulates these processes. Brain researchers yielded evidence to support brain asymmetry — the idea that the two sides of the normal brain are different naturally. Studies on what cognitive processes come into play as individuals try to make sense of complex situations are conducted through 'cognitive profiling'.

Cognitive profiling takes advantage of the anatomical organisation of the sensory and motor systems in order to 'trick' the brain into revealing the mode of operation to define patterns of cognitive functions unique to the individuals. Cognitive functioning is the consistently preferred modes of information gathering, storage, organisation and use unique to the individuals. Cognitive testing is gaining popularity in providing a qualitative picture of an individual's strengths and weaknesses. It provides an outward display of how individuals think, reason, solve problems, draw conclusions, formulate concepts and process information.

- d) Learning styles, cognitive styles and thinking are directly related. The common factor in thinking, learning styles and cognitive styles is 'information processing or 'meaning making'. In thinking, information processing is termed 'operations'. In learning and cognitive styles, information processing is the 'psychological domain of learning' (Yeap & Chong, 1997). The 'thinking schools and learning nation' concept, and information technology in Singapore accelerated an interest in mental activities involving the organisation of thinking and brain functioning.
- e) Learning styles is related to ability driven education. It is also in line with Singapore's strategic plan to create a learner centered school environment which allows for learning efficiency (as opposed to teaching efficiency) as it takes into account the aptitudes, abilities and learning modalities of the learners. The assumption in 'ability driven education' is that every child has some talent or ability though the sphere of the talents differs as identified in J. Guilford's and H. Gardners' theories (Woolfolk, 1998). Research has shown that through accommodating students' learning styles or matching teaching and learning styles, individuals' development and potentials can be maximised. One such type of research is the aptitude treatment interaction (ATI) where different types of instruction can be designed to complement the characteristics of learners.

Frequently related terms have been loosely used interchangeably and synonymously even though there may be some differences. The following section provides some definitions to enable researchers to differentiate the terms.

### **3. Distinguish definitions, terms, and labels**

Distinguishing terms, definitions, and certain vocabulary are important as they clarify meanings, avoid vagueness, allow for more definite references and determine the scope of learning styles. References like 'Encyclopedia of Psychology' (2000) can







be of great help to obtain the meanings and an elaboration of the terms. Provided below is an example of some useful terms related to learning styles.

Terms	Definitions
Learning styles	Conditions under which an individual is most likely to learn, absorb, retain new and difficult information and achieve.
Cognitive styles	Information processing characteristics that indicate an individual's way of understanding, thinking, remembering, and solving problems.
Dominance	The condition or fact of one member of a paired organ being the one principally used to carry out a task, e.g., foot, eye, hand, brain
Hemisphericity/brain dominance	The tendency to use one side of the hemisphere more than the other.
Lateralisation	The fact that two lateral halves (hemispheres) of the brain are somewhat specialized.
Brain asymmetry	The idea that two sides of the normal brain are different naturally.
* Whole brain functioning * Holistic	* Integrated functioning of the brain * Able to perceive and understand the 'big picture' without dwelling on individual elements of an idea.
Metacognition	Thinking about how to accomplish a thinking task; awareness of own cognitive processes and exert control over them.
Metalearning	What do I want out of these (motives) and how do I propose going about getting there (strategy).
Thinking	Mental activities to find meaning assumed to exist already or to make meaning out of something that has no readily apparent meaning.
Creative thinking	State of mind to see things in a new way that can result in inventing new combinations and putting things together in new and novel ways.
Critical thinking	Judgmental aspect of thinking through mental operations like detecting bias and determining credibility.
Learning strategies	Thinking about different approaches to harness the potential of learners to solve problems, e.g., planning ahead, monitoring one's own performance, checking and self test.
Study skills	The area of work that is directed to improve students' study habits, e.g., note taking, use of dictionary, understanding tables, organise study time, how to plan an essay.

#### 4. Know who's who in learning styles

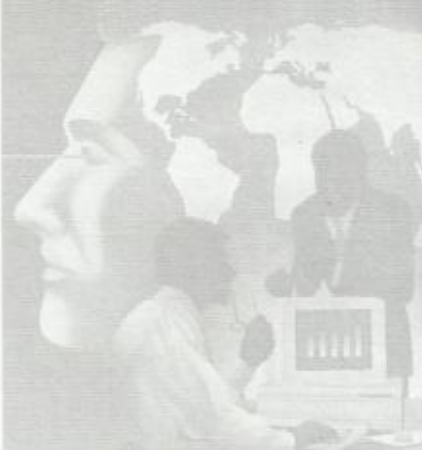
It would be useful to know names of some learning style advocates because very often names are cited as references in the literature. Equally important is the association of names to learning style domains and models. Who's who in learning styles is listed below.

1. Rita Dunn, Kenneth Dunn & Gary Price	11. Paul Torrance
2. Joseph Renzulli	12. James Keefe
3. Ronald Schmeck	13. John Biggs
4. Anthony Gregorc	14. Myers Briggs
5. David Kolb	15. Harold Gordon
6. Herman Witkin	16. Bernice McCarthy
7. Ned Herrmann	17. David Hunt
8. Robert Zenhausern	18. Norman Kagan & David Krathwohl
9. Albert Canfield & Judith Canfield	19. Anthony Grasha & Sheryl Riechmann
10. Richard Riding	20. Charles Letteri

#### 5. Associate learning style domains with names

Advocates of learning styles define learning styles differently. The definitions differ according to the different learning domains as interpreted by these advocates. The table below matches learning style domains associated with the respective learning style advocates.

Learning style domains	Learning style advocates
• Conditions/stimuli	Rita Dunn, Kenneth Dunn & Gary Price
• Conceptual level	David Hunt
• Learning preference dualities: Perception & ordering	Anthony Gregorc
• Learning modes: Perception and processing	David Kolb
• Instructional modes	Joseph Renzulli
• Brain functioning/ hemisphericity	Paul Torrance, Bernice McCarthy, Harold Gordon, Robert Zenhausern
• Mental preferences, thinking & brain functioning	Ned Herrmann
• Learning strategies	Ronald Schmeck, Norman Kagan & David Krathwohl
• Thinking	Richard Riding
• Learning & teaching styles	Albert Canfield & Judith Canfield
• Cognitive style	Charles Letteri, Herman Witkin, James Keefe
• Motives & strategies	John Biggs







## 6. Match learning style labels/vocabulary with advocates who coined them

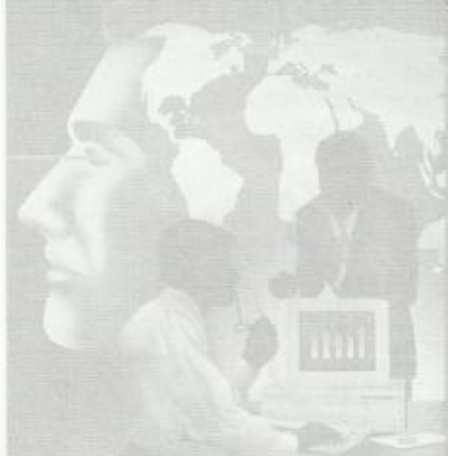
Different learning style advocates 'coined' different vocabulary to describe learners who embody certain learning characteristics. The characteristics may overlap though they are labelled differently. The table below provides some examples.

Learning style labels/vocabulary	Learning style advocates who coined the labels/vocabulary
Conditions/stimuli: <ul style="list-style-type: none"><li>• Environmental</li><li>• Emotional</li><li>• Sociological</li><li>• Physiological</li><li>• Psychological</li></ul>	Rita Dunn, Kenneth Dunn & Gary Price
<ul style="list-style-type: none"><li>• Abstract sequential</li><li>• Abstract random</li><li>• Concrete sequential</li><li>• Concrete random</li></ul>	Anthony Gregorc
Learning styles: <ul style="list-style-type: none"><li>* Diverger</li><li>* Accommodator</li><li>* Assimilator</li><li>* Converger</li></ul>	David Kolb
Learning modes: <ul style="list-style-type: none"><li>• Abstract sequential</li><li>• Concrete experience</li><li>• Reflective observation</li><li>• Active experimentation</li></ul>	David Kolb
<ul style="list-style-type: none"><li>• Dynamic</li><li>• Analytical</li><li>• Imaginative</li><li>• Common sense</li></ul>	Bernice McCarthy
<ul style="list-style-type: none"><li>• Surface</li><li>• Achieving</li><li>• Deep</li></ul>	John Biggs
<ul style="list-style-type: none"><li>• Elaborative processing</li><li>• Deep processing</li><li>• Fact retention</li><li>• Methodical study</li></ul>	Ronald Schmeck
<ul style="list-style-type: none"><li>• Hemispheric dominance/ tendency towards the right and left brain functioning</li></ul>	Harold Gordon, Paul Torrance, Bernice McCarthy, Robert Zenhausern
<ul style="list-style-type: none"><li>• Independent</li><li>• Dependent</li><li>• Unsocialised</li></ul>	David Hunt

Learning style labels/vocabulary	Learning style advocates who coined the labels/vocabulary
<ul style="list-style-type: none"> <li>• Field dependence</li> <li>• Field independence</li> </ul>	Herman Witkin
<ul style="list-style-type: none"> <li>• Wholist-analytic dimension</li> <li>• Verbal-imagery style dimension</li> </ul>	Richard Riding
<ul style="list-style-type: none"> <li>• Focusers</li> <li>• Scanners</li> </ul>	Norman Kagan & David Krathwohl
<ul style="list-style-type: none"> <li>• Independent</li> <li>• Avoidant</li> <li>• Collaborative</li> <li>• Dependent</li> <li>• Competitive</li> <li>• Participant</li> </ul>	Anthony Grasha & Sheryl Riechmann
<ul style="list-style-type: none"> <li>• Field independence/dependence</li> <li>• Scanning/focusing</li> <li>• Breadth of categorization</li> <li>• Cognitive complexity/ simplicity</li> <li>• Reflectiveness/impulsiveness</li> <li>• Leveling/sharpener, tolerant/intolerant</li> </ul>	Charles Letteri
Instructional preferences: <ul style="list-style-type: none"> <li>• Lecture method</li> <li>• Simulation</li> <li>• Recitation</li> <li>• Peer teaching</li> <li>• Discussion</li> <li>• Games</li> <li>• Independent study</li> <li>• Programmed instruction</li> </ul>	Joseph Renzulli

#### 7. Select learning style instruments to match domains to be measured

The 'accuracy' of diagnosing learning styles in order to obtain meaningful learning style profiles depends very much on how appropriate the selected instruments are. The more popular examples of learning style instruments are cited on the following page.

