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Incorporating Thinking Tools to Enhance Facilitation of Problem-Based Learning

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INCORPORATING THINKING TOOLS TO ENHANCE

FACILITATION OF PROBLEM-BASED LEARNING

by

John W. Yeo

An Abstract of a Project

in

Creative Studies

Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science

December, 2008

Buffalo State College

State University of New York

International Center for Studies in Creativity

ABSTRACT OF PROJECT

Incorporating Thinking Tools to Enhance Facilitation of
Problem-Based Learning

This project focuses on a review of challenges some teachers experience during

facilitation of Problem-based learning (PBL) and aims to design a training package to

address the above challenge. This training package consists of some Thinking Tools that

can enhance cognitive engagement in PBL. In addition, Thinking Tools equip teachers

with a wider range of facilitation strategies to increase their flexibility to better meet the

needs of each stage of PBL. Through the use of Thinking Tools, this training package

provides opportunities to foster new relationships between teachers and students through

the development of student-led enquiry-based learning activities. The Thinking Tools

also help to equip students with creative and critical thinking skills that will develop their

responsibility to and ownership of their learning.

Date: December 8, 2008

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<u>December 8, 2008</u>

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                                        Candidate

Dedication and Acknowledgment

My Master Project is the culmination of a deep interest to develop myself both academically in my pursuit of creativity studies as well as professionally in problem-based learning. I wish to dedicate this project to my loving wife, Vanessa and our darlings- Joshua and Joanna. You were my inspiration- especially during the painful months while I was away on the other side of the globe. Your support and love drive me to pursue what I truly treasure- *creativity*!

I would like to acknowledge the many wonderful people who have provided me with the best learning opportunity. To my two cohorts of classmates- *Lucky Sevens* (2007) and *Class on the Grass* (2006) as well as dear friends in Toronto, wonderful friends in Emergenetics in Colorado & Singapore, as well as the many buddies in my Garden City-Singapore, our shared passion for the manifestations of what is creative, will always remind me to push the boundaries of education in the 21st Century, and serve my community and beyond through this work. Special thanks to Irene and Alice- you both are best positioned to understand the needs of our Singapore educators as Master Teachers who have worked extensively with PBL projects. I would also like to thank Professor Tan Oon-Seng for generously sharing his insights on this project.

To the two leaders, maestros and lovers of creativity- Susan Keller-Mathers and Mary Murdock, both of whom I have utmost love and respect for all that they believe in education as well as creativity, *thank you.*

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SECTION ONE: PROJECT BACKGROUND

Introduction

The knowledge of strategies gained from my Master of Science degree programme in Creativity Studies and Change Leadership as well as the propensity toward applying them propelled the exploration to leverage the rich learning for my professional development. This project- *Thinking Tools to Enhance Facilitation of Problem-Based Learning* is a creative product derived from my personal exploration in the creative problem solving process: sensing gaps, defining problem, gathering and evaluating information, and developing solutions.   I aimed to create a training package that incorporates some of the Thinking Tools from the module on *Advanced Cognitive Tools for Creative Problem Solving* (CRS 614) to enhance effectiveness of facilitating Problem-based learning (PBL) for teachers.

In the spirit of learning to be a reflective practitioner, I aspired to synthesise a more hands-on approach to increase flexibility of teachers by equipping them with a wider range of facilitation tools to enhance metacognition. For the purpose of this project, a Thinking Tool can be defined as "a structured strategy to focus, organise, and guide an individual or group's thinking" (Puccio, Murdock, & Mance, 2007, p.95). Through the use of Thinking Tools, this project aimed to foster new relationships between teachers and students through the development of student-led inquiry-based learning activities, especially in PBL where learning is an active process with students mutually engaged in dialogue. Thinking Tools thus serve as scaffolds to make the thinking more "visible" to all. The overarching goal is

to empower teachers to facilitate young people's development of thinking skills through

PBL as well as to foster greater responsibility and autonomy in their learning.

Thinking Skills as a Core Competency of 21st Century Education

This project integrates two areas of theory into a single practice: facilitating

problem-based learning and enhancing thinking skills. Treffinger (2002) used productive

thinking as an expression that includes creative thinking, critical thinking, problem solving,

and decision making. While productive thinking is recognised in many of the US national

educational reports, he was of the opinion that it will help students meet the challenges of

shaping, supporting and advancing local, national, global priorities and goals. Similarly,

my comparison of the different educational models of 21st Century literacies (see Appendix

B) showed the common focus on the importance of equipping students with thinking skills

to help them contribute effectively in a knowledge-based global economy.

Curriculum Innovation in Singapore

Singapore's Ministry of Education (MOE) initiated the *Teach Less, Learn More* or

TLLM initiative (http://www.moe.gov.sg/press/2008/pr20080108.htm) in response to the

Prime Minister's call for education to move towards a more flexible system that nurtures

students with a capacity for independent thinking (see Figure 1).
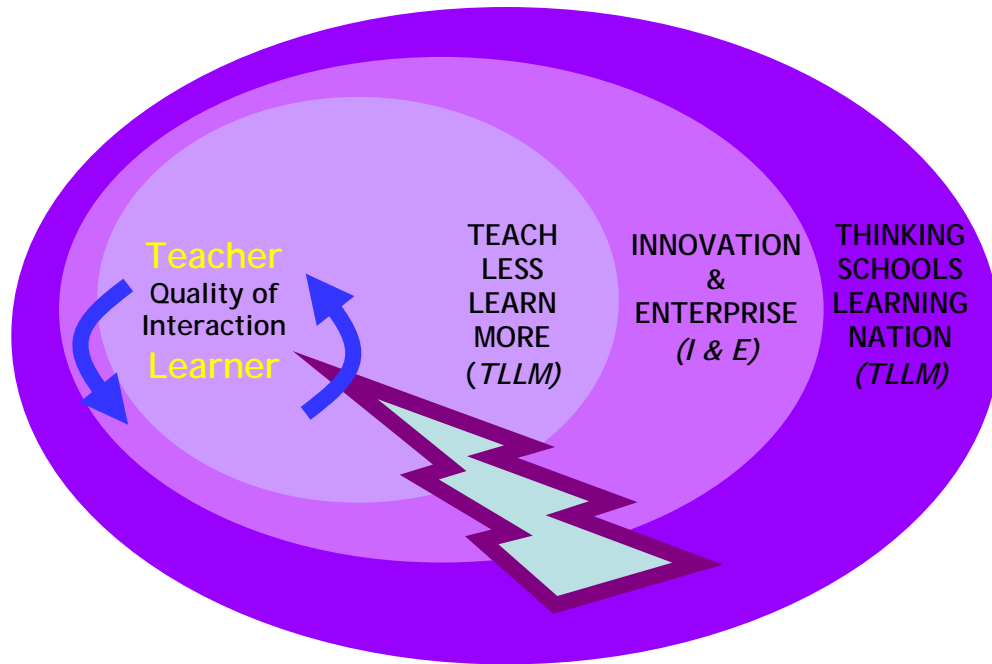
Figure 1
Genesis of 'Teach Less, Learn More' initiative

Since 1997, Ministry of Education (MOE) has adopted the vision of *Thinking Schools, Learning Nation* or TSLN. This vision of TSLN still holds true today and it provides the basis for all our education decisions. Under this vision, MOE established a firm foundation in the core areas and continue to grow from strength to strength in these areas and aspire to bring Singapore schools to a higher level. The *Innovation and Enterprise* or I & E was launched in 2003 to encourage a mindset of initiatives and creativity. 2005 saw a progressive movement towards TLLM. TLLM builds on the groundwork laid in place by the systemic and structural improvements under TSLN, and the mindset changes encouraged under I&E. It continues the TSLN journey by focusing on improving the quality of interaction between teachers and students, so that students can be more engaged in learning and better attain the desired outcomes of education.

Teach Less, Learn More

Figure 2 shows the TLLM framework. It contains core components which bring about TLLM in schools. The learner is at the centre of everything MOE does. MOE recognise that students have diverse needs, abilities, aspirations and backgrounds. As educators of the 21st century, Singapore teachers are asking how we can more effectively cater to the needs of our students, and teach in a manner that can better prepare them for life. One systemic approach was to allow schools provision to customise curriculum and programmes by leveraging on school-based innovations to engage their students better. Beyond the curriculum flexibilities, time and space, and developing the capacity of teachers and leaders, there needs to be an open and sharing culture, in order for school-based innovations to be developed and sustained. To support the schools in their TLLM *Ignite!* journey, MOE started a curriculum partnership for each school. This partnership presents a synergistic alliance between MOE and schools in customising curriculum to develop teacher capacity for schools to actualise their TLLM ideas.
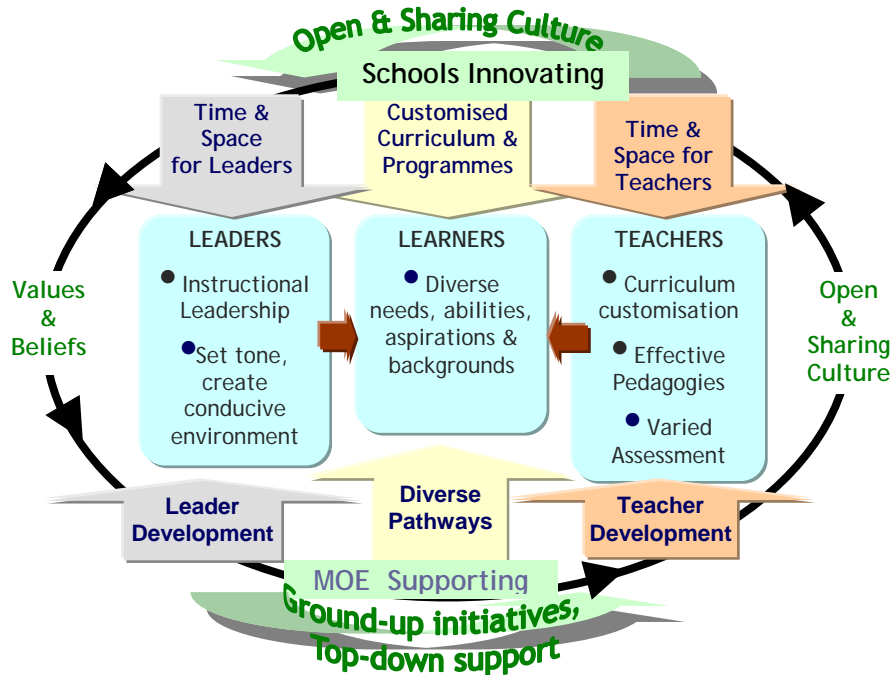
Figure 2
TLLM Framework

As a curriculum partner, I support a network of Research Activists (RAs) while they design, plan and implement their action research on Problem-based learning (PBL). As the RAs carry out their action research to investigate the effects of these new ways of teaching and learning, they also come together as a community of learners to carry on a dialogue with one another and curriculum partners to deepen their experience with these curriculum innovations. I have the opportunity to work closely with the RAs to help them design, implement and evaluate their own research project. Over the past months, my observations of this network of RAs facilitating the PBL in classrooms further deepen my own understanding of the intricacies of implementing PBL in different classroom contexts. As a curriculum partner, my reflections and evaluation of the process led me to unpack the challenges faced by some of these RAs with their experience in PBL.

Problem-Based Learning

A New Way of Teaching

PBL is a pedagogical approach that facilitates active construction of knowledge. It has been adopted by many learning institutions around the world since its inception in the late 60s in the medical school at McMaster University in Canada. Today, PBL is one of the most popular a curricular innovations in education (Marincovich, 2000). The relevance of PBL seemed all the more important with "advanced economies, innovative industries and firms, and high-growth jobs (that) require more educated workers with the ability to respond flexibly to complex problems, communicate effectively, manage information, work in teams and produce new knowledge" (Partnership for 21st Century Skills, 2008). With Forgarty defining PBL as a "curriculum model designed around real-life problems that are ill-structured, open-ended, or ambiguous" (1997, cited in Wu and Forrester, 2004, p.64), it thus further suggests why many education reform movements embrace PBL.