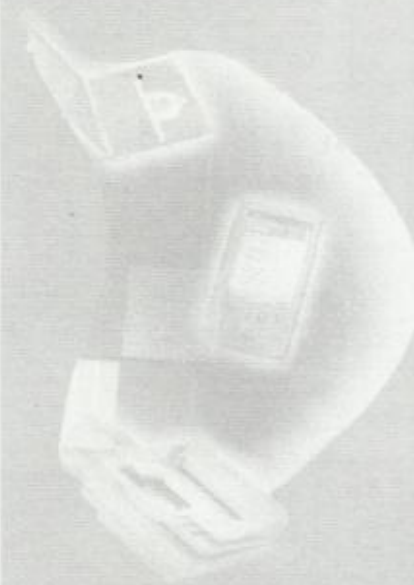






Learning style instruments	Learning style domains	Names of developers
Learning Style Inventory (1985)	Conditions/stimuli under which an individual is likely to learn, absorb, retain information and achieve	Rita. Dunn, Kenneth Dunn and Gary Price
Learning Styles Inventory (1978)	Instructional modes: recitation, peer teaching, discussion, games, independent study, programmed instruction, lecture & simulation	Joseph Renzulli and Linda Smith
Inventory of Learning Process (1982)	Continuum of student information processing preferences from deep & elaborative to shallow & repetitive (learning strategies): elaborative processing, deep processing, fact retention, methodical study	Ronald Schmeck
Embedded Figures Test (1971)	Cognitive functioning & styles to assess analytic ability, social behaviour, body concepts, analytical versus global styles of information processing, field dependence, field independence	Herman Witkin
Learning Styles Inventory (1986, 1998)	Learning modes in perception & processing: feeling (concrete experience), watching (reflective observation), thinking (abstract conceptualization), doing (active experimentation)  Learning styles: diverger, converger, accommodator, assimilator	David Kolb
Gregorc Style Delineator (1982)	Combinations of learning preference dualities (Perception & ordering): concrete sequential, abstract sequential, concrete random, abstract random	Anthony Gregorc
Hemispheric Mode Indicator (1993, 1998)	Left & right brain approaches to learning	Bernice McCarthy

Learning style instruments	Learning style domains	Names of developers
Cognitive Laterality Battery (1986)	Brain hemispheric preference	Harold Gordon
Learning Strategies Questionnaire (1967)	Learner strategies that focus on the details of a learning situation (focusers) or attempt to piece together the larger picture (scanners)	Norman Kagan & David Krathwohl
Herrmann Brain Dominant Instrument (1990)	Mental preferences/thinking styles/brain functioning	Ned Hermann
Your Style of Learning & Thinking (1988)	Brain hemispheric preference/thinking	Paul Torrance
Differential Hemispheric Activation Instrument (1979)	Hemispheric dominance	Robert Zenhausern
Paragraph Completion Method (1978)	Conceptual level: independent, dependent, unsocialised	David Hunt
Learning Process Questionnaire (1985)	Motives and strategies approaches: surface, deep, achieving approach and strategy	John Biggs
Student Learning Styles Questionnaire (1974)	Student attitudes toward courses taken: Independent, avoidant, collaborative, dependent, competitive, participant	Anthony Grasha & Sheryl Riechmann
Cognitive Profiles (1980)	Seven dimensions of cognitive styles to predict student achievement level: field independence / dependence, scanning/ focusing, breadth of categorization, cognitive complexity/simplicity, reflectiveness/ impulsiveness, leveling/ sharpener, tolerant/intolerant	Charles Letteri
Cognitive Styles Analysis (1991)	Organise knowledge: Wholist-analytic dimension, Represent knowledge: verbal-imagery dimension	Richard Riding
Learning Style Profile (1989)	Cognitive, affective, physiological, environmental domains	James Keefe, John Monk et-al.







### **8. Evaluate the instruments**

Useful references on learning style instruments are the 'Tests in Print' (1994) and 'The Twelfth Mental Measurement Yearbook' (1995) which document a range of learning style instruments including other tests. Instruments are easily located through the author, title and subject indexes. Useful details like author of the instrument, domains the instruments measure, scoring procedures, studies using the instruments, cost and directory of the publishers are also provided.

Because of the availability of a wide range of learning style instruments including those from the internet, teacher researchers must be able to determine the quality of these instruments. The criteria below may be helpful for the selection of instruments:

- Are they developed from research base or experiments?
- Does the continuum in the items measure what is defined as learning style?
- Do the items measure the domains in the objectives of your study?
- Are they easily available or accessible?
- Are they affordable?
- Do they allow for immediate self-scoring versus computer scoring by the company?
- What are their validity and reliability?
- Are they accompanied with a clearly written manual or handbook?
- Do they allow for large group versus individual administration?
- Do the researchers need special training or to be licensed?
- Are there many studies that use the instrument for research?
- Are the instruments well documented in the literature?
- Are the instruments preference inventories or performance tests?
- Are the language and vocabulary levels suitable for your sample?
- Do the instruments reflect bias in terms of culture, language, references made to objects, gender and race?
- Do they allow for duplication of multiple copies or are they copyrighted?

### **9. Keep abreast with learning style research trends and issues**

Teacher researchers should keep tabs on research trends and issues so as to keep abreast of the field, the types of research done by fellow researchers world wide and the impact of the findings on learning. Keeping abreast of such information can also be achieved through the use of electronic databases, bibliographies and by attending conferences, workshops and seminars. The following table provides some trends of learning style research.

Learning style research trends	Some research issues
1. Diagnosis of learning styles	<ul style="list-style-type: none"> <li>• Is there a right 'style match' for a particular profession/task/discipline?</li> <li>• Must all styles be diagnosed?</li> <li>• Do individuals know their own learning styles?</li> <li>• Can there be a match between self perceived versus measured learning styles?</li> <li>• What are the learning style profiles in terms of gender, academic achievement, achievement groups, performances in various disciplines, grade levels, age groups and ethnic groups?</li> <li>• Can styles be changed?</li> <li>• Is there a 'best' style?</li> <li>• Is there a relationship between intelligence and styles?</li> <li>• When should one assess styles?</li> <li>• How 'good' are the available instruments to identify learning styles?</li> <li>• Must styles always be diagnosed through instruments? Is there a place for intuition, 'gut feeling' or knowing oneself?</li> <li>• To what extent is learning styles related to working and management styles?</li> <li>• Can style diagnosis be used as a criterion for the selection of candidates or as a recruitment tool?</li> </ul>
2. Accommodating style/Matching teaching and learning styles.	<ul style="list-style-type: none"> <li>• How do teachers accommodate style diversity in large group instruction?</li> <li>• To what extent can teaching through students' learning styles increase academic achievement, performances, change in learning attitudes and motivation of the learners?</li> <li>• Should students adapt to teaching styles or should teachers change to accommodate students' styles?</li> <li>• Can learning styles of individuals be used as one criterion to form working or management groups?</li> <li>• Should individuals go through similar forms of assessment when their learning styles are different?</li> </ul>
3. Diagnosis of brain functioning	<ul style="list-style-type: none"> <li>• How is brain functioning related to gender, age, academic performances and ethnicity?</li> <li>• How is brain functioning related to learning style domains like perception, processing, instructional modes, emotional, sociological, environmental and physical stimuli?</li> <li>• Can brain functioning diagnosis predict learners' achievement, potentials to achieve and thinking patterns?</li> <li>• Can individuals' potential abilities in music and art be distinguished by brain functioning diagnosis?</li> <li>• What is the brain functioning profiles of different professionals, e.g., engineers versus nurses, IT professionals, artists, lawyers, teachers, medical professionals?</li> <li>• Can brain functioning profiles be used to match individuals with their job responsibilities?</li> </ul>







## Conclusion

Mastering the basic knowledge on learning style is crucial. It establishes a firm and basic content grounding on learning style prior to the teacher researcher embarking on the implementation of the research.