Characteristics of PBL

Unlike traditional didactic teaching where students amass and assimilate taught knowledge, PBL has been more objectively described as starting with an ill-structured mess (Gardner, 1983). While students address this initial "mess" through discussion and research, they begin to determine the real issue at hand (Fogarty, 1997). Tan (2008) in his keynote speech address at the 7th Asia-Pacific Conference on PBL in Shenyang, China, noted that PBL is a highly learner-centred pedagogy. In his slides, he highlighted that PBL integrate advances in cognitive, psychoneurological and learning sciences. He also shared

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that PBL is able to demonstrate efficacy in knowledge construction and application with deeper awareness of the range of cognitive functions and allows students to apply them within rich and meaningful problem solving situation.

Wu & Forrester (2004) summed up the following characteristics displayed in PBL approaches:

1. All PBL approaches begin with a problem or question;

2. The process of PBL involves clarification, definition with reframing, analysis, and summary with synthesis;

3. Students assume primary responsibility for analysing the problem and making inquiry;

4. The teacher's role is primarily facilitative.

In a typical PBL process (Tan, 2003) PBL schema will include the following stages:

1. Meeting the problem;

2. Problem analysis and learning issues;

3. Discovery and reporting;

4. Solution presentation and reflection;

5. Overview, integration and evaluation.

The Creative Tension

If creativity is needed to bring about new thinking to resolve a problem, then diagnosing the critical gap first is essential for effective problem solving. The opportunity to serve as a curriculum partner to the RAs in the PBL network has allowed me ample

opportunities to carry on a dialogue with the research activists on their problem-scenario crafting, observe the planned PBL lessons and co-evaluate their research.

I observed that some of the PBL lessons struggled to attain the intended learning outcomes and superficial learning took place in some of the classes based on the analysing the products of some students' work. In addition, the interaction with some students and teachers led me to believe that in many of these first-time PBL lessons, there was little evidence of acquisition of problem solving skills, depth of disciplinary inquiry and discipline-related reasoning skills.

Another level of discourse is derived from the pedagogical shift that is pre-occupied with content. Since PBL designs learning around 'real-world' problems, students then achieve learning outcomes through the process of actively working on unstructured problems. By exposing students to viewing problems framed in a real-world context, teachers themselves then need to have both the skill-set and mindset to discern the nuances of the changing forces, and synthesise new ideas to function amidst a complex and chaotic environment, manage multiple changing and emerging factors, and appreciate learning as connecting, creating and making an impact. This would imply then that PBL teachers need to have a clear conception of what is understood by thinking. Otherwise, if the teachers fail to achieve a sufficiently clear conception of thinking, then the chance of effective teaching or assessing learning through PBL will be greatly diminished.

Facilitation to Enhance the Creative Process of PBL

Rhodes (1961) articulated his conception of creativity in terms of 4Ps- *Person, Process, Product and Press.* Comparatively, PBL as a pedagogy involves teachers in

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mediating students' learning (i.e., *Person*) through a problem scenario with iterations in

information processing (i.e., *Process*). Furthermore, Weissinger (2004) pointed that in PBL,

metacognition can be derived through activities such as journaling, discussion and self-

evaluation, thus cognitively helping teachers and students "use good judgment with respect

to knowledge" (p.51).   PBL also requires an inquiry mindset of both teachers and students

to embrace an open learning environment (i.e., *Press*) to accept the 'chaotic' nature of

unstructured learning through the problem. On a process level, teachers also negotiate the

acquisition of knowledge and skills with much self-reflection- constant monitoring,

assessing the level of interactions and learning, as well as making mental notes on next

steps, etc. All of the above were done with consideration of the dispositions of students in

order to bring about a fruitful learning experience. In addition, Simonton (1988, 1990)

added a fifth P- *Persuasion*, thus emphasising the teacher's role of facilitative leadership

that can influence the degree of meaningful engagement in a PBL classroom. Thus, by

improving facilitation skills, teachers can better help students develop their metacognition

throughout the PBL process.

In PBL, the teacher facilitates both the learning of the content (i.e., learning agenda

and domain-specific knowledge acquisition) as well as the process (i.e., methods,

procedures, group dynamics, climate of interaction, etc). Tan (2004b) opined that PBL

teachers need to have a "defined core body of disciplinary knowledge" since "the purpose

of PBL is to enable students to appreciate the depth of the inquiry often unique to the

discipline" (p.205). This lends support to how PBL can enhance creative thinking with

Kaufmann's (1988) proposition,

> We may now expect that high-level creativity is crucially dependent on a
> large amount of well-organised domain-specific knowledge. Before the fruits

of creativity can be reaped, then, we may expect that a long history of building up domain specific knowledge and skills must precede. (p.114)

Thinking Tools and Problem-Based Learning

This led me to realize that Thinking Tools can be effectively employed to organise the knowledge. This new-found connection made much sense as I realised that both creative thinking as well as PBL require iterations of divergent and convergent thinking. If PBL requires students to build on prior knowledge, then divergent thinking is needed to "intentionally opens up new possibilities… challenges paradigms and creates new knowledge" (Puccio et al., 2007, p.72). On the other hand, Puccio et al. (2007) also point out that convergent thinking requires a critical awareness of the standards that must be met to ensure success by making decisions on alternatives which are most useful. Likewise, PBL requires students to converge by making meaning of the problem scenario and gather relevant information in order to ensure that learning results in enhanced knowledge acquisition.

Further incubation of the problem led to the new thought: that if PBL requires students to solve an "ill-structured" problem in a real world context, and that the learning from one subject area in PBL should be transferable to other areas in curriculum and everyday life, then it ought to make good reasoning for PBL to 'adopt' real world tools such as those used frequently for knowledge management in organisations. Examples of such tools include SWOT Analysis and Gap Analysis Diagram, which are used for envisioning and/or strategic planning sessions. I was thus intrigued to explore whether the use of such 'real-world' tools enhance the effectiveness of solving real-world problems in PBL. This sparked my curiosity then to uncover the Thinking Tools identified by Barbero-

Switalski (2003) gathered from sources such as Total Quality Management, Strategic

Management and Creative Problem Solving Process, and study the relevance of these tools

to PBL thinking processes. My literature review also led me to conclude that there is little

research on the use of these 'real-world' Thinking Tools with direct application to PBL.

SECTION TWO: PERTINENT LITERATURE

Introduction

This chapter reviews and highlights some of the literature that supports how thinking skills, especially those pertaining to metacognition, can bridge the gap to strengthen facilitation during PBL. The next section examines the use of different forms of Thinking Tools to support better instruction in PBL and is also discussed in the light of some typical PBL templates and visual tools used by most PBL practitioners. Finally, a discussion on the three main reasons for the use of 'real-world' Thinking Tools in PBL to: (1) enhance facilitation and pedagogical strategies; (2) create a conducive environment for students to collaborate; and (3) enhance teachers' own thinking.

Ineffective Facilitation

In an informal discussion with Ms Ho Peng, Director of Curriculum Planning Division, MOE (Singapore), she commented that I should consider devising a methodology that is engaging and also allows teachers to think. This comment led me to further analyse the chasm between advocates of PBL and the reality of the teachers' facilitation experience.

The earlier workshops to train the Research Activists on the PBL pedagogy were useful- evident in their confidence to design PBL lesson plans incorporating some of the above tools. However, the workshops were not designed to equip them with facilitation skills. Little was also mentioned of the need to understand psychological tools and the construction of knowledge in the use of PBL. Many of the RAs also lacked sufficient experience to effectively manage the thinking process that is needed to activate students' prior knowledge (i.e., the axioms, language, and the tools of certain domains) (Tan, 2004b).

Many of the RAs were challenged in areas such as effective questioning skills, providing quality responses, and managing students' ability to *flow* in the process of interaction and reflection. One of my key observations was that although the RAs generally had well-prepared lesson plans, some of the lessons were clearly unable to reap the intended outcomes of engaged learning in the students as outlined in TLLM framework. This is especially detrimental as PBL foundationally serves as an inquiry process that places students as active learners with the role of problem-solvers confronting an ill-structured problem that mirrors real-world problems (Finkle & Torp, 1995). This poses potential problems with the perception of PBL as a pedagogy being ineffective if it is unable to help students attain the learning objectives, and consequently affects the motivation of the learners and defeats the goals of PBL. This is further confirmed by Tan (2004b) who noted that students who plunged into self-directed and self-regulated learning without appropriate mediation often end up producing mediocre work as a result of "unproductive use of time, unnecessary anxiety, loss of interest, feeling of hopelessness, and superficial learning" (p.206).

Taking a broader perspective, Russell et al. (2003) listed the following factors that may enhance student engagement: nature of tasks, context, teacher-student relationships, pedagogy, classroom climate and support from school leadership – all critically affecting the success of a well designed and effectively implemented PBL lesson. This project aims to improve the problem of insufficient awareness of different thinking skills to meet the needs of different stages of PBL.

In theory, the use of PBL allows teachers to design new learning milieus and curricula that really encourage motivation and independence so as to equip students with

learning, thinking and problem solving skills through contextualisation of content

knowledge (Tan, 2003). Yet, Tan (2004b) also highlighted that for PBL to effectively

enhance thinking, the teacher needs to be able to shift from lecturing to acting as coaches in

their role as well as facilitating more effectively with psychological, pedagogical, and

technological tools.

Tan noted that although many teachers may accept the rationale for PBL and

recognize the potential value of such a learning paradigm, they may, however, become

overwhelmed with the number of practical realties (Tan, 2001). Many teachers are still

very much immersed in teacher-centred pedagogy and they struggle with the shift in

mindset as well as an insufficient repertoire of skill set. As Wee (2002) noted, good

facilitators "guide learners in non-directive ways using questions at a metacognitive level.

They rarely provide learners with their knowledge or opinions."(p.8).

Differentiating Types of Thinking

> "Problem-based learning is an instructional strategy that encourages students
> to develop critical thinking and problem solving skills that they can carry with
> them throughout their lifetimes." (Samford University, n.d.)

An extensive review of literature provided some evidence that there was no

shortage of models and theories of thinking with some notable works by Cohen (1971),

Marzano et al. (1988), Perkins (1992) and Presseisen (2001). Cohen (1971) and Presseisen

(2001) described four specific complex thinking processes i.e., problem solving (resolve a

known difficulty), decision making (choose the best alternative), critical thinking

(understanding particular meaning) and creative thinking (create novel or aesthetic ideas or

products). PBL as a learning process requires the above four thinking skills needed in

different stages since it involves a cognitive transition from "simple to more complex operations, from observable to abstract dimensions, and from an emphasis on creating or inventing new, previously unknown approaches" (Presseisen, 2001, p.48).

More specifically, many higher education institutes that adopt PBL aim to equip their students the ability to transfer abstract principles to concrete applications under the construct of critical thinking (Wood, 1997). Weissinger explained that PBL provides excellent opportunity to develop critical thinking skills in its four domains (see Figure 3): (1) PBL can provide a strong grasp of knowledge base- factual and applied; (2) it provides opportunities for the development of critical appraisal skills; (3) its environment encourages students to question; and (4) the PBL teacher steps back and allows students to direct their own learning, which becomes the foundation for future professional behaviours (Wessinger, 2004, p.46).
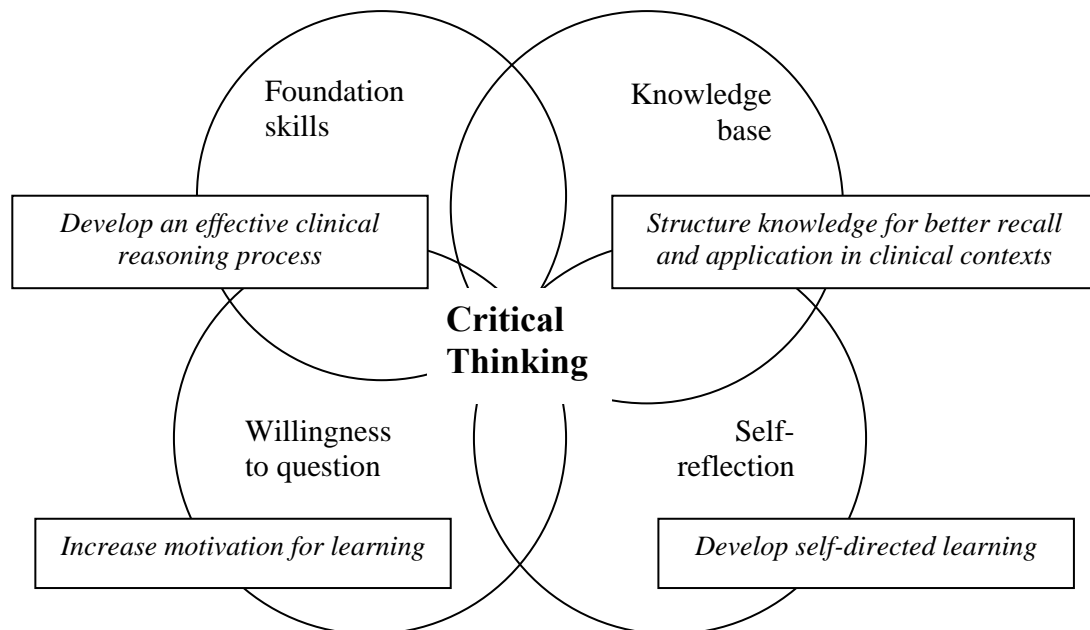

Figure 3:
 Alignment of the main objectives of PBL with the 4 components identified in definitions of critical thinking (Weissinger, 2004, p.47).

Arguably, the many theories, perspectives and terminology may tend to confuse rather than enhance curriculum planning. The challenge thus lies in identifying or constructing a model of thinking that should be both valid as well as useful for teachers to use in the classroom. For the purpose of this project, I am building upon the list of thinking skills identified by Barbero-Switalski (2003) associated with the seven Creative Problem Solving steps (Puccio et al., 2005).

Barbero-Switalski (2003) organised and categorised a set of Thinking Tools reviewed from a range of management and decision-making processes in her Master's Project on *Evaluating and Organising Thinking Tools in Relationship to the CPS Framework*. Barbero-Switalski's definition of each of the thinking skills is presented in Table 1 below.

Table 1
Thinking Skills Defined

Thinking Skills	Definitions
Diagnostic thinking	Examining situation closely by using this analysis to decide what process step to take next
Visionary thinking	Describing a vivid and concrete picture of the desired future
Strategic thinking	Identifying the critical gaps and the pathways that need to be followed to attain the desired outcomes
Ideational thinking	Producing original mental images & thoughts that respond to challenges or opportunities
Evaluative thinking	Assessing the reasonableness and quality of ideas in order to develop workable solutions
Contextual thinking	Understanding the interrelated conditions & circumstances that will support or hinder success
Tactical thinking	Devising a plan & measurable steps for attaining end & monitoring its effectiveness

By explicitly highlighting the above thinking skills in the PBL process, the teachers can help students develop richer cognitive interactions in their small groups. These engagements in PBL involve instructional iterations pertaining to scanning the environment,

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understanding the problem, gathering key data and analysing them, and elaborating on

solutions. The above thinking skills are applicable to PBL as they would frame group

dialogues more meaningfully. Also as the students begin to experience the various thinking

skills, they would consciously be shifting away from their preconceived notions- and

liberated from being locked into their own limited or prejudiced perspectives. The thinking

skills are thus useful for developing creative and critical thinking, through purposeful

reflection. The type of thinking skills that may strengthen each stage of PBL is proposed in

Figure 4.
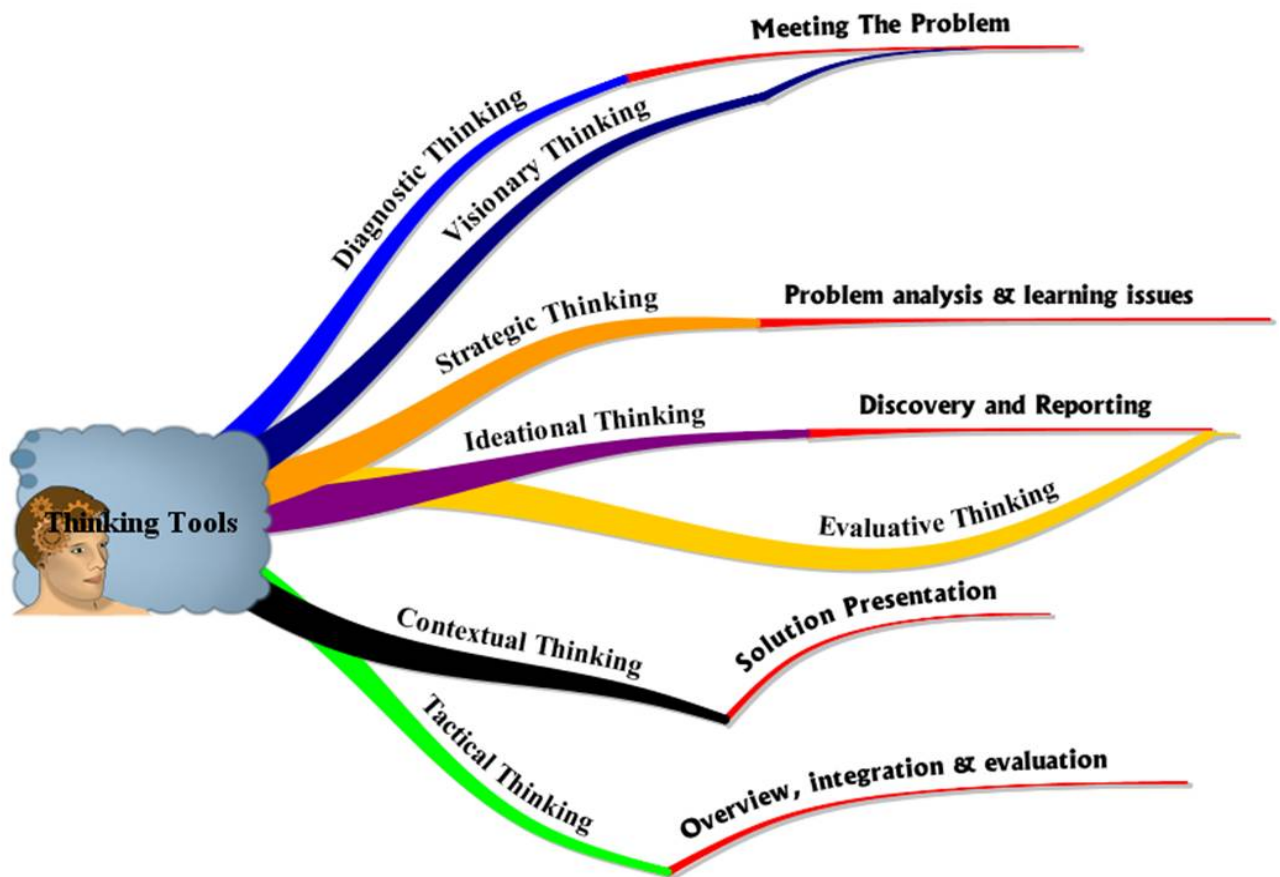
Figure 4: *Proposed Map of Thinking Skills to Stages of PBL*

The Purpose of Thinking Tools

Based on the earlier definition of Thinking Tool as "a structured strategy to focus, organise, and guide an individual or group's thinking" (Puccio et al., 2007, p.95), this project explores the use of Thinking Tools to enhance each stage of PBL process to bring about the intended function.

Typical Templates Used in PBL

In the early stages of Meeting the Problem and Problem Analysis & Learning Issues, most PBL teachers will introduce an organizational template (see examples in Table 2) to scaffold students' planning and use information from the template to assist the reasoning process. The template is often used in these early stages to teach the identification of the problems based on facts to guide student discussions (Suthers & Hundhausen, 2001). These stages also entail getting students to learn to ask questions in order to obtain a more accurate and thorough understanding of the problem. Some teachers who are new to PBL may merely start by brainstorming of ideas, which tend to lead straight into hypothesizing causes and suggesting solutions without thoroughly listing the facts of the problem. Also, without thorough fact-finding of the problem, there may be a "tendency to perceive the problem with a sweeping or bias perception" (Tan, 2003, p.52).

Hmelo-Silver et al. (2004) pointed that these organizational templates are most useful to have substantive discussions for students to rank and decide viable hypotheses, negotiate ideas and signify agreement by the group. Table 2 presents some of the typical templates used to help students inquire by asking questions to obtain a more accurate and thoroughly understanding of the problem.

Table 2: *Typical PBL templates*

(a) FILA template

List the **FACTS** in the problem.	List as many **IDEAS** as you can generate to manage the problem.	List the **LEARNING ISSUES** that you need to learn in order to manage the problem.	List the **ACTION PLAN** to show how, what and where you intend to seek new information.

(b) KNL template

What we **KNOW**	What we **NEED** to know	What are the **LEARNING** issues

(c) IFL template

List of **IDEAS**	List of **FACTS**	**LEARNING** issues

(d) SINI template

What is the **situation in need of improvement?**	Formulating hypotheses	List of learning needs

(e) KIND template

We **KNOW**	Our **IDEAS**	We **NEED** to know	Our to **DO** list

(f) KWHLAQ template

What do we think we **KNOW**	What do we **WANT** to find out	**HOW** will we go about finding out	What do we expect to **LEARN**	How will we **APPLY** what we learn	What new **QUESTIONS** do we have following our inquiry

As a visual tool, the templates provide a more systematic way of approaching problems. More explicitly, the templates also serve the purposes of helping teachers and students clarify facts (what we know) from ideas, identify what further data or information

is needed, identify knowledge gaps, list new learning that is needed to be achieved

(learning issues) and to clarify the action plan (Tan, 2003).   Working independently,

students are encouraged to ideate and to analyse the problem, followed by identifying the

learning issues and formulating the learning objectives before coming together as a group

to establish consensus on their learning issues. The collective effort to think together, with

appropriate peer feedback and evaluation, would further enhance their ideational and

analytical ability.

Other Tools That May Be Used In PBL

Forrester and Wu (2004) recognise that visual tools such as brainstorming webs,

graphic organisers and thinking process maps are useful mental mapping techniques that

play certain roles in cognitive processes. These tools help to activate the visual generation,

change and communication of information during PBL. Along with key scholars, they

describe the following three roles of visual tools (Forrester and Wu, 2004, p.71):

1. *Organizing information:* The human mind organises and stores information in a
   series of networks. Thus, as the visual depictions resemble networks that enable
   students to add or modify their background knowledge by seeing the connections
   and contradictions between the existing knowledge and new information.

2. *Understanding information and relationships:* Visual tools serve as mental tools to
   help students understand and retain important information and relationships.

3. *Depicting knowledge and understanding:* Visual tools provide an optional way of
   expressing knowledge and understanding, so they are particularly beneficial for

students who have difficulty with expressing relationships in written format (Hong

Kong Education Department, 2001).

Using 'Real-World' Thinking Tools

Thinking Tools to enhance facilitation and pedagogical strategies.

Although Tan (2004b) advocates that PBL facilitators need to "scaffold learning

through a protocol of questions", I am proposing that the use of Thinking Tools can further

serve to probe into students' thinking "to develop their acumen in problem solving and

critical thinking in that knowledge field" (p.206). Just like the other tools that were

previously highlighted, the Thinking Tools provide additional strategies for teachers to

engage students in a discussion with greater clarity in appropriate thinking skills. As such,

PBL constructs a real-world learning environment that embraces the use of both

questioning and visual tools with "an open pragmatism that considers and prioritizes all

forms of learning… in terms of their contribution to problem resolution" (Forrester & Wu,

2004, p.72).