Though teacher researchers will encounter some realistic problems when implementing learning styles in the classroom, learning style research does provide a substantive framework for teachers to appreciate learning styles as a non-traditional approach of looking at learning, instruction and classroom activities related to the learners' characteristics. **As students learn differently, they should be taught differently.** All these call for another look at the current modes of instruction and assessment. Learning is a process that occurs in students' minds and how information is presented and learned is vital.

Learning style research findings can be utilised to:

1. identify sets of variables in terms of environmental, sociological, emotional, physical and psychological factors that may determine whether the learners find a lesson exciting or boring,
2. place learners in their preferred learning environment,
3. remove obstacles that may inhibit or 'demotivate' the learners,
4. develop matching methodologies and curriculum that will support, reinforce and complement the learners' learning style preferences,
5. recognise and realise the fact that there is a horizontal dimension (learning preferences) versus the traditional vertical dimension (IQ) to compare relative performances of learners.

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# Secondary Science Projects: Does 'Sophisticated' Mean Better?

Daniel Tan Kim Chwee and Boo Hong Kwen

A group of Secondary Two students were working on a project to determine the amount of caffeine in five different brands to know *"which tea contains the most caffeine and so that we can avoid drinking too much of it. Hence, we can cut down our chances of getting harmful effects caused by caffeine."* They boiled the tea leaves, filtered off the leaves and extracted the filtrate using chloroform. They then used a spectrophotometer to determine the amount of caffeine present in each brand of tea by studying the absorbance of ultraviolet light at 274 nm by each sample.

Another group of Secondary Three students carried out a project to determine how much iron nails rust in different parts of Singapore and to provide explanations for the findings. The students hypothesized that iron nails rust faster in the following kinds of environment:

1. Areas with heavy rainfall
2. Areas close to the industrial zones
3. Areas near the sea
4. Areas close to busy roads

The procedure involved project students distributing iron nails in petri dishes to their schoolmates living in the various parts of Singapore and these nails were weighed at regular intervals. They assumed that the greater the percentage increase in mass, the greater the rusting.

The Secondary Two students' project seemed to be the more impressive compared to the Secondary Three students' project as it involved more laboratory work and the use of sophisticated equipment. Thus, one would believe that the Secondary Two students are doing a better project than the Secondary Three students, and one might conceivably be inclined to award them a better grade.

During the question-and-answer session, the Secondary Two students were asked to explain the term "absorbance" which occurs many times in their report. Strangely though, none of the students were able to offer even the slightest suggestion. It should be reasonable to expect that even though they may not have encountered this particular concept in their school science curriculum, in the course of their

project they should have thought about the meaning of this key term on which the project appears to be based. One would think that it is reasonable to expect them to be able, perhaps, to suggest that the term "absorbance" relates to absorption of ultraviolet light by the caffeine. The Secondary Two students were also asked what they thought was the meaning of the term "nm" in the context of the statement "Caffeine extracted from each tea was measured in UV spectrophotometer to record absorbance value at 274nm". After a lapse of several minutes, one of them ventured the answer, "newton metre". This seemed to indicate their lack of understanding of the use of spectroscopy in the quantitative analysis of caffeine. One then wonders why the students decided to use spectroscopy in the first instance. When probed further as to whether their investigation could be conducted in the absence of sophisticated scientific equipment such as the spectrophotometer, the students replied that there would be no way then of carrying out their investigation. Such a response from the students is disconcerting as it would seem that not only did the students not understand their method of investigation, they also did not do much literature search on other possible ways to determine caffeine in tea. This certainly gives rise to questions of how the students managed to propose such a project in the first instance.

To summarise, sophistication in a project does not always mean that it is a better project, and the students' ability to produce a report on the project does not mean that they fully understand what they have done. We do not have anything against the Secondary Two students' use of a 'sophisticated' instrument, provided they understand the basic principles involved – otherwise the instrument becomes something merely to impress others. In contrast, though not perfect, the Secondary Three students' project work was within the ability of the students to perform and understand, and related to what they have learned in class – the topic of redox in chemistry. To be effective, project work should be relevant to students, within their abilities to understand so that they know what they are doing, and enable the students to produce knowledge instead of merely *'reading it off from the instrument'*.

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# Best Practices in Online Delivery: 10 winning ways for excellence in e-education

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Paul Thompson, Bernard Randell & Pok Yang Ming

*Abstract: Proponents of e-education using Internet based educational tools have long claimed their potential. While the Internet has been oversold and overhyped in many contexts there appears to a growing consensus that it really is, and will, create waves in the area of education. E-education, looks set to radically alter the way that education and learning is conducted and hence carries enormous ramifications for educational institutions. This paper reports on those important features that the authors believe will characterise online learning institutions as they evolve. Properly managed the use of information technology (IT) resources in education, does improve pedagogic outcomes. The authors reach a positive conclusion, and attribute those improved outcomes to management understanding of the use of IT resources through the conduit of improved student motivation.*

E-education will do much more than change the way that students are taught and educational establishments operate. The fuel for worldwide economic and social development is information. The Internet provides the propulsion. And with it there is the potential for lifelong learning for all, but perhaps more importantly the opportunity to educate the otherwise uneducated and to promote worldwide tolerance of diversity of race, colour, and creed through informing the uninformed.

In short online learning is predicated upon revolution. We are not talking incremental change that the management gurus, sell in their management seminars but a severe and total break from the past. That change will herald a new era for mankind's social development no less. A chance for all of us to be included in a global learning community – to learn anytime, anyplace, anywhere and in any language.

By e-education we mean the use of web technologies to deliver broad solutions that lead to lifelong learning. E-education is going to change the way everyone does education. The reasons for this are many and varied; globalisation, uninhibited access to information, and the de facto emergence of English as the global language are but a few.

If governments attempt to create regulations aimed at ensuring their sovereignty over the medium then there is a real risk that the benefits that e-education offer will never materialise. But their efforts will be in vain – they might just as well seek





highway speed limits to suit the trishaw, Kelman (1998). E-learning is and will happen irrespective of the instincts of some.

Yesterday does not work anymore. The educator who does not comprehend the changes that are going to overtake him will go the way of the tea auctions, eliminated by the Internet, International Herald Tribune (1998). The integration of the World Wide Web into education will encourage creative thinking, lifelong learning and generate innovative teaching methods.

The Web will make classrooms both fun and challenging, facilitate teamwork, and encourage the students to learn by doing and discovering. Student motivation will be enhanced by the high levels of interactivity that comes with computers and the Web and this can have improved results. Below is an outline of those important features that the authors believe will characterise online learning institutions as they evolve over the next 10 years.

1. **Develop teaching managers who combine a deep understanding of the web with senior management experience.** The use of the Web for teaching can only be achieved if it is properly managed. Those responsible for the management of the web at every level must be hybrid managers, experts not only in the traditional areas of management in education but also in the development and implementation of information technology particularly in e-learning management systems.

The Web, in teaching, has developed in a disorganised way, led predominantly by enthusiasts working 'under their own steam'. It has not been led by senior management. And there is no question that education has benefited from that. The opportunity costs for those enthusiastic teachers that have pioneered web based teaching have been high – night after night burning the midnight oil. But such costs go unrecognized in the management information systems of institutions. The time has come free of charge, volunteered.

The time has come for a more systematic, top down approach to harvesting the benefits of the web for teaching. Only then will its potential be realised. This means proper management. The problem of random development of the Web into teaching programs is that leads to inconsistent application. It may also succeed in increasing costs especially when it only gets deployed as a supplementary device. It needs to be seen as a substitute for some face-to-face teaching.

When shown new online web teaching developments, management should consider whether it can effectively replace 'chalk and talk' and, more importantly, whether it can add value to the learning experience. If the answer is 'no' then the 'development', irrespective of past costs incurred, should either be employed in a supplementary capacity, or else dropped altogether. The acid test is whether student learning is enhanced or not.





At the same time, management should question whether it is sensible to continue consigning information technology as no more than a support tool. Ultimately, such resource based learning should mean that we can take more and more students without increasing the number of staff.

2. **Enhance learner motivation on the Web.** A teacher who cannot motivate students in the conventional classroom is likely to face the same situation using computers. Teachers who have a caring attitude, can encourage and compliment students and at the same time develop rapport. A teacher's passion and enthusiasm for online learning is an important source of motivation for students. This can be achieved by a good knowledge of the material and an enthusing communication style. Motivation can also depend on the IT environment. Computers and labs need to be user friendly, well maintained and pleasant places to 'hang out'.

Learning efficiency varies from student to student and is largely influenced by a student's ability and motivation. In an earlier paper, we drew upon an analogy in control engineering and pioneered the 'education loop'. Here, motivation is represented in the feedback path as a switch. When student motivation drops to zero, the feedback path is switched off. The system becomes an open loop. Teachers receive no response from students and will try to work frantically, leading to over-teaching. Using computers helps to motivate students to maintain the feedback part of the close loop system intact, Gilliver et. al. (1998). Web education can provide levels of responsive feedback as well as individual involvement. This can be highly motivating, mitigate student distraction and reduce disruptive classroom behaviour.

Students are also motivated by challenging tasks. One way of doing this is to design a simulation or micro-world on the Web. When the learning can be anchored to everyday life this will often facilitate learning. This should enable teachers to reach higher levels on Bloom's taxonomy, going beyond understanding to synthesis and evaluation.

Feeding a student's curiosity is also an important element in keeping their attention. Internet sites can be designed to offer many and varied facets, unavailable with traditional course delivery methods, such as on-demand videos and graphics.

Educators – at least those who see education purely as a process of learning rather, should accept the notion that one can achieve a near zero dropout rate from an effective online education system. If an airport control tower can be designed to be 100 per cent reliable then the education system that is of equal public interest should also meet these criteria. For example, if air travellers were told that their plane had an 85 per cent chance of getting safely to their destination, the great majority of otherwise eager passengers would not board the plane, Stringfield (1995). Similarly schools and tertiary



institutions are increasingly being seen as accountable for the success and failure of virtually all of their students.

3. **Use search engines to surf for substance.** Learners will need to develop advanced skills in searching for and selecting valid, relevant and up to date information from web databases. The Internet is known for being a vast repository for information, but it is also renowned for being a place where finding information is difficult. It need not be.

Before one can begin to unlock the secret vaults of the Internet the tools necessary to break in must be understood. The various searching interfaces currently available such as Lycos and Yahoo should be used to develop the students' learning skills. That will teach them how to find and use information wisely and thereby boost their achievement and realise their potential. The ability to know what you need to know and how to find what you need to know will increasingly distinguish the good student from the not so good student. And the good teacher from the not so good teacher.

Grids could be established to find and use online learning and teaching materials. This can lead to a mosaic of inter-connecting networks and education services based on the Internet which can both support teaching and learning as well as assist with training and administration in schools. Libraries, with their vast stores of information and accessibility to the public, could be an integral part of this grid.

4. **Develop a sense of collaboration, sharing and social responsibility.** Currently most online programs that exist were developed by staff at institutions and the tendency of staff at other institutions is to avoid using other peoples' material. That's one aspect of academic snobbery. So staff develop their own bespoke material and this keeps costs high. The high fixed costs of developing online material does not get shared across many students, programmes and institutions.

One way to overcome this is to develop material externally rather than in house. Or else have a central clearing house where staff from various institutions sell or donate material for use by others. Institutions should collaborate in the production and transmission of educational programs. In the foreseeable future electronic journals serving a world wide network will be common.

The wider goals in education are also important. Students should appreciate and understand the moral code on which civilised society is based. They should also develop attitudes to life and work such as responsibility, determination, care and generosity which will enable them to become good citizens.



The proxy servers filter some undesirable sites such as pornography. Perhaps, school children could be offered a programme on copyright so as to instill a sense of public awareness and understanding concerning the importance of intellectual property in the information age. In particular, students should be informed as to why copying material from the web without the permission of the owner is unethical.

5. **Commence with online business courses.** Many reckon that virtual learning will be ideally suited to short business related courses. Businesses are enthusiastic about online learning, but whether many are actually seeing any real benefits from their Net-based education programs is unclear. Working professionals with limited time on their hands are likely to find virtual courses on professional development and training especially attractive. Traditional students may continue to want at least some of 'the real thing'.
6. **Make materials available 24 hours a day.** The Web offers the opportunity to depart from the traditional constraints of the curriculum allowing teachers and learners to schedule the place, time and pace of learning. It provides an easier way of collaborative working, visualisation assessment and consolidation of learning. The student can get immediate and 'rich' feedback from online material. Feedback – its timing, accuracy and regularity – are vital to the learning process.

The Web enables communication between staff and student outside of normal hours and hence classrooms without walls or timetables. Students will expect continuous access to their school's network and hence a link to its learning environment. Physical and temporal obstacles to student access will be overcome with the help of information technology. Making materials available 24 hours a day will assist the twin goals of independent and life-long learning. And students will acquire more general and transferable IT skills at the same time.

7. **Use computers interactively in real time to make learning more effective.** Our use of the Web must be embedded in a broad understanding of learning theory and teaching methodology. Students are being brought up in a culture where fast and direct feedback is becoming the norm. They increasingly use different communications media simultaneously, expecting high levels of interactivity. They demand sophisticated presentation modes, using pace, colour, movement and sound.

Good teachers will use conferencing systems, streaming media and so on effectively. Conferencing systems allow students and teachers to communicate in real time with video, sound and white board features. Given a choice individuals are likely to choose to receive information and 'experience' learning in the company of others rather than alone. They will also tend to prefer to receive it from a person who is present.





An online web course can be interactive with a variety of choices and paths so students may design and manage their own learning. Students should be able to choose the path, content, pace and nature of the feedback they receive. This can also lead to higher order thinking.

8. **Provide for interaction among participants.** Socialising, communication and developing a sense of community for students in a virtual learning environment is important. Otherwise there is none of the value added from, say 'bouncing ideas off others'. Moreover, low interactivity can stifle the development and honing of social skills.

In the 1930's an experiment was conducted known as the Westinghouse experiment. Workers were observed and output measured under different lighting conditions. It was expected that the dimmer the light, the lower the output. Quite the contrary was observed. Experimenters found that output actually increased. Why? Because staff appreciated the interest and care shown by the researchers and responded accordingly.

The same can be true of online learning. If the student feels they are being individually attended to, albeit electronically, they will respond favourably. Surveys of learning programs support this notion. Perhaps the personal attention the students receive which they might not otherwise get is important. This attention can be achieved through the web by use of structured emails, chat, conferencing systems and diagnostic feedback from the system.

9. **Remember the Orbicular Model.** This model, Gilliver et. al. (1999) describes the education process on the Web in which information is converted into knowledge and skills. It involves four steps. First, the World Wide Web is seen as a vast repository of **information**. The relevance or quantity of such information may be subject to debate but it is important to emphasise the exponential growth of Internet based information – growth which negatively correlates with the declining cost of technology.

Second, **teaching** takes place by educators. Whether that teaching is instructionist or constructionist is only partly relevant to the convergence which inevitably takes place between the learner, the teacher and the syllabus. Technology provides the vital framework and delivery infrastructure to enable educators to be as imaginative, creative, and flexible as they wish. In the context of working with the Internet in education, teaching is seen as the active task of inculcating learners with the skills and behavioural patterns to "direct" and "focus" their learning on the Internet. Third, **learning** is the inevitable, and desirable, outcome of this pedagogical process

Finally from learning flows **discovery** – the demonstrable competencies of learners applied to their living frameworks. Learner interactions with their environment – whether academic, employment or social – results in





"discovery". New information is thereby obtained, tested and recorded. As this "discovery" process evolves, the product of the process becomes new information available.

10. **Be prepared for unforeseen problems.** Over the next 10 years there will be exponential growth in the degree to which courses are organized, communicated and delivered via the Internet. The Internet will provide a valuable ally and support to lifelong learning.

While it is important to think positively and not dwell too much on the negative comments about the Web, it is important to be alert to unforeseen problems. For instance, in the US, there is currently a debate as to whether or not computers can coach students for exams. Typing answers on the keyboard is not tested in exams but learning to write fast is important. Globally, bandwidth is also a problem.

Educationally, online learning is of major significance. E-learning is designed for both professionals in the workplace seeking lifelong learning and students preparing for the electronic business environments in which they will now operate. Online learning should provide students with a sound educational foundation that prepares them for life, while ensuring they stay on top of the Web wave and have fun in the process.

Today's administrators and teachers are being increasingly forced to consider the applications of new technologies and not only for the sake of education redesign. In many cases the Internet and the global market place it oils poses a real threat to their very survival. It is no longer possible to assume this is the sole domain of specialists. E-education gives organisations the opportunity to create strategic alliances and to outsource functions and processes that can be carried out more efficiently by others.

As changes take place companies will need to be able to integrate new technologies. Any educational institution that hopes to survive and thrive must become an e-learning education institution. E-education harnesses the power of the Internet and in so doing enables them to both create, and capitalize on, new educational opportunities. Teaching online should encapsulate this new broader model of education. It will thus serve to emphasise to potential employers the relevance of the curriculum and in turn make graduates more employable and attractive to potential employers.

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# Project Work in Upper Serangoon Sec School

Christine Siau

Project Work (PW) has been implemented in USSS since 1999. I will share with you the structure of the programme which the school adopted in 2001 and which had evolved as a hybrid of the school initiated programme in 1999 and the Project Work initiative of the Ministry of Education, introduced in 2000.

## Structure

CLASS	SUBJECT LINKS	SUPERVISING TEACHER	RESOURCE TEACHER(S)	EXPLICIT THINKING
1E1	EL & Geog	Chan Wei Meng	Rebecca	Juwana
1F2	EL & Geog	Clarice/Rebecca	Rebecca	Clarice
1N3	EL, CME & Art	Juwana	Mrs Woo	Juwana
2E1	Sci & Geog	Ivy	Sharon	Ivy
2E2	Sci & Geog	Sharon	Sharon	Ivy
2N3	EL/Hist	Christine	Jeremy	Christine
3E1	Sci, Geog & Maths	Tor Seng/Sharon	Ashokan/Boh Peng	-----
3N2	Sci, Geog & Maths	Champion	Tor Seng/Boh Peng	-----

PW is implemented in Sec One to Sec Three Express and Normal Academic classes. Every class has a supervising teacher and one or two resource teachers, according to the subject links in their project tasks. In addition, Sec One and Two classes have 2 periods of Explicit Thinking Skills lessons. These Thinking Skills lessons are based on the MOE Thinking Programme and lessons target specific skills needed to help students in their project tasks.