The teacher as the content expert will benefit by acquiring a wider range of

cognitive facilitation skills, apart from the traditional "skill and drill" methods. By

expanding his/her repertoire of Thinking Tools, the teacher himself/herself can gain deeper

understanding of thinking skills. Consequently, he/she will be better able to appropriate the

relevant tools to help students' thinking become more "visible". Transfer of learning can

then be assessed by observing students select and use the appropriate Thinking Tools to

hone these thinking skills. The students' application in various contexts allow them to be

able to concisely determine the learning objectives, choose probable resources, mine for

information, plan the learning task and decide on the depth of inquiry, monitor and reflect upon their own thinking and progress. Dressel & Mayhew (1954) shared that for strong inquiry-based pedagogy, students were better able to select pertinent information for the solution, make relevant hypotheses, draw valid conclusions, and judge the validity of inferences.

Thinking Tools to create a conducive environment for students to collaborate.

As in visual tools, Thinking Tools help students share more readily when thoughts, data, facts, ideas, learning issues are visually 'transparent' to all and thus synergise with the use of cooperatively learning techniques to share and/or debate in pairs, small groups or even as a class (Albanese, 2004; Hmelo-Silver et al., 2004; Tan, 2004b). This is clearly "visible" during brainstorming and group reflection, which will help students find their shared purposes and priorities. For example, by drawing together onto flipcharts the issues emerging from a group discussion also serve as a physical means for the group to clarify their shared purpose and priorities in order to write a group development plan to guide their collaborative enquiry and learning.

Johnson, Johnson, & Smith (1998) studied team dynamics and found that groups usually make a more informed choice only if they understand what effective group process is and how its own process falls short. Consequently, the role of the facilitator is to periodically help the group consider how much further it wants to improve its process skills. Their project indicates that collaborative learning brings about higher achievement academically. This is achieved through knowledge acquisition, accuracy, creativity in problem-solving, and higher reasoning skills, as well as positive effects such as persistence

toward goals, intrinsic motivation, transfer of learning to other situations, and staying longer on tasks (Johnson et al., 1998).

Thinking Tools to enhance teachers' own thinking.

With the above merits, Thinking Tools also allow teachers to build on their own 'grounded theory' about aspects of their practice rather than trying to apply academic theory to their experience. If metacognition is about thinking about one's own thinking, then self-reflection drives the "development of thinking skills as well as the habits and dispositions to use them" (Weissinger, 2004, p.45) to monitor their own as well as their students' level of understanding in order to correct any faulty thinking patterns.

Collaborative learning with Thinking Tools, even among teachers, can be a powerful strategy especially as a formation of a community of practice. Within the community, this can be further reinforced by action research (data gathering, wider reflection, action and evaluation), in order to develop increased understanding and control over professional judgments. The fresh perspectives and skills gained from these communities will thus provide the psychological basis for pedagogy and reinforce the teachers' personal learning (Feurstein & Feuerstein, 1991).

SECTION THREE: PROCESS PLAN

Introduction

This chapter is an exposition of the step by step map of what I have done in the project- from beginning until end. Yet throughout the whole process, I had yet another 'Aha' moment as the thinking, implementing, and reflecting, all exactly resembled Torrance's (1995) definition of creativity: "I have tried to describe a creative thinking as taking place in the process of (1) sensing gaps, problems, gaps in information, or missing elements; (2) making guesses and possibly revising and retesting them; and finally (4) communicating the results. I like this definition because it describes such a natural process" (Torrance, 1995, p.72). The processes involved in this project includes preliminary navigation through possibilities before the careful diagnosis of the problem, then struggling through each new challenge arising during implementation, to eventually sharing the outcomes. I learnt that the creative person, creative product and the creative press are intricately interwoven as part of this amazingly creative process. Although the plan as drafted in the concept paper delineates the process in phases, many of the process elements are dynamically interlinked. To fit Torrance's four-step process on creativity, I have modified the drafted project timeline with the inclusion of Phase 3 to test and modified the idea as part of the complete project plan. I would also like to add that though not part of the recorded plan, the project was preceded with substantial amount of time invested to explore all possible project areas and weighing the pros and cons of each idea in relation to my other commitments and motivation level. In retrospect, all of these *thinking*

were also described as the first two stages of creative problem solving proposed by Graham Wallas in 1926 – Preparation and Incubation.

Phase 1: Sensing a Problem or Gap in Information

This project design phase began by scanning the various areas that I am passionate about- i.e., family, curriculum development, blogging, etc. The primary direction of this project was focused on marrying both my learnings in this creativity programme to that of deepening my professional development.

Research Methodology: Observation, Interviews and Focus Group Discussion

With a heightened creativity consciousness, I observed that just as the Creative Problem Solving Process had many complementary skills and mindset to that in PBL, my interaction with the RAs illuminated the opportunity to introduce the thinking skills to overcome many of the problems they faced during facilitation. For example during a post-lesson evaluation, the RA led a discussion with her teachers who co-facilitated a module. The common concern raised was the difficulty to facilitate effectively a class of 40 students. They shared that it was even more challenging to getting all the students to participate actively. As I shared on how Affinity Diagram can be used to facilitate the information processing during the whole-class discussion, the teachers agreed that such a tool was useful to enhance the social knowledge construction. Further discussion with the other curriculum partners made the connection between Thinking Tools and PBL even more possible. Mdm Irene Tan, Master Teacher and fellow curriculum partner to the PBL network agreed that these Thinking Tools are useful scaffolds and commented that tools

such as SWOT analysis and Fishbone Diagram can help students use their prior knowledge to make more meaningful connections when they see the data visually. An online focus group discussion was facilitated to further explore the issues PBL practitioners faced which further confirmed two preliminary thoughts: (1) facilitation in PBL was a major area of challenge most teachers faced; and (2) many students were not able to see the different types of 'thinking' during a PBL class. These interactions were critical to validate the purpose of the project and allowed me to seek clarity on the feasibility and manageability on the project.

Research Methodology: Literature Review

The foundation of my literature review was based on two main areas- Thinking Skills and PBL. The questions that guided my thinking were primarily the origins of each area were and further studies on their inherent relationship between two. It was interesting to learn that more research was carried out in the past few years that highlighted the role of Thinking Skills in PBL. Most studies done provided empirical evidence of how students through PBL, were able to develop and internalize problem solving competencies through heightening awareness of multiple ways of thinking needed in working on a problem (Tan, 2004). That mentioned, there was evidently little written on use of specific tools in PBL. Types of PBL tools that were mentioned in the literature included: worksheets, graphic organisers such as concept maps and flowcharts, whiteboards and large pieces of newsprint, technology, and most commonly used were the conceptual and representational tools such as the typical PBL templates in Table 2.

Phase 2: Forming Ideas

The next steps involved conceptualizing the idea of how real-world Thinking Tools can enhance the facilitation of PBL by concretizing the idea into several possible scenarios. The earlier discussion with teachers allowed me to continue to study the feasibility on the use of these tools by talking to more experts. Many of these conversations were highly fruitful as they helped to clarify the purpose as well as identify possible areas of success and challenges (i.e. issue of language of the tools and age appropriateness). Being one of the event organisers for the National Project Work Sharing Session on the 29th October, I had the opportunity to dialogue with more project work coordinators in primary and secondary schools. Contextually, this further affirmed the concept of how Thinking Tools, even beyond PBL, may be great facilitation tools in any project-related pedagogy. As with Wallas' (1926) incubation stage, these expanded developments were processed at different levels since I was subconsciously incubating on the main idea of Thinking Tools in PBL and yet as I was consciously attending to other related areas (eg., Inquiry-based in Project Work, Rubrics design, Story-telling as a pedagogy, etc.). I was able to make new connections as well as further strengthening the prior concept by incubation while "getting away from the problem" (Davis, 2004, p.124).

Phase 3: Testing and Modifying the Ideas

With all the divergent thinking and planning, the very first sharing of the concept on 29th October represented a milestone. Prior to the sharing, I sent a welcome note to the thirty participants who signed up for my sharing session to provide a overview of the presentation. In addition, I sent a document based on the Thinking Tool of *Praise First*

with PPCO (Appendix E) to invite them to reflect upon their own experience with PBL. Based on the Torrance Incubation Model (TIM), this was a direct application of one of the cognitive strategies of *Heightening Anticipation* by "using the incompleteness and the resulting arousal and creative tension that comes from not knowing what to expect to get learners involved" (Murdock and Keller-Mathers, 2008, p.12). Participants were thereafter invited to give their feedback on the session, some of which served as important considerations for the design of the next workshop on 11th November. For example, although feedback from most participants was extremely positive and encouraging, one stood out from the rest with the following comment: "Session taught no thinking skills. It was a waste of time." Though the initial reaction was of hurt, this comment helped me to be extremely focused in ensuring that most of the activities for the subsequent workshop entailed participants to make their thinking "visible".

To increase the realism of walking through a full PBL lesson, I co-designed a problem scenario with Mdm Irene Tan, Master Teacher and co-curriculum partner for PBL network. Together, we selected from the initial list of fifteen tools to just eight to ten tools so that participants could experience some of Torrance and Safter's (1990) cognitive processing strategies represented in metaphors such as *getting into deep water* and *digging deeper* for each the tool and allocated sufficient free space for *listening/ talking to a cat* with more group interaction. Besides crafting the task and preparing the presentation slides, here were many other logistical preparations such as preparing the toolkit for each tool, worksheets, etc. Concurrently, the organization of the whole session was also energy-zapping as there were many other constraints such as limitation of time and difficulty to contact teachers since it was during the school holidays. It was a stroke of fortune as Irene

brought along another experienced Master Teacher, Mdm Alice Aw who came along to add her inputs in the designing of the workshop as well as to serve as a critical friend to observe the session. The full-day workshop was finally conducted on 11th November (see Section Four for the outcomes). Building on the TIM's cognitive strategy of *Shaking Hands with Tomorrow,* participants were then required to participate in an online discussion to post their reflections on the day's learnings.

As a volunteer officer serving the Boys' Brigade, I needed to conduct two Life Skill modules on the 13 and 14th November respectively. As I wanted to gain a deeper experience with actual facilitation with the Thinking Tools, I decided upon a last minute decision to design the workshops with some of the tools to deliver the outcomes. This opportunity indeed affirmed that Thinking Tools do work wonders for effective facilitation!

Phase 4: Communicating the Results

To help teachers gain more insights on the tools, I created two Blog entries on http://think-learn-grow.blogspot.com for participants to use as platform for discussion and to share their reflections next year when they will trial the tools in class. Meantime, as I continued to identify new possibilities and directions for the paper, I was fortunate to be able to discuss further partnerships with two schools to enhance the model (i.e., Jurong Secondary School to do video lessons for the Thinking Tools and Nan Hua High School to integrate the Thinking Skills in their lesson package for 2009).