## PROJECT TASKS 2001

Class	Tasks (Modified from tasks in MOE Resource Package)	Curriculum Links
1E	Moving with the Times	EL & Geog
1NA	Our Very Own Rojak Goody Bag	EL, CME & Art
2E	Friends of the Earth	Sci & Geog
2NA	Our Futuristic National Monument	EL & Hist
3E/3NA	Making the area around the Kallang River more attractive to locals and tourists	Sci, Geog & Maths

The project tasks are crafted by the supervising and resource teachers for their classes. Most of the projects tasks have been modified from the sample tasks given in the MOE Resource Package, taking into account, the abilities and interests of the students.

### Emphasis on PROCESS

- Forming groups/Assigning roles
- Project web to clarify the project task
- Project task allocation
- Information gathering
- Reflection / Taking Stock (thrice)
- Completion of product
- Oral presentation using powerpoint
- 'Best Projects' Presentation at Assembly





Sec 1 & 2 classes have two Explicit Thinking periods which complements the Project Work programme in the school. All PW classes have 3 'block' periods per week for their PW. These are reflected as banded subjects on the time-table e.g. 2 SG means 2 Science and 1 Geography period. This will give the students the opportunity to consult as well as get help from their resource teachers. The time-table is structured in December of the preceding year for teacher-involvement.

#### IMPLEMENTATION

LEVEL	EXPLICIT THINKING SKILLS No. of periods per week	PROJECT WORK 'BLOCK PERIODS'
Sec 1 & 2 E / N	2	3
Sec 3 E / N	-----	3

#### 'Block' periods

These are reflected as banded subjects on the time-table.

eg. 2 SG – 2 Science periods and 1 Geography period (The Science Teacher is the Supervision & Resource Teacher and the Geography Teacher is the Resource Teacher.)

'Block' periods give students the opportunity to consult their Supervising and Resource teachers. Normal lessons are carried out if students do not require help with their projects.

#### Time Frame

Time Frame	
Duration of Project Task	Jan 2001 – end July 2001
Assessment of completed projects (by Supervising & resource trs)	August
Presentation of best projects at Assembly	Sep 2001

Students work on their projects from January to end July. Their projects are assessed in August and the best projects are presented at the school assembly in September through to October.

#### ***Other features of the PW Programme***

### **HP Email Mentoring Scheme**

#### **Rationale:**

- To provide the weaker class more consultation time
- Tap on expertise of global HP staff
- To experience working with people virtually



### **HP EMAIL MENTOR SCHEME**

- Scheme started in March
- Students made use of 4 period blocks to work on projects
- Minimum of 2 emails per week – to be documented in PW files
- Review progress of mentoring programme through checkpoint responses from Mentor



An additional feature of the programme is the involvement of an outside organization. The Hewlett-Packard e-mail mentoring scheme pairs mentors from the company with students from one Secondary Two class. The students tap on the expertise of their HP mentors and get help with information on useful websites etc. The students involved have benefitted from this relationship.



### ***Mentor Involvement***

Mentors are involved in the following ways:

- Feedback on video production
- Assistance in web-page production
- Help in crafting questionnaire
- Group dynamics – How to manage groups
- Brainstorming ideas on making a boardgame
- Research – websites
- Help in crafting questions for interview

### ***Assessment***

The assessment follows the band descriptors given in the MOE Resource Package but the allocation of marks for each skills domain has been tailored to meet the requirements of the Continuous Assessment in the school.

#### **Our Project Task – to design a futuristic national monument for the S21 Committee**

1. What is meant by 'Futuristic' ?
2. Factors to consider in the design
3. How can this monument be made strong and durable?
4. Possible locations of this monument
5. How can the S21 committee be convinced to adopt the design?

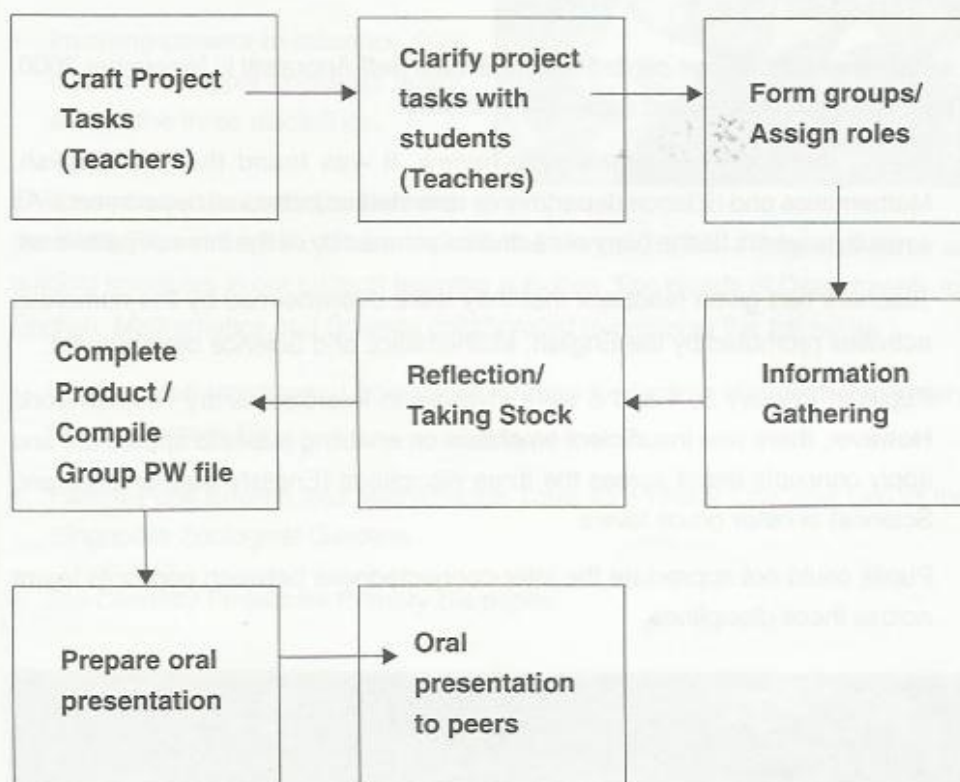
### ***Problems encountered***

- Unequal contributions from members.
- Keeping to the schedule.
- Difficulty in summarising the information we collected.
- Difficulty in getting suitable pictures.

### ***What we learnt from our project***

- Singapore is a global city...
- The properties of different types of materials...
- The multi-racial people of Singapore living in harmony...
- The importance of team work...

### ***Stages of Project Work in USSS***



### ***Follow – up activities***

Students had the opportunity to see the work done by their schoolmates at the 'Best Projects' Presentations in September and October. In addition, the projects were showcased at an exhibition on Speech Day.

**Mrs Christine Siau** is the Subject Head for English and Project Work Coordinator in Upper Serangoon Secondary School.



# EMAS in Northland Primary

Wong Bin Eng, Cha Sau Mei, Teo  
Wan Churn and Michael Long

## *Implementing EMAS in Northland*

### **Background**

Like all other schools, we carried out the School Self-Appraisal in November 2000. The following feedback and data were gathered:

- During the 2000 end-of-the year review, it was found that the English, Mathematics and Science departments operated as individual departments. As a result, teachers had to carry out activities planned by all the three departments.
- Teachers had given feedback that they were overwhelmed by the numerous activities promoted by the English, Mathematics and Science departments.
- Pupils in Primary 3, 4 and 5 were involved in Interdisciplinary Project Work. However, there was insufficient emphasis on enabling pupils to appreciate and apply concepts learnt across the three disciplines (English, Mathematics and Science) in other grade levels.
- Pupils could not appreciate the inter-connectedness between concepts learnt across these disciplines.



***Strategy to address areas of concerns in the feedback and data gathered***

From the data and feedback gathered, school leaders and the staff discussed and identified one of the three main strategic thrusts for 2001 to focus on:

- adopting an interdisciplinary approach to learning and teaching.
- involving parents to influence their children to apply concepts learnt across the three disciplines.

This emphasis was incorporated into the Work Plan of English, Mathematics and Science (EMAS). They also serve as guiding principles in our support learning activities. The Heads of Departments for English, Mathematics and Science collaborated to organise the following:

- English, Mathematics and Science Workshops for parents of pupils from Primary One to Primary Six.
- Parent-Pupil English and Mathematics Trails for Primary One and Two at the Singapore Zoological Gardens.
- Bio-Diversity Project for Primary Six pupils.





The Table below shows examples of activities involving interdisciplinary approach conducted for Parent-Pupil English and Mathematics Trails for Primary One and Two at the Singapore Zoological Gardens.