Table 3: Process Plan of the 3 Project Phases that showed Both Planned and Actual Project Timeline

Planned and Actual Project Timeline
▨ *Planned*   ▦ *Actual*

Phase	Detailed tasks	Sept					Oct				Nov				Dec
	dates	1	8	15	22	29	6	13	20	27	3	10	17	24	1
1: Sensing a Problem or Gap in Information	Research on the principles of PBL and Thinking Skills;	▨	▨												
		▦	▦	▦	▦	▦	▦	▦							
	Prepare concept paper draft (due 19th Sep)	▨	▨	▨											
			▦	▦											
	Interview Research Activists and curriculum partners to gather feedback on their implementation issues		▨												
				▦	▦	▦									
2 : Forming Ideas	Prepare draft of Sharing materials for 20th Oct				▨	▨	▨	▨	▨						
						▦	▦	▦	▦						
	Prepare draft of Chapter 1-3 for submission on 27th Oct						▨	▨	▨						
							▦	▦	▦	▦					
	Present The Big Concept with one tools-hands on during Project Work coordinators Sharing on 29th Oct									▨					
										▦					
3: Testing and Modifying the Ideas	Invite participants from 29 Oct to share their feedback on the session									▨	▨				
											▦	▦			
	Gather feedback on the concept plan and refine training package to simulate a PBL lesson with all stages on 11th Nov									▨	▨	▨			
											▦	▦			
	Full day workshop (11th Nov)											▨			
	Post-workshop online discussion											▨			
												▦	▦		
	Trialing of tools for students in Boys Brigade camp (13th & 14th Nov)												▬		
	Continue on Draft for Chap 4-6 for submission on 17th Nov									▨	▨	▨			
										▦	▦	▦	▦		

Phase	Detailed tasks	Sept					Oct				Nov				Dec
	dates	1	8	15	22	29	6	13	20	27	3	10	17	24	1
4: Communication of Results	Create Tools in PBL blog entry on www.think-learn-grow.blogspot.com												▓	▓	
													▓	▓	
	Refine and finalise complete project paper												▓	▓	▓
													▓	▓	▓
	Initiate discussion with two schools who may be keen to pilot action research with Thinking Skills in PBL/PW													▓	▓
														▓	▓
	Submit Completed Project and Celebrate on 8th Dec 08														▓
															▓

SECTION FOUR: OUTCOMES

Introduction

The purpose of the presentation on 29th October as well as the full-day workshop on 11th November was to provide teachers with opportunities to inquiry, explore and reflect on the use of Thinking Tools in PBL. Just as students are regularly engaged in metacognition in a PBL environment, the sessions aim to expose and see if teachers are able to transfer the learning within a new setting. Since PBL is considered a pedagogy that brings about higher-order thinking such as problem solving skills, this rationale thus accords not only with the ethos of Singapore's *Teach Less, Learn More* initiative but also with the thinking expressed by UNESCO in its seminal reports on education:

> Education must include activities and processes that encourage awareness of, and commitment to, the solutions of global problems. This should be done in such ways that people learn solutions are possible through cooperation at all levels- at the levels of individuals, organizations and nations.
>
> **UNESCO** (quoted in IGCSE Global Perspectives Syllabus Document in www.cie.org.uk/docs/dynamic/22453.pdf)

The simplicity of the idea in using Thinking Tools for PBL may not seem to abound with much finesse. Yet, as long as there are problems and learning to be done, a strong facilitative teacher can impact the richness of learning with deeper reflective practice. Thus, my experience of conceptualizing, designing, testing and reflecting all encompass the above elements with a single purpose: that Thinking Tools can be great catalysts to reach out and make a difference at all possible levels- the Person(s) (both teachers and students), the Process, the Press and the non-negotiable learning as the Product.

Sharing Session- Project Work Sharing on 29th October

The Process Skills Unit in Curriculum Planning and Development Division in MOE

invited the Project Work coordinators of Primary and Secondary schools in Singapore to

attend the Annual Project Work Sharing. This year, the Unit organised the event with

participants selecting four concurrent sessions that are of 45 minutes each, presented by a

total of 21 schools (including myself). A total of thirty two Singapore teachers attended my

sharing session, of which 12 teachers were from Primary schools and 20 others from the

Secondary schools. Although in my programme outline, I highlighted that this session

would be more useful to teachers with PBL experience, a quick reality check at the start

indicated that only 18 teachers have had such relevant experience. See Appendix C for

presentation slides.

Table 4: *Presentation Plan for Sharing Session on 29th October*

Time	Activity	Resources
3.30 – 3.40 pm	***Intro: PBL and Thinking Tools*** Welcome! **Activity 1: PBL <Chart 1>** Q: Vote- which stage does students and teachers struggle most and why (in 2 different columns)	Distribute hand-out 1: slides Slide 1 - large chart of PBL 5 stage - 2 different colour stickers
3.40 – 3.45 pm	**Tools** Q: *What are tools to you?* **Activity 2: Object teaching-** participants to 'play' with different items on table **Reflecting on your use of PPCO** – how did it help you 1. channel and organise your thoughts 2. visual means to collect different points of views	Slide 2-3 - toy / stationary items on table Make reference to the pre-work on PPCO - slide 7

	Thinking Tools *Q: What are Thinking tools to you?* *Metacognition : thinking about thinking* *Q: How can we meaningfully assess if our students are thinking? Do they know what they are thinking?*	
3.45 – 3.50 pm	**PBL with Thinking skills** Introduce the stages of PBL mapped to PBL **Thinking- Critical, Creative, etc** Q: *How are these skills taught/ learnt in a PBL curriculum?* Q: *Are they explicitly taught?*	Slide 4 - 6 Distribute handout 2: Thinking Skills to PBL chart ** due to limitation of time, slide 7-8 not covered*
3.50 – 3.55pm	Explain Diagnostic Thinking and Tool: Affinity Diagram	Slide 12-15
3.55 – 4pm	**Activity 3: Video** 'A vision of Students Today'	Video (4min 44s)
4 – 4.15 pm	**Activity 4: Hands-on-** Affinity Diagram (facilitated in 3 groups by 3 facilitators) Facilitators to share outcomes	• Instruction sheets for affinity diagram • Butcher sheets • Post its • Markers
4.15 - 4.20pm	Conclusion and evaluation	Evaluation forms

Table 5: *Collated Evaluation for 29ᵗʰ October*

Section A : Overall		
5 point Likert scale- *(1) Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly Agree(5)*		
Q1.	I have learnt useful skills	3.5 / 5
Q2.	There were sufficient hands-on activities	4.2 / 5
Q3.	Presenter was engaging	3.5 / 5
Section B *: Free-Response Comments		
- It was a fun learning experience. - Session highlighted to me need to look beyond current tools in PBL- thank you! - The affinity diagram was really an eye-opener.		

- PBL seemed to be an interesting teaching method.
- changed my views on how I can gather students' response differently.
- John had a unique way to 'market' his theory due to his strong and assertive facilitation style.
- I am keen to learn more about the tools and how I can use them for my lessons. Can you conduct school-based training?
- Most enlightening and rewarding session.
- There were no thinking skills taught. It was a waste of time!
- Session should have been longer. But it was useful.
- There is value in establishing work system with use of tools rather than spotting and intervening with students behaviour all the time.

"Is your curiosity piqued?"   **Group discussion**

Figure 5: Photographs of Sharing Session on 29th October

Post-Sharing Evaluation by Some of the Participants

Some of the participants were very generous in sharing their feedback on the session as well as their insights on their learning. Many of these thoughts also further helped to shape the discussion and activities for the session on 11th November. As there was so much food for thought in their comments, it made much sense to share these with the participants on 11th November as part of *Heightening Anticipation.* This was done so as we might jointly experience more by benefiting from the comments as prior knowledge.   I

would like to thank the teachers below for giving their verbal consent to share within the education fraternity their insights and experiences in writing below.

Mdm Chua Sheau Horng, Dunman High School.

Very often when we mentor students on projects, we come across students complaining that they have not been taught the skills to do research, be it in Creative Problem Solving or other necessary skills. I think this is due to the fact that they lack the tools/ methods to reflect on their own thinking. As a result, they cannot master and internalise the skills. Thinking tools will definitely help in this aspect, at least making students aware that they can engage different types of thinking to serve different needs.

Ms Lim Mui Mui, Adeline, St Anthony's Canossian Secondary School.

As a starter, I believe that thinking skills and tools to develop such skills should be overtly taught in class and used in all areas of teaching and learning. I am always glad when anyone mentions thinking skills and happier when they can suggest tools to aid teachers in this. What troubles me is always the measurement of success i.e. how can one effectively measure if students have picked up the skills? This question is one of those that keep me awake at night!

Mr Roland Khor, Telok Kurau Primary School.

I am glad that I attended your session. It suddenly made a lot of sense why I took so long before experiencing some success in PBL. In fact, I thought that PBL is not

really suited for Primary school children as they may not be able to handle the

massiveness of non-structured components such as information gathering. I always

ended up 'spoon-feeding them. You were very right when you pointed that perhaps

the language of the thinking skills may be a problem with primary school students.

I think, in real class situation, some students (and parents) may even ask, "why

should we care about the different thinking skills?" The big challenge would be to

see how these will impact students' learning and thus improve their academic

achievements."

Ms Elaine Jee, Westwood Secondary School.

How would you suggest an effective debrief after the whole activity? I personally

feel that the teacher/facilitator must be very sharp and competent to do a debrief so

that the activity will be meaningful and fruitful to the students. The PPCO tool that

you exemplified as an evaluation tool used in lesson observation showed that tools

can be very useful to bring about change in mindset. The way you used PPCO was

really very affirming, even the negative pointers phrased in an empowering manner.

It goes to show that tools can really make a lot of differences, if used correctly.

Aims of the Full-day Workshop on 11th November

Based on the first sharing session, it was *not* realistic to aim for the participants to

gain mastery of the Thinking Tools within the one-day workshop. A more realistic

expectation would be for the participants to become more aware of the potential of

Thinking Tools as well as developing dispositions through a shared immersive experience

in this workshop. The aims were thus divided into *ends*- understandings, and *means*- habits of mind.

The aims are to:

Ends

1. become aware of a range of Thinking skills and the complexities of facilitating PBL and of the connections between them;

2. develop insights into the causes of the complexities of PBL, and the possible advantages of how Thinking Tools can mediate some of the challenges;

3. develop first-hand insights into the student's learning experience by working through a PBL problem scenario collaboratively,

and to:

Means

4. develop the disposition to engage in inquiry, i.e., cognition, metacognition, affective dispositions, that draw out very different perspectives on each of the PBL stages;

5. develop the disposition to engage in dialogue, collaboration and action, and to build shared knowledge;

6. develop the dispositions of reflection and evaluation, i.e. thinking about experiences, observations, data, feelings, ideas, and practices – their own and others';

7. develop the disposition to seek deeper understanding of how Thinking Tools function in the context of PBL.

Table 6: Programme and Facilitation Plan of 11th November Workshop

Time	Duration	Programme	Details	Resources
8.30		Registration		Attendance Music Coffee/tea
8.45	15 min	Setting Expectations	❖ Welcome ❖ Setting Expectations- 'what you give/ what you like to take'	Mahjong paper
9.00	10 min	Welcome & Activity 1: *Big group introduction*	❖ Warm up with 'How PBL are you' floor targeting	Masking tape on ground
9.10	30 min	Activity 2: *Small group Introduction with VIR*	❖ Activity 2: **VIR** *Visual Identified Relationship* ❖ Grouping- based on colour tabs ❖ Workshop outline	Photo cards PowerPoint slide
9.40	35 min	**PBL Stage 1** Encounter with Problem Statement and dissemination of task Activity 3: *Meeting the Problem with THIRST slideshow*	❖ Introduce Tool: *Affinity Diagram* ❖ **Meeting the Problem** o Global warming & water pollution has led to water crisis in many parts of the world. o You are part of a team of environmental ambassadors in your school. Your task is to design a proposal for water conservation. o Problem trigger: THIRST slideshow ❖ Introduce Tool: *Fish bone diagram*	PowerPoint slides ❖ TSPBL ❖ THIRST
10.15	15 min	Activity 4: *TaD Tool 1*	❖ *Doing-Thinking on tools* o Affinity Diagram o Fish bone Diagram	Groups' Incubating Corner
10.30	30 min	**PBL Stage 2** Activity 5: *PBL templates*	❖ **Problem Analysis & Learning Issues** ◆ Introduce templates- FILA & KWL *(different groups)* ◆ Invite participants to analyse problem scenario using the template ◆ Invite groups to share their templates	

Time	Duration	Programme	Details	Resources
11.00	15 min	**PBL Stage 3** Activity 6: *Excursion for ideation*	❖ **Discovery & reporting (Part I)** ❖ Tool*: Excursion* ◆ Information Gathering- Research @ Library	PowerPoint slide
12.00	60 min		**LUNCH**	
1.00	10 min	Welcome & Activity 7: *Facilitators assessment*	❖ Warm up with 'Are you Unconsciously Unskilled/ Consciously Unskilled/ Consciously Skilled/ Unconsciously Skilled' floor targeting	Masking tape on ground; Cards of the four levels of skills
1.00	20 min	Activity 9: *'Tooling with tools' Game* Activity 10: *Targeting 1*	❖ **Game: What can you do with a tool** ❖ Tool: *Targeting 1* ▪ 'Affinity Diagram was great for Meeting the Problem' ▪ 'Fish Bone Diagram was great for Meeting the Problem'	Rolled up paper 'tool' Target boards
1.20	20 min	Activity 11: *Sharing*	❖ **Discovery & reporting (Part II)** ❖ Invite participants to share their discussions ◆ Excursion ◆ Learnings from excursion & info gathering ◆ Propose 3-5 action plans for conservation ❖ Record their discussions on mahjong sheets ❖ Paste their completed discussion on the wall	PowerPoint slide
1.40	30 min	Activity 12: *Using Card Sort and Success Zone*	❖ **Discovery & reporting (Part III)** ❖ Tool : *Card Sort (whole group)* ❖ Tool : *Success Zone (whole group)* ❖ Record their discussions	PowerPoint slide White board
2.10	20 min	Activity 13: *TaD Tool 2*	❖ **Discovery & reporting (I- III)** o Excursion o Card Sort o Search for Success Zone	Groups' Incubating Corner
2.30	30 min	Activities 14: *PMI and SWOT with*	❖ **Discovery & reporting (Part IV)** o Tool : *PMI (Group A)* o Tool : *SWOT (GroupB)*	PowerPoint slide

Time	Duration	Programme	Details	Resources
		peer teaching	❖ Record their discussions on mahjong paper ❖ World café sharing	
3.00	30 min	Break		Refreshments Music
3.30	30 min	Activity 15: *Targeting 2*	❖ Tool: *Targeting 2* ▪ 'Card Sort was great for Discovery & Reporting; ▪ 'Searching for Success Zone was great for Discovery & Reporting'; ▪ ' PMI was great for Discovery & Reporting'; ▪ 'SWOT was great for Discovery & Reporting'. ▪ Identify 1 to 2 push factors and 1 to 2 pull factors	Target boards
4.00	*45 min*	***PBL Stage 4*** *Activity 16: Performance Dashboard*	❖ **Solution Presentation & Reflection** ❖ Tool: Performance Dashboard ❖ Targeting of Performance Dashboard	Presentation
4.45	30 min	**PBL Stage 5** Activity 17: *Reflections and Conclusion*	❖ **Overview, Integration & Evaluation** ❖ Summarise the day's activities ❖ Highlight the stages of PBL linked to each thinking skill ◆ Meeting the Problem ◆ Problem Analysis & Learning Issues ◆ Independent Learning - Discovery & Reporting, Solution Presentation & Reflection ◆ Overview, Integration & Evaluation	
5.15	15 min	Activity 18: *Evaluation*	❖ Invite participants to fill in 3-2-1 Reflection Sheet ❖ Farewell	Reflection Sheet

The following figures showed the outcome of our experiences during the workshop based on the problem scenario crafted in Activity 3. The Water Conservation scenario was

one of the core learning units for lower Secondary Social Studies students. The design of

this collaborative inquiry experience as a strategy for adult learning had facilitated our

understanding of the use of Thinking Tools within the same curriculum context, which

paralleled that of students.

Getting it all warmed up

Classroom set up different areas serving different purposes

Visually Identified Relationship Activity

Collaborative learning:
"What can you GIVE to the group? What do you want to TAKE from the group?"
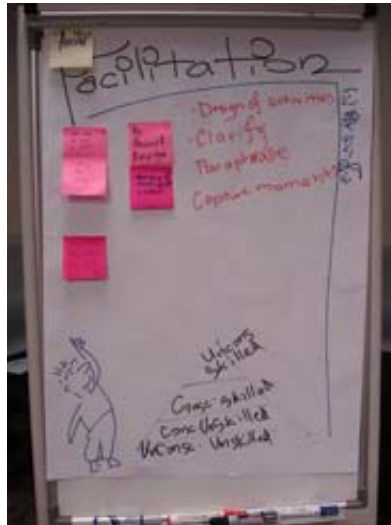
Parking Lot for facilitation

Ample resources for individuals to 'fool around'

Affinity Diagram at work
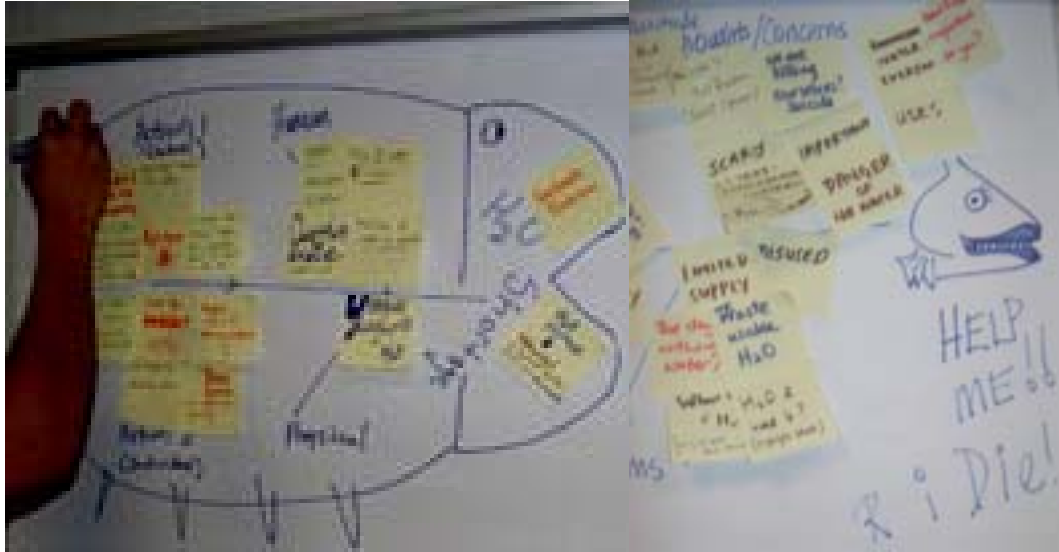
Two sides to a Fish- Creative representation of Fish bone diagram

Whose Fish is *Fishi-er*?

Fiddling with FILA

Where do you stand on the line-
from unconsciously unskilled to unconsciously skilled?
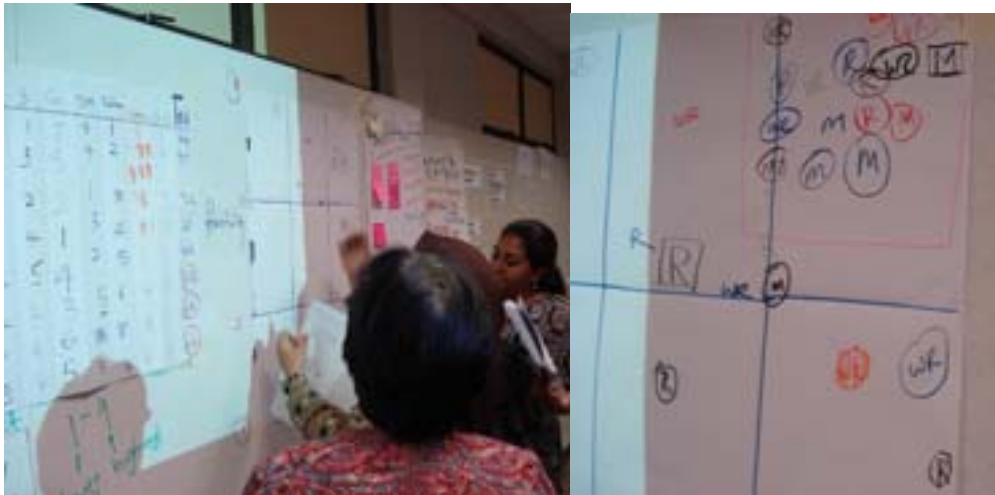
Having FUN with Card Sort followed by Searching for Success Zone

Thinking in the Doing is found in *TaD* Tool
(Or is it Tattoo?)
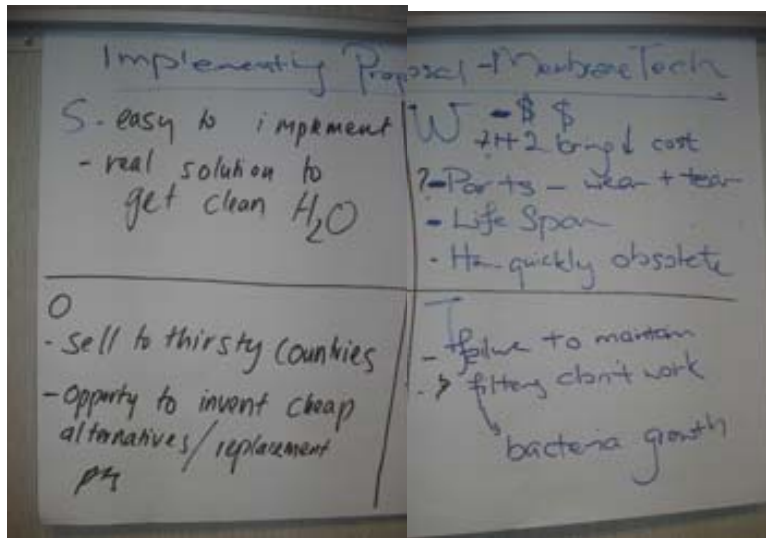
Sorting out SWOT

Figure 6: *Series of photographs of the teachers' collaborative learning on 11th November*

Boys' Brigade Life Skills Workshop on 13th and 14th November

Module 4: Values, Self-Image, Self-Esteem

In terms of content, the boys learnt how to identify and clarify their core values and express them in their daily life, understand the difference between self-image and self-esteem as well as make plans for success. The learning outcomes are: (1) learn that communicating one's values allows one to add value to the people around; and (2) reflect on the importance of these values by applying them in one's relationship with friends, parents, teachers and the community.

As this was a group of fourteen to fifteen year old boys that I was teaching for the first time, I was careful to 'test-waters' to observe their reactions. Personally, I felt that the boys enjoyed the process of using Thinking Tools allowed the boys some constructs to be engaged in more structured dialogue that focused more on inquiry. One observable merit of using the tools is that the boys were more mutually responsive to the different views expressed and were more disposed to be influenced by opinions based on some criteria as they merit acceptance or approval of ideas. Even when disagreement surfaced, the boys were able to reach some resolution together after debating and rebutting based on their original opinions. With increased understanding from working with three thinking strategies (i.e., brainstorming, hits, and card-sort), I was confident that the boys would be more receptive to be engaged with more tools for the following lesson.

Table 7: Programme and Facilitation Plan of Module 4: Values, Self-Image, Self-Esteem

Time	Duration	Programme	Details
7.30	10 min	Introduction	Share personal anecdote on what I treasured as a teenager

Time	Duration	Programme	Details
7.40	20 min	Activity 1: *Brainstorming*	❖ What are the core values that guide your life?
8.00	10 min	Activity 2: *Hits*	❖ Select your top 10 values that mean the most to you
8.20	20 min	Activity 3: *Card Sort*	❖ Based on your top 10 values, rank them based on what teenagers value most
8.40	20 min	Discussion	❖ Self-image and Self-esteem ❖ Differentiating self-image and self-esteem
9.00	20 min	Activity 4: *Case Study*	❖ *Case Study discussion and problem resolution* o Think-pair share
9.20	10 min	Conclusion	❖ Reflection

Get real... we are going to be THINKING ??!@+#

Brainstorming on Values and Top 10 Hits

Card Sort on *"What do teenagers value most today?"*

Figure 7: *Series of photographs of Life Skill lesson on Values, Self-Image, Self-Esteem*
(See Appendix G for approval to use the above images of Zhonghua Secondary School's
Boys Brigade students)

Module 5: Passion

In terms of content, the boys learnt how to identify their passion in life, understand how to live life based on their passion, and set effective goals for themselves and visualize these goals into reality. The boys acquired some skills to achieve their goals they have set for themselves.

As the boys were more psychologically receptive to the use of Thinking Tools, I felt more confident to facilitate the learning with more tools and had the whole session designed with tools to facilitate their own self-discovery. This is aligned to the research findings in educational psychology that informs educators of the importance of appropriate scaffolding to bring about feelings of competence, motivation, and self-efficacy (Tan, 2004b, cited in Tan, Parsons, Hinson & Sardo-Brown, 2003).