Name Of Activity	Subjects Integrated	Thinking Skill Applied	Description Of Activity
<b>Gummy Bears</b>  Venue: Polar Bear and Sun Bear Enclosures	English  Mathematics  Science	Estimation  Compare and Contrast	<b>Task 1</b> <ul style="list-style-type: none"> <li>Read and comprehend information about the polar bears at the information board.</li> <li>Estimate the height and weight of the polar bear and the number of times the polar bear is as tall /heavy as you are.</li> </ul> <b>Task 2</b> <ul style="list-style-type: none"> <li>Use the facts given at the information board to solve a crossword puzzle.</li> <li>Give the similarities and differences between the polar bear and the sun bear.</li> </ul>
<b>Rule Jengar Rule</b>  Venue: Playground at the Children's World Playland	English  Mathematics  Art & Craft	Spatial Visualization  Logical Reasoning  Creative Problem Solving	<b>Task 1</b> <ul style="list-style-type: none"> <li>Identify and list the shapes of the playground equipment.</li> </ul> <b>Task 2</b> <ul style="list-style-type: none"> <li>Colour the shapes given and cut them.</li> <li>Use the cut-out shapes to create the playground equipment you desire to have at the playground.</li> </ul> <b>Task 3</b> <ul style="list-style-type: none"> <li>Write down some safety rules which you think the Play Land should have.</li> </ul>
<b>The Gold Rush</b>  Venue: Train Station at the Children's World Playland	English  Mathematics	Interpreting Data  Making Comparison  Critical Thinking	<b>Task 1</b> <ul style="list-style-type: none"> <li>Calculate the charges for a train ride of a family, comprising of 2 adults and 2 children, using both the normal and special package.</li> </ul> <b>Task 2</b> <ul style="list-style-type: none"> <li>Calculate the savings for choosing the special package.</li> </ul> <b>Task 3</b> <ul style="list-style-type: none"> <li>Refer to the information board on the schedule of departure time for train rides.</li> <li>Find the total number of trips the train makes from 10 a.m. to 1 p.m. on Monday.</li> </ul>

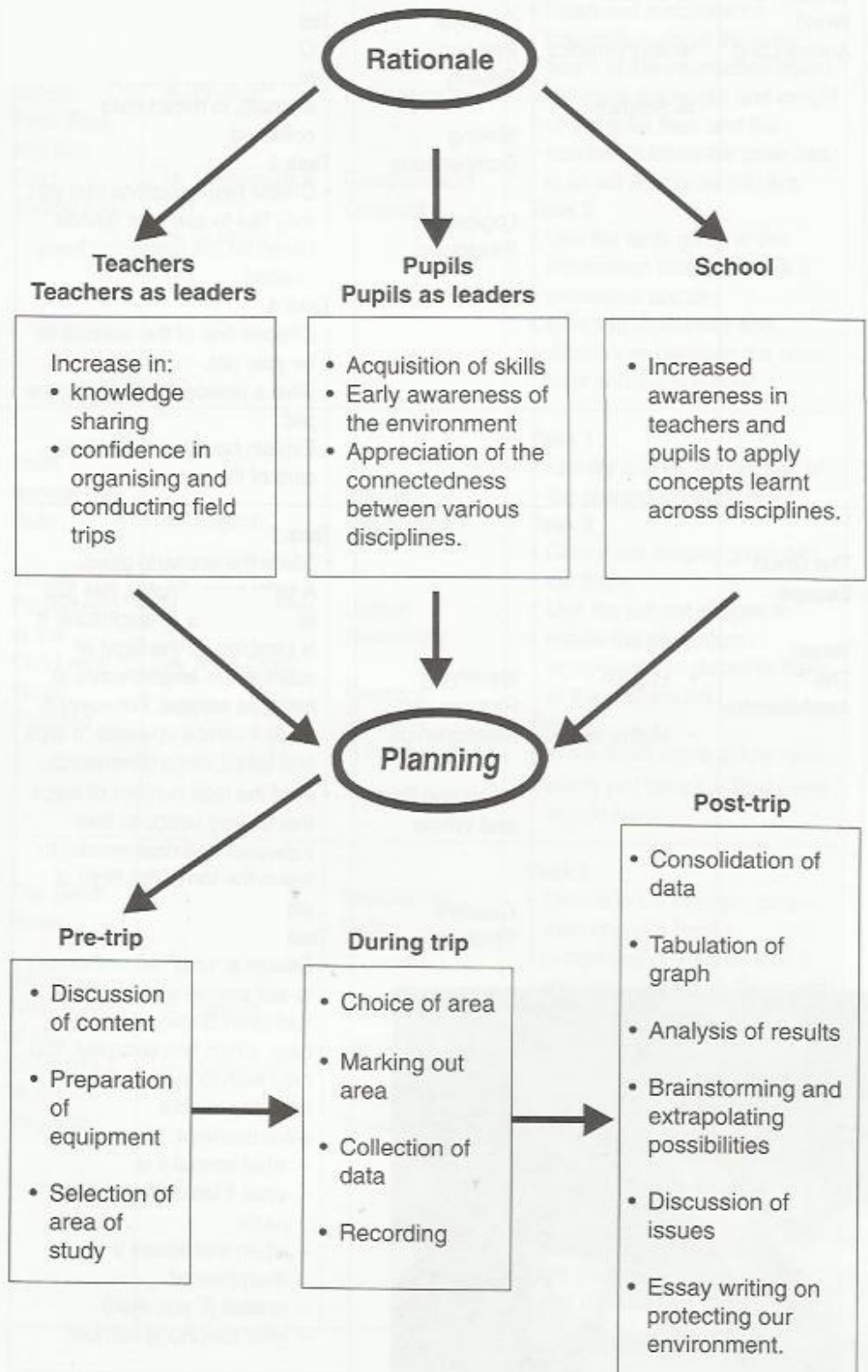
Name Of Activity	Subjects Integrated	Thinking Skill Applied	Description Of Activity
<b>Animania</b>  Venue: Children's World Animal Land	English Mathematics Science	Collecting Data  Creative Problem Solving  Making Comparisons  Logical Reasoning	<b>Task 1</b> <ul style="list-style-type: none"> <li>Walk around the Animal Land to count the number of cows, sheep, goats, rabbits and horses</li> <li>Record data in a given table.</li> </ul> <b>Task 2</b> <ul style="list-style-type: none"> <li>Create a graph, using a triangle to represent 2 animals, to depict data collected.</li> </ul> <b>Task 3</b> <ul style="list-style-type: none"> <li>Create <b>two</b> questions that you may like to ask your friends based on the graph you have created.</li> </ul> <b>Task 4</b> <ul style="list-style-type: none"> <li>Choose one of the animals to be your pet.</li> <li>Give a reason for choosing the pet.</li> <li>Explain how you would take care of the pet.</li> </ul>
<b>The Great Escape</b>  Venue: The Amphitheatre	English Mathematics	Identifying Patterns and Relationships  Analyzing Parts and Whole  Creative Thinking	<b>Task 1</b> <ul style="list-style-type: none"> <li>Study the scenario given: A baby bear, Snowy, has just escaped from its enclosure. It is climbing up the flight of stairs at the amphitheatre to make its escape. For every 5 steps it climbs upwards, it slips and falls 2 steps downwards.</li> <li>Find the total number of steps that Snowy needs to take (upwards and downwards) to reach the top of the flight of stairs.</li> </ul> <b>Task 2</b> <ul style="list-style-type: none"> <li>Design a "Lost" advertisement to ask people whether they had seen Snowy, the baby bear, which has escaped. You may wish to include the following in your advertisement:               <ul style="list-style-type: none"> <li>what animal it is</li> <li>what it looks like and its name</li> <li>when and where it disappeared</li> <li>reward (if you wish)</li> <li>your telephone number</li> </ul> </li> </ul>





**An example of a Bio-diversity Project framework  
as carried out by P6 pupils**

Subjects integrated: Science, Mathematics, English and Social Studies



## ***Benefits Reaped***

- ❖ We reduced the number of activities organised by the three departments. Thus, we contributed to reducing the teachers' level of stress.
- ❖ At the same time, the strategic thrust to use interdisciplinary approach helps the three departments to be more focussed in achieving goals set. School and departmental goals and priorities were matched and met.
- ❖ Pupils enjoyed the opportunities to extend the application of knowledge acquired in the various disciplines to real-life situations that were beyond the boundaries of their classrooms. This increased their joy and gave meaning to their learning.
- ❖ Parents were extremely appreciative and supportive of this learning approach. They have a better knowledge of what their children were learning in school. This led to greater collaboration between parents and teachers in enhancing pupils' learning experiences.
- ❖ Parents' appreciation of the challenges and difficulties their children sometimes experience in their learning journey has increased.
- ❖ The Trails also created opportunities to increase bonding between parents and their children as they became immersed in completing the challenging tasks at the five stations. For example, at The Great Escape station, parents and children were seen holding hands and role-playing to solve the task assigned.
- ❖ Teachers, parents and pupils had greater appreciation of the connectedness between concepts learnt in the different disciplines.
- ❖ Teachers were less apprehensive to explore and employ interesting teaching methodologies to provide opportunities for pupils to apply concepts learnt across disciplines in the classroom.

## ***Reflections***

We recognized that the activities planned were too challenging for our Primary One pupils. Parents gave feedback that they had to give their children a lot of guidance to complete the activities. On the whole, it was a good learning experience for them.





More time should have been given for pupils to walk around the Zoological Gardens with their parents. In fact, several parents also took the opportunity to teach their children other Science concepts. We should also have allocated time for parents and their children to watch the animal shows.

There were two other 'surprise' benefits that we reaped from organising the Trails.

- ❖ In the process of organising the Trails, we saw a significant increase in bonding and collaboration amongst the Primary One and Two teachers. Teachers' capacity for reflection and being more proactive increased as they engaged in dialogue and discussion when planning and organising the Trails. The moral support that teachers' lent to one another helped to allay fears of being judged by their pupils' parents. In fact, on the day of the trail, the teachers displayed a very high level of professionalism that impressed the parents deeply.
- ❖ We realised that it had become a good channel for enhancing the image and social standing of the school. It is, in fact, an effective and cheap method to advertise and 'sell' the school. This is possible when school leaders and the staff ensure that the Trails continue to be well-planned and organised by our competent and dedicated teachers.