One of the key process considerations was to provide more opportunities for the boys to report their observations and thinking to the whole class. Based on the earlier lesson, I was also aware that the boys tend to not take the ideas and learning processes seriously as it may risks them breaking with the "*culture of cool*" which mandated that extrinsic motivation was fine. For example, the boys were quick to vote for *money* as one of their top ten values (13th November) as the unspoken lingo that exhibited their extrinsic motivation was "I'm in it for the money". When one boy indicated his displeasure of their choice, the outpouring response from the rest indicated the unspoken group betrayal in the intrinsic importance of "serious" intellectual exchange.

Table 8: Programme and Facilitation Plan of Module 5: Passion

Time	Duration	Programme	Details
7.30	10 min	Warm up and recall	Summarise key learning areas on Values and Self-esteem

Time	Duration	Programme	Details
7.40	30 min	Activity 1: *Self Introduction with VIR*	❖ Introduce new tool: **VIR** *Visual Identified Relationship* ❖ Choose a picture that best described your interest and passion in life
8.10	20 min	Activity 3: *Webbing*	❖ Case Study ❖ Identify the best problem statement to describe Jimmy's dilemma
8.30	30 min	Activity 2: *SWOT*	❖ Propose course of action with SMART acronym o S- specific (clear & direct) o M- Measurable (quality & quantity) o A- Achievable (realistic) o R- Relevant (motivation) o T- Time-based (deadline) ❖ Analyze proposal using SWOT analysis
9.00	20 min	Activity 3: *Cartoon Storyboarding*	❖ Goal setting by describing the future vividly
9.20	10 min	Activity 4: *PPCO*	o Reflection on experience and future directions
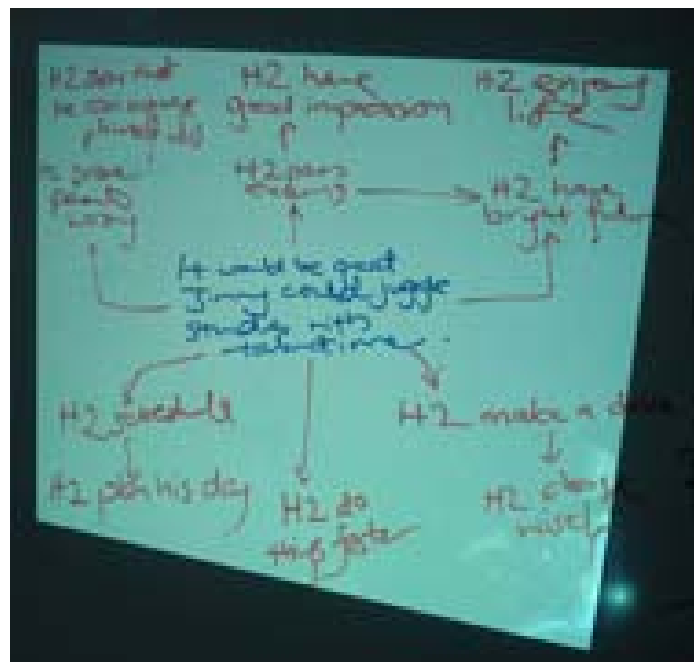
Webbing: of abstraction to concretization

Sorting out SWOT

I have a dream….
Here's my Cartoon Story Board

Figure 8: *Series of photographs of Life Skill lesson on Passion*
(See Appendix G for approval to use the above images of Zhonghua Secondary School's
Boys Brigade students)

SECTION FIVE: KEY LEARNINGS

Introduction

This section reviews some of the key learnings derived from each phase of this project. Firstly, I would highlight some of challenges faced during facilitation in the two pertinent areas of content and process the earlier discussions with teachers who implemented PBL. Next, I would share on my thinking behind the design of the workshop-physical classroom setup and the modelling of facilitation skills. I would briefly provide an explanation on why the proposed operationalisation of thinking skills to the PBL stages (Figure 4) needed further thinking and testing for more meaningful implications. Finally a review on the feedback of the Thinking Tools would be presented based on the experiences of the teachers during the various sharing platforms.

Examination of the Challenges Teachers Faced During PBL

To provide a more complete perspective of the different levels of challenges that teachers struggle, I thought it was also useful to gather some primary source of information from the teachers themselves to supplement the literature review. As part of preparing participants for the Sharing Session on 29th October, I emailed an article that on Praise First with PPCO for two purposes: to give them a sense of working independently through an evaluative Thinking Tool as well as gathering their responses on their individual PBL experience (Appendix E). In addition, I invited some of the more expressive participants to fill-in a more detailed and focused worksheet (Appendix F) to consolidate their thoughts on areas of challenges during facilitation in PBL.

All the teacher-participants found that the most difficult challenges were the need to change the teachers' own mindset towards facilitation as well as the evident lack of skill-sets to bring about what Tan (2004b) highlighted as the pedagogical transition from content coverage to problem engagement. Other frequently raised concerns can be broadly clustered below in terms of content and process:

1. Content:

- Designing and dealing with unstructured problems (either real-world or simulated complex problems);
- Ensuring students' learn the specific content knowledge as specified in the subject syllabus;
- Scaffolding learning to drive students towards becoming better independent learners.

2. Process:

- Managing multiple perspectives and transferring of cross-disciplinary knowledge;
- Challenging students' current knowledge, attitudes, and competencies;
- Ensuring collaborative, communicative and cooperative learning;
- Acquiring inquiry and problem solving skills.

The workshop on the 11th Novembers was designed with an iterative structure of repeated practice of different tools. To help overcome some of the above challenges, participants also had to collaborate to problem solve and work through experientially the above concerns to gain a deeper understanding from the students' perspective.

Optimal and Creative Use of Space to Influence Behaviour

A skilled facilitator needs to remember that since humans are creatures of habit and so if we want a change in behaviour or habit, something must change in the environment to trigger that change. With consideration of how the participants can gain the most of this immersive environment for learning, I intentionally design for the classroom to bring about more space for interaction in order to foster the kinds of behaviour that will enhance the PBL learning experience. Details such as dividing the room into different work areas were planned before hand. For example, the group areas are for convergent work such as decision-making, small group spaces to facilitate collaborative behaviours and whole group space for exploring new ideas and experiential learning.
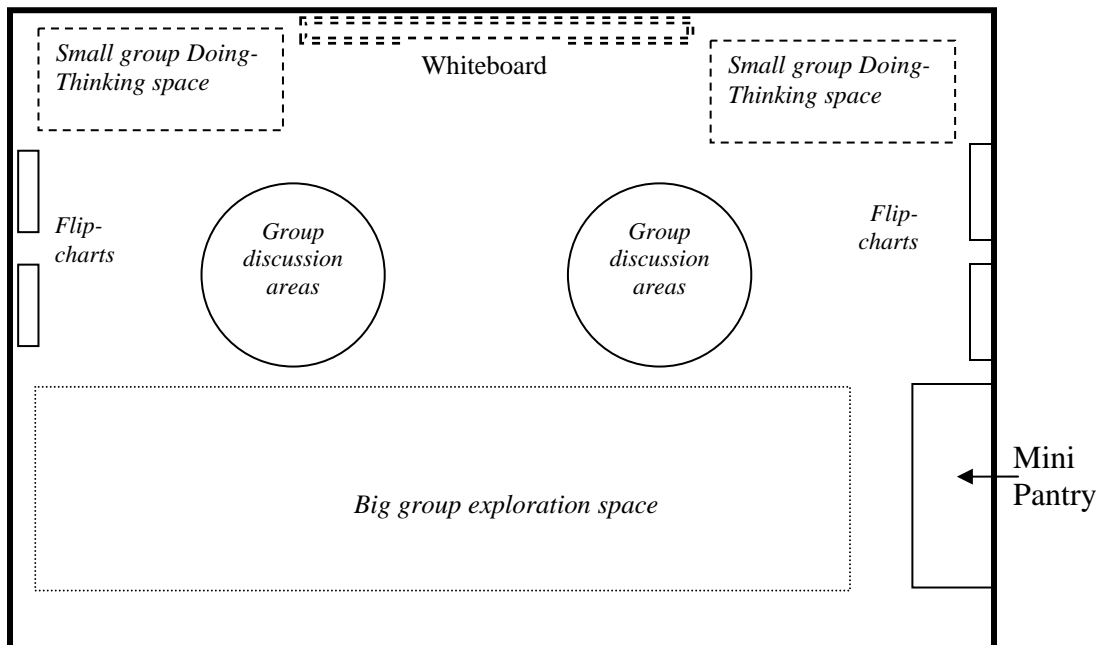
Figure 9: Classroom re-designed

Teacher Modelling

Bandura(1986) suggests that modeling good attitudes and behaviours, such as problem solving, can be a good way to foster the invitational environment. This is especially useful since Irene and myself are both experience PBL practitioners thus as we set the expectation for complete honesty during the interaction, we openly shared our successful and less successful experience in the hope to establish a higher of trust in the facilitative process as well as setting the climate for partnership. In the beginning, I explained the use of a dedicated flip chart intended to capture observed facilitative behaviours as well as learning points based on the on-going discussions.

Another three Parking Lot charts (one for each group and one for the Facilitator) were created to help participants develop a trusting relationship with three intentions: (1) establish trust between participants by affirming the freedom to think- for all to freely raise any questions, concerns or ideas and that the teacher may respond publicly to foster open communications, (2) establish trust in the process where participants have the space to park their thoughts for the right time to address; and (3) for peer-to-peer interaction so that participants learn the value of listening, focusing on the topic, questioning each other, responding positively, building on each others' ideas, develop consensus and so forth.

One of the feedbacks from the participants was the effectiveness of how we behaved as facilitators of the process. The participant remarked that the high level of assertiveness on the process was note-worthy. As part of modelling positive behaviours that fostered an open participation, we were mindful in ensuring that we constantly stay on track, providing feedback and collecting ideas by inviting participants to scribe their thoughts and post them in the parking lots at situated periods during the sessions.

Figure 10: Getting participants to switch roles to debrief

Tools for Formative Assessment

For the workshop on 11th November, I intentionally designed some activities to model different ways of assessing students' learning, beyond the commonly practiced pen-and-paper modes. The three Tools described below, though seemingly open-ended, allowed participants to demonstrate competence in a variety of ways. More importantly, I thought that such assessments may reflect higher-order thinking skills along with the use of a broad range of knowledge. The workshop was a platform for the participants to experience these adapted authentic assessments to help students take more responsibility for their learning and thinking.

Floor Targeting Tool

For starters, participants warmed up to assess their levels of facilitation skills in the beginning of the workshop by simply standing along a masking tape line on the floor. Deceptively a simple tool, participants reflected that much of the work prior to taking a stand required them to actively process their prior experience before engaging in a conversation with others to self-evaluate their own level of competency. One of the comments that were posted in the parking lot stated that this activity was fun as it was

kinesthetic in nature and allowed the students to focus their own thinking before comparing with others. As I reviewed this remark during the reflection, participants also noted that this activity may be less feasible and manageable in a classroom setting of 40 students.

After lunch, this activity was repeated with a new twist. Earlier in the session, I shared the 4 levels of facilitation skills articulated by Puccio et al. (2007), i.e., unconsciously unskilled, consciously unskilled, consciously skilled and unconsciously skilled. With a card indicating each of the levels, participants were invited now to re-evaluate their position on the line. This activity was designed to reinforce the earlier concept of the four levels as well as to demonstrate that spiral progression of learning can take place by building systematically on participants' previous experience. In facilitating the discussion around this tool, participants reviewed that this could be a more kinesthetic mode of exemplifying rubrics markers as students could benefit by appreciating the benchmarks. Another participant expressed that this activity allowed the 'freedom' to change her position as she was free to change her mind and took a stand based on her personal evaluation. This invited a comment that this tool may not be appropriate for young children as they may not be ready to "have a personal voice" and would have a tendency to adopt a herd mentality for fear of sticking out from the rest.