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**Mrs Wong Bin Eng \***, **Mrs Cha Sau Mei**, **Ms Teo Wan Churn** and **Mr Michael Long** were the teachers working on this project in Northland Primary.

*\*Note: Mrs Wong is currently the Vice-Principal of Jiemin Primary School. This article was written when Mrs. Wong was a Head of Department in Northland Primary*



# Web-Tutoring Project in River Valley High

Teo Soh Wah

It all started in 2000, when the Mathematics Department wanted to set up a Peer-tutoring Project with a difference – to make use of advanced technology and the internet. This would meet the academic objectives as well as ride on the current interest of young people to conduct peer interactions via the internet. With the help of the staff of Ngee Ann Polytechnic and collaboration with the Mathematics Department of Bedok Town Secondary, the project was able to take off.

A group of senior River Valley students were identified as tutors to help the Sec I Express and Normal (Academic) students in Bedok Town Secondary School improve their Mathematics without having to travel to each other's homes or school. Tutors would e-mail weekly assignments to their respective students. These students would then have one week to complete the assignments before submitting their work back to the tutors via e-mail. In the course of interacting on the project, new friends were found and friendship bonds were built as the peer tutors learnt and benefited from their 'students' as well!

Hi Azilah! I have included some hints in this assignment and hope that you won't have any problem with this assignment! ☺ Try your best OK? Love you...

Some formulas to help you...

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $(a + b)(a - b) = a^2 - b^2$
- $(a + b)(c + d) = ac + ad + bc + bd$
- $x^2 + xy = x(x + y)$

1.  $(x + y)^2 =$

- (a)  $x^2 + y^2$
- (b)  $x^2 + 2xy + y^2$
- (c)  $x^2 - 2xy - y^2$
- (d)  $x^2 + 2xy - y^2$

2.  $(2a + b)(2a - b) =$

- (a)  $(2a)^2 + b^2$
- (b)  $2a + b$
- (c)  $a + b$
- (d)  $(2a)^2 - b^2$





#### Student's Answer(read-only):

hi, I have work out the answers:

- 1.(b)
- 2.(d)
- 3.(d)
- 4.(c)
- 5.(a)
- 6.(c)
- 7.(d)
- 8.(d)
- 9.(a)

#### Tutor's Comments :

Great! This time you've only got one mistake!!! Cool! Look at question 7 again and see if you can work out the correct answer...The answer for Q7 is (c)  
Take care! [8/2/00 7:01:16 PM]

Upload Attachment

Assignment Description

#### *A learning experience for all*

Feedback from the peer tutors was very positive and they felt that they had learnt to be more responsible and disciplined. In trying to make their students understand the difficult mathematics concepts, they also learnt to be motivating in word and deed, to a less able student. It took effort to make mathematics interesting for a peer who may not be mathematically inclined. They readily agreed that it was necessary to have the right attitude in order to participate as a peer tutor. They had to learn to look beyond the project and see that it is not just a Community Involvement Programme.



Peer Tutors of River Valley High.

### ***Difficulties faced***

At times, communication breakdowns were inevitable as the students from both schools were on different examination schedules. There were times when either 'tutor' or 'student' were cut off from each other. There was no contact via the phone, regular mail or e-mail when the examinations were on and the affected students buckled down to studying. Student tutors also reported that at times they were unsure of what topics to set as assignments for their 'students'.

### ***Solutions and suggestions***

With hindsight, it would have been good to allow the student tutors access to and contact with the respective Mathematics teachers in the partnering school. Periodic conferencing would allow the peer tutors to find out what kind of assignments they should set so as to better meet their tutees' needs. The students themselves realised that they had to exercise self-discipline and make it a point to set assignments on time, no matter what their own personal schedules were.

### ***Conclusion***

There was a general consensus that the benefits derived from this project far outweighed whatever difficulties that may have been faced by either the student tutors or the students. Therefore, there are plans for the students from both schools to continue on this project in future.

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***Mdm Teo Soh Wah*** is the Head of Department for Mathematics in River Valley High.







# Mathematics Department Projects in Bedok Town Secondary School

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Eric Leong

## *Introduction*

In our ever-changing and demanding world, our pupils are required to be flexible, resourceful and creative. IT is also a pre-requisite and an important mode for communication and learning. IT is shaping our education system and our future. Our pupils will need to learn how to use IT effectively

The benefits of IT are clearly seen in Bedok Town Secondary School's Mathematics Department's efforts to incorporate IT into their Instructional Programme. Two important projects that the department has piloted are the "**Peer Tutoring Programme**", a collaboration with River Valley High, and the "**Internet Holiday Homework**".

## *Methods*

### *a) The "Peer Tutoring Programme"*

The "Peer Tutoring Programme" started in 2000 with the help of Ngee Ann Polytechnic. Students from Bedok Town Secondary were virtually tutored in Mathematics by the senior students from River Valley High. The programme continued in 2001 and will be an on-going programme for the students.

A weekly assignment was e-mailed by tutors to their 'students', who in turn were given a week to complete and submit the assignment to their respective tutors. The tutors will mark and provide feedback. The students are also encouraged to e-mail any problems they may encounter in Mathematics to their tutors.

### *b) "Internet Holiday Homework"*

Piloted in June 2000, the Mathematics holiday assignments for the Secondary 1 students in the Express and Normal Academic were assigned to the students on the Internet. The assignments are posted weekly and students are expected to retrieve the homework from the Internet.

The Project continued its reign during the December 2000 and June 2001 holidays. Levels were included by phases and it is expected that this mode of assigning homework will be extended to all levels within the next 2 years. This project encourages students to be responsible and to have more exposure in the use of the Internet. A helpdesk is being set-up (e-mail addresses of teachers) for students to contact the teachers when they have difficulty with their assignments.

## **Findings**

### **The “Peer Tutoring Programme”**

The students were asked to provide feedback (through e-mail to the teacher in-charge) regarding the peer tutoring programme.

The students from Bedok Town Secondary School have benefitted from this programme in the following ways:

- They have more exposure in the use of IT, e.g. improve in their Microsoft Word skills and more exposure in use of the Internet.
- There is improvement in the grades of some of the students involved in this programme.

**Note:** Refer to **Appendix A** for an e-mail feedback by one of the students involved.

### **“Internet Holiday Homework”**

There were many benefits from this Project and some of the significant ones are listed below:

1. Students were taught to be more responsible and to obtain their own assignments.
2. There was an improvement in Parent-School Collaboration. There were parents who helped their children to retrieve the assignments and became involved in their children’s progress on their holiday assignments.
3. Foreign students could also retrieve their assignments from any where in the world. Even students who lose their assignments can retrieve another copy at any time convenient to them.
4. There was easier access to help from teachers, the students could e-mail their questions to the teachers directly.

Here are some comments from our students’ parents:

“Once again, thanks to you (The Mathematics Department) for working so hard and preparing the students with homework that they can retrieve from the school website.”

**Bibi Fatimah Binti Sheikh M J**  
(Parent of Student from Sec 2E2)





"...this is really a marvellous concept. Keep it up!"

**Nithya**

(Parent of Student from Sec 2E2)

### **Conclusion**

Through the use of IT and with the help of River Valley High, the Mathematics Department has found interesting ways to enhance the learning of Mathematics. It is also good to know that the students and parents have found the two projects to be beneficial. The department will continue with these projects and extend it, in phases, to encompass all the levels.

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**Eric Leong Yew Hon** is the Level Head for Mathematics in Bedok Town Secondary School.

Appendix A: E-mail from a Bedok Town Sec student who was on the Peer Tutoring Project.

Hi Mr Leong,

I'm Rosemarie Deng Aixian from 2E1. I was selected by Mrs Ng to participate in the Maths web-tutoring programme. You had requested us to tell you some comments on this programme long ago in April. I would like to tell you now. I hope that I am not too late to do so.

Well, I will start by giving you some comments on my web-tutor, Eunice Tang from River Valley High School. She's actually a very creative person because whenever she gave me the weekly assignments, she would decorate it with cute, colourful pictures and words to make it more attractive for me. I think this is a very good idea because this will encourage me to love Maths. And she gave me every assignment punctually on Tuesday and explained clearly and systematically the questions that I had attempted but got them wrong.

Moreover, she also helped me in my schoolwork too. She's a great....great....great help to me!!! I think I have benefitted from this web-tutoring programme. Not only did I improve in my Maths tremendously, I also made a new good friend.

This programme should continue between schools because we can interact with other students and learn new things from them. I hope to meet my web-tutor one day, in person, so that I can get to know her better.

**Rosemarie**

# Reaching Out and Doing Things Differently in Anderson Junior College

Derek C. Trueman

*One of the key goals of Anderson Junior College is to nurture the students to become innovative leaders, able to use creativity and originality in a rapidly changing world. To meet this goal, the principal, Mr Tan Tiek Kwee, challenged all students and teachers to do things differently. This article will share how the college's Current Affairs Society, headed by Mr Derek Trueman, a geography teacher, was able to meet that challenge, with only twelve dedicated members and reach out to the whole college in four different ways.*

## **General Knowledge Quiz**

Once a year, thirty-four JC1 classes are given a short Current Events 'Test'. The best three teams enter a Grand Final held in front of the whole year group in the Auditorium. They contest eight creatively-inspired Rounds, dreamed up by the Society members, in an entertaining and educational forty-five minute quiz run completely by the Society members themselves. Strong use is made of IT, with all questions shown to the teams through computer monitors and to the audience via a big screen Microsoft Powerpoint production. This popular Quiz has enabled Society members to develop initiative, creativity, leadership and organisational talents.

## **Current Affairs Magazines**

The Society also produces a magazine, "AWARE", two or three times per year, on current issues to assist students in their general knowledge and their General paper "A" Level examination. Each magazine consists of ten to fifteen essay-length articles, written by the Society members on issues they research. The authors aim to provide both existing information on the topic as well as share their own opinions or interpretations. Some essays are highly original and creative in their own right. Owing to printing costs only about eight copies are given to each class, but the whole magazine is placed on the College intranet website for student reading and downloading. The magazines are enthusiastically awaited and well received.





### **USA Crisis Opinion Board**

The day after the New York World Trade Centre disaster, students designed a large notice board for the college foyer. Media information was updated daily on half of it while the other half was devoted to students' opinions during those awful days. Surprisingly, it was very popular and soon the board was full. Perhaps even more surprisingly, there were hardly any contributions that offended and had to be removed. This represented another effort to reach out to the whole student body at very short notice and which turned out successful.



*"Hougang Polling Station" before polling begins.*

### **2001 General Election**

The Current Affairs Society "adopted" a constituency – Hougang, because its own constituency, Ang Mo Kio, was not contested. This was done to highlight to the students the machinery of a General Election, in line with their National Education programme within the College.

Notice boards were set up in the Foyer explaining the stands of the two opposing candidates, using information gained by actually

attending the Election Rallies and from varied Media sources. A television and VCR played highlights of the televised Party Political Broadcasts. Students handed out information sheets to the passing "electorate" during recess. Time was allowed during Assembly each morning for one week to remind the students of the main issues and to advise them to read everything they could on the Hougang constituency contest. At the end of the campaign, a proper polling booth was set up at the Canteen and all JC1 students had to produce identification and compulsorily vote either for Mr Low Thia Kiang (Workers' Party) or Mr Eric Low



*Waiting for their turn to "cast their votes".*



(Peoples' Action Party). The Principal acted as Returning Officer and the HOD's as the 'scrutineers'. Staff was able to vote too (for some their only chance this Election). The result was officially announced on the last day. The whole 'election' exercise was a popular success for the organising students and the "electorate", in terms of teaching both how a General Election occurs, as well as the important considerations which need to be made before voting responsibly as a citizen. By having the exercise based on a real constituency and real candidates, the added air of authenticity made it more exciting, as did the presence of a TVWorks reporter and camera crew. The whole exercise was aired as a segment on TVWorks Election Night Special on 3rd November, before the results were announced.

The following is a report on the event submitted by a JC1 student, Kenneth Chia, and a member of the Current Affairs Society:

### ***AJ's Mock General Elections***

by  
Kenneth Chia

*It is not everyday that one gets to see solemn, pensive individuals lining up in an orderly fashion in front of counters flanked by voting booths. (Nay not with the typical Singaporean's kiasu mentality and pragmatism, at least.) In fact, this phenomenon takes place a mere once every five years in Singapore. For most Anderson Junior College students, it is probably the first time they had ever witnessed and taken part in such an event – a mock General Election.*

*The school population was first informed of this exercise around a week before the actual event, and I could vaguely recall the "uh huhs" and "hmmms" coming from the audience. Not exactly the enthusiastic response that one would expect from the "top twenty percent of the nation's cohort" (who are expected to be politically aware, of course). Further considering that this had been the brainchild of the Head of Arts, Mr Sim Chong Boon, and the first of its kind ever to be held in school, the announcement absolutely*



Tracy Quek, TVWorks reporter filming AJC Students on "Polling Day".



"Polling Day" in full swing.



*deserved a more exuberant reaction. However, when a second announcement informed the students that television reporters would be coming down to cover our elections, realisation suddenly dawned on them. This was no shoddy activity, and it was definitely going to be AJC's shot to fame. "History in the making?" I asked myself.*

*The mock General Election took the school by storm. Batches of students flocked to the notice boards located at the Foyer, where information pertaining to the actual elections was pinned up, so that they would not sound "politically incorrect" if they had the honourable chance of being interview. Others kept abreast of rallies that the various political parties had organised so as not to make a wrong choice during the mock election. Since Hougang had been adopted for AJC's mock election, there were whispers of "Eric Low or Low Thia Khiang?" all around the college.*

*Yes, you are right. I am probably exaggerating things a bit. But that aside, most students could be seen to be exhilarated on the day of the election itself. That morning, the Current Affairs Society members arrived in school early, and we swiftly geared ourselves up for a thrilling, yet possibly arduous day of work. I vividly remember the multitude of people reading up-to-date information off the notice boards, even at 7.00 a.m. much to my surprise. Most probably, they are attempting some last-minute memorisation of facts so that they would be able to regurgitate everything in case they had the opportunity of appearing on national television. There were still many things to be done before 9.15 a.m., when the reporters were due to arrive and the first batch of students would begin voting. The class lists had to be arranged in a specific order so that there would not be any disruption in the casting of vote; officers guarding the ballot boxes also had to maintain order. Everything just seemed so mind boggling when the crowds started coming in. Cameras rolled; lights flashed. Boisterous laughter rippled through the crowds as they*



*AJC Students being interviewed by TVWorks reporter, Tracy Quek.*



lined up and got ready to cast their votes. Mr Trueman, the teacher-in-charge of the Current Affairs Society, became very busy directing the camera man, speaking to the reporter and controlling the crowd. My fellow members of the Society proved that even though we were greenhorns for such an event, we still managed to carry out our tasks with absolute efficiency. Occasionally, teachers came down from the Staff Room to participate too and students greeted them jovially. Well...everyone was well aware that the crewmen from TVWorks News were filming the entire event. Reputations were at stake.

Throughout the duration of the election, interviews were held with various members of the Current Affairs Society and selected students. Most interviewees spoke well, but a bit of stammering here and there was unavoidable for some. In the end, everyone went off happily, hoping that what they said would eventually appear in the paper. It would have been a bonus to the dash of excitement for the day.

The counting of votes would have been an easy task if not for the small number of spoilt votes. The cameraman also made us re-enact our actions so as to make them, ironically, look more "natural". Soon after, the results were passed to our principal, Mr Tan who graced the event and made the announcement to a small audience. The results were also consequently announced the following day during morning assembly to the entire college.

Just when everyone thought that the pain and sweat and toil was all over, we realised that the cleaning up could be gruelling too. Nevertheless, while carrying all the tables and chairs back to the respective classes, we were grinning from ear to ear. Well, publicity and satisfaction were the fruits of our labour and we could already feel the relief coursing through our bodies. Never mind if the results of our mock election were "politically incorrect". Never mind if AJC's election was only a two-minute clip on the TVWorks Election Special. It had been terrific seeing the entire school supporting this event. That, perhaps, is what we have identified as the AJ spirit. Just the way it should be, I suppose.



AJC "Counting Centre" in action.



# *Teachers' Clipboard...*

## **A Teacher's Prayer**

Enable me to teach with

**Wisdom**

For I help to shape the mind.



Equip me to teach with

**Truth**

For I help to shape the conscience.



Encourage me to teach with

**Vision**

For I help to shape the future.



Empower me to teach with

**Love**

For I help to shape the world.

*Author unknown*



## MEMBERSHIP FORM

NEW APPLICATION ☐RENEWAL ☐UPGRADING MEMBERSHIP ☐

If this application is for renewal or upgrading, please provide previous Membership No: \_\_\_\_\_. Thank You.

Name (As in I/c): \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Postcode: \_\_\_\_\_

Telephone: (Home): \_\_\_\_\_ (Office): \_\_\_\_\_ Fax: \_\_\_\_\_

Organisation / School: \_\_\_\_\_

Occupation: \_\_\_\_\_ Sex: \_\_\_\_\_ Race: \_\_\_\_\_

Membership Category: (please tick against type of membership selected)

Types of Membership	Fees Payable	Please tick
Ordinary Membership <i>For those interested in supervision, curriculum and instruction.</i>	S\$30.00 per annum	<input type="checkbox"/>
Institutional Membership <i>For schools, institutions, libraries or educational societies.</i>	S\$300.00 per annum	<input type="checkbox"/>
Life Membership <i>For individuals</i>	S\$500.00	<input type="checkbox"/>

Payment: (please tick one)

☐ Payment by cheque:  
Enclosed, please find my cheque number \_\_\_\_\_ of S\$ \_\_\_\_\_ in payment  
for membership in ASCD Singapore.

☐ Payment by Visa Card:  
Please charge membership fees of S\$ \_\_\_\_\_ to my Visa Card.  
Card holder's name (in block letters): \_\_\_\_\_  
Account Number: □□□□ - □□□□ - □□□□ - □□□□ Expiry Date: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Please make payment to "ASCD Singapore" and return completed form to:

The Treasurer  
ASCD Singapore Secretariat Office  
c/o Tele-Temps Pte Ltd  
1002 Toa Payoh Industrial Park #06-1475  
Singapore 319074  
Tel: 250 7700

For official use only:

Remarks: \_\_\_\_\_

Date Received: \_\_\_\_\_ O/Receipt No \_\_\_\_\_

List Updated ☐ Membership No \_\_\_\_\_Computer Updated ☐ Card Issued ☐