3-2-1-1 Feedback Sheet

As a summative activity for the workshop on 11th November, we requested the participants to pen down their preferences on the various tools (Appendix G). For the row of *3 tools I prefer*, the responses were varied with all the tools that were shared indicated. The top four tools in order of preference (in terms of number of indications) were as

follows: *Affinity Diagram, FILA, Card Sort/ Searching for Success Zone, Excursion and Targeting*. For the column on *2 tools I would use in my PBL lessons* as well as *1 tool I would like to share with my colleague* received varied responses from participants. However, eight out of ten participants indicated *Affinity Diagram* as a preference in both columns. Interestingly, besides the Thinking Tools that were shared, two teachers indicated *Parking Lots*, one teacher noted *use of post-its* as well as another teacher who wrote *How-How/ Why-why for ideation.*   Finally, for *1 tool I would like to know about* six teachers indicated the use of *Performance dashboard* while two wrote *Excursion* and another teacher indicated *Socratic question strategies*.

Targeting on Tools

As a quick method to gather quick feedback of the Thinking Tools, participants were provided with cartoon stickers for all to use as 'darts' on the target in relation to the ideal state. For the purpose of assessing the compatibility of each of the Thinking Tools to stages of PBL, all the ideal states were similarly framed as the following examples- *Affinity Diagram was GREAT for Meeting the Problem, Searching for Success Zones was GREAT for Searching and Discovery,* etc. After darting their on the board, participants were next invited to write on different coloured post-its considerations in terms of Pull and Push factors. For example, with the ideal statement: *Fishbone Diagram was GREAT for Meeting the Problem,* the Pull factors posted include the following- *neat way to categorise the facts, allow collaboration, good way to extend thinking, structurally appealing and organised, easy to categorise.* The Push factors for the same ideal statement included the following- *not easy to write headings and sub-headings, don't know how to group facts,*

need to generate ideas before categorizing, and too tedious to keep branching out.

Participants were also informed that Targeting may also take on a problem solving

approach by extending the thinking from the Push and Pull factors by either strengthening

the pull factors or converting the push factors into "*how to...*" statements to brainstorm on

possible solutions.
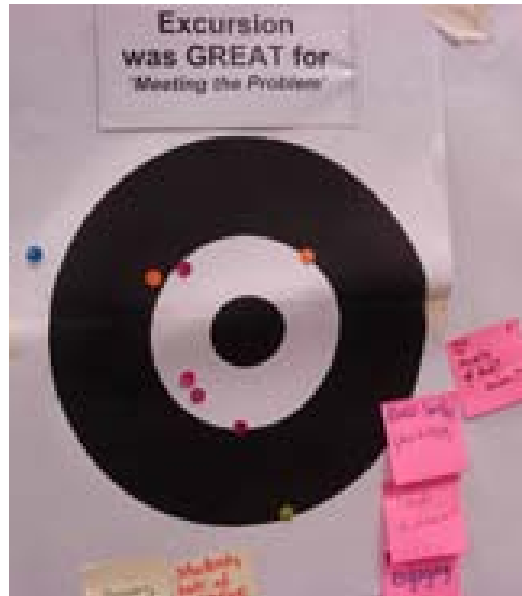
Figure 11: *Targeting as a formative assessment tool*

Thinking Tools Exposed

For the purpose of this project submission, I would only highlight the key learnings

gathered from the use of 'traditional' PBL tools (i.e., FILA and KWL template) as well as

that of Affinity Diagram. These two tools were selected to provide a comparison of how

the 'real-world' Thinking Tools can either complement the traditional tools or serve as a

stand-alone tool to enhance the PBL process. Other key learnings are consolidated for

further refinement for the development of the training package. I conclude with discussion

on a new Thinking Tool- TaD Tool (Thinking about Doing) that was created out of a

comment that negatively slanted the earlier sharing session.

FILA and KWL Templates

Both templates are strategies that form the core of the inquiry process being used in a PBL. The templates- FILA (i.e., Facts, Ideas, Learning issues, Action plan) and KWL (i.e., what you Know, what you Want to know, what are the Learning Issues) are of a more overarching nature that may be a good long-term strategizing tool which provide a guided structure for the entire unit.

However teachers have shared that it may be an uphill task to get students to trust in the process and even more difficult at times to help students become active participants in their own learning. Some of the teachers share that it is also mentally exhausting to get the templates completed as it tends to be time consuming especially with the time spent on planning, monitoring progress and evaluation. One of the main resisters to PBL is that it is far more difficult to shed the "old hat" of being a disseminator of information then to guide students toward discovering some of their own answers. This is especially so since most teachers fear that students may have missed some of the important content knowledge through PBL. Barell (2003) noted that for a successful implementation of PBL, the teacher needs to invest more time in structuring the process, monitoring progress and guide students to figure out the learning.

OTO- A Simpler Strategy for Younger Students

In response to the earlier concerns on FILA and KWL, one of the Master Teacher who served as a critical friend during the workshop, suggested the use of another simpler tool to replace FILA and KWL for younger children. Due to the extensiveness of the earlier templates, many students may find the information gathering and organizing process

too overwhelming for younger students. An alternative strategy that teachers can use in class to get younger kids to "tune-in" to the inquiry process could be Observe-Think-Question (O-T-O). The O-T-O strategy is a simpler three-step process that helps students become more sensitive to the need to get the facts first and then drawing some preliminary conclusions. The three steps as proposed and described in Barrell (2007, p. 89):

1. **Observe:** What do you notice about any specific object or situation? Make close observations, not inferences. Observations can be verified firsthand; they are what everyone can agree on. Inferences are conclusions based on data or evidence.

2. **Think:** Relate what you observe to what you already know about the subject. What similarities and differences do you notice between what you experience and what you have stored in memory? Are you noticing different aspects or elements? Did you recall experiences in a different way?

3. **Question:** What curiosities arise from your investigations? What questions emerge from your comparisons between present or more recent experience and what you assumed to be true? Use these to propel the inquiry project.

Affinity Diagram Thinking Tool

Most participants found that the Affinity Diagram was a fast and simple way to gather a large amount of data and ideas and then organise them into groups. All the participants agreed that in terms of facilitation, this tool was a useful strategy to allow everybody to participate and contribute. Of all the tools, almost all wrote that they would be using this tool to provide a *voice* to students who are very quiet.

Participants were of the same opinion that Affinity Diagram was a great way to engage students independently to observe, think, and shift their ideas and facts while collaboratively organizing them. However, some participants were concerned that students may not have the language proficiency or more specifically, lack the linguistic vocabulary to do the following tasks: select the items pertinent to the problem and/ or classify the facts into discrete categories. On a higher level, some may grapple with a common understanding of appropriate headings. Others raised the concern that for some students-especially the younger ones, a high level of conceptual thinking may be the biggest challenge students' face during the classification and selection of appropriate heading for each cluster. Also, since the tool is *voiceless*, the lack of explanation on what is written may also be subject to many different interpretations.

A New Tool is Born- TaD Tool (Thinking about Doing)

As mentioned earlier, the written comment from the sharing session on 29th October, "There were no thinking skills taught. It was a waste of time!" inspired me to incubate on how best possible to make the thinking even more explicit during the experiential learning process. Deliberating on the proposed mapping of each Thinking Skill to the PBL stages (refer to Figure 4), the insights proved that it may be a futile effort to force the connections between the skills to the PBL stages as more time was needed to ensure the clear relevance for each linkage. However, this was not to refute or disprove the fundamental thinking of the prior proposition of the various thinking skill/s to each PBL stage. With further thinking into the rationale of the earlier remarks, I realized that participants expected more *tangible* outcomes from the session. Most would expect that the immediate takeaways

could be directly applied back in the classroom, rather than merely acquiring a conceptual understanding of thinking skills. Therefore, the above reasons led me to facilitate the full-day workshop with an approach geared towards creating a more hands-on experience by working through the Thinking Tools to experience the facilitation component of PBL.

More importantly, I also wanted to harness the value of the metacognitive processes behind the *doing* element while manipulating the tools. It therefore made sense for the participants to differentiate the two aspects of *thinking* and *acting* after working through each of the tools. A list of adjectives were compiled from different frameworks and models of thinking skills, eg., Revised Bloom's Taxonomy, Four Frames of Knowledge, and Durrell's list of mental activities (1943). Some of the adjectives prepared for this activity include the following: comparing, categorising, eliminating, connecting, evaluating, choosing, processing, prioritising, differentiating, organising, summarising, inferring, interpreting, recognising, critiquing, writing, listening, debating, researching, feeling, demonstrating, experimenting, manipulating, remembering, understanding, applying, listing, tabulating, predicting, classifying, concluding, and actualising. Although the participants remarked that the exercise was mentally exhausting with the repetition of differentiating the various adjectives to the *Doing* and *Thinking* columns. However, they recognised none-the-less, that the purpose of making thinking "visible" by working through each tools was very valuable.

TaD could be further developed as a Thinking Tool with the potential to explore how it can be used to "right-size" the type, breath and depth of thinking skills as a curriculum design model. Broadly, it could be an integrative tool that shows how different aspects of thinking are related and how they can be effectively orchestrated by providing a

"common context" to differentiate between operations in doing and thinking. Specifically, TaD could provide a visual representation of the thinking skills used in a wide variety of teaching and learning activities. Another level of integration could also be to leverage the different thinking skills to align various disciplinary outcomes for each subject. For example, a teacher may require students to write a proposal as part of a PBL unit plan. The teacher may choose to focus on the skills of analysis and evaluation for this proposal writing task. With identifying the various arguments, the teacher could still evaluate the quality of the arguments and respond to views and ideas in a more critical and informed manner.

Figure 12: TaD Tool (Thinking about Tools)

SECTION 6: CONCLUSION

What Have We Been Thinking about Thinking?

> "To be proficient in a thinking skill or strategy means to be able to use that operation effectively and efficiently on one's own in a variety of appropriate contexts." (Beyer, 1987, p.163)

The 1980s saw an emphasis on the "teaching of thinking" as a relatively new concept (Resnick, 1987; Costa & Lowery, 1989). Tan (2004b, p.208) noted that "two decades or so of research on teaching thinking points to a confluence of greater understanding of the individual as thinker and the importance of thinking about thinking (i.e., metacognition)." In the spirit of *Teach Less, Learn More*, I am arguing that before teachers study how various pedagogic interventions can increase the "visibility" of their students' cognition, teachers themselves need to be also mindful of their own thinking.

Lee and Tan (2004) noted that recent research on constructivist models of teaching and learning showed evidence that student learn more effectively and achieve better when challenged to construct meaning, process relationships among ideas, solve problems, and make decisions. On fostering a learning culture with critical openess, they rightly pointed out that:

> The paradox of collaborative learning is that, through the process of interacting with others, individuals rediscover themselves and their perspectives expands. If collaboration is to provide a way for participants to negotiate multiple positions, it must involve two recursive moves: a dialectical encounter with an "other" (person or idea) and a reflexive engagement with self. (2004, p.135)

This is especially important for PBL since students learn intrinsically from how their teachers model the process of learning by make their own thinking "visible" (Tan, 2004b, p.1).

Personally, one of the biggest takeaway from the workshops was to repeatedly witness how *thinking* was enhanced through the use of Thinking Tools to bring about collaborative learning. A participant commented that when she was placed in a group setting, she was able to appreciate how she was learning better as a learner with the others walking alongside her. Elaborating on, she admitted that she struggled initially with the tension arising from interacting with diverse personalities in her group. However she recognised that it was precisely this difference in perspectives that made her learning more insightful. A more experienced teacher echoed the same sentiments in the context of the many learning styles of his students in the classroom. He acknowledged that though it was difficult, he found it most rewarding when he was able to tap on the students' individual strengths to motivate them to stay on task. He further shared his reflections on how the older generation of teachers struggled with PBL primarily because of the distinct shift in the "locus of authority" in a PBL classroom to become more consultative and facilitative. However, he learnt that it was most fulfilling when he learn to "let go" and as a result he begin to observe how some students became more articulated with higher level of social and intellectual maturity.

From the feedback gathered from participants, many felt that the Thinking Tools had helped them to level up their own cognitive coaching skills. All participants concurred that the cognitive process could also be strengthened and made more accessible if the students themselves are equipped with the Tools for greater self-directed learning in PBL. Collaboratively, an awareness of the different thinking skills may better bring about higher-order thinking through mutual exploration, meaning-making and feedback.

Steps Forward

Using Thinking Tools to Build Teacher Learning Communities

As Thinking Tools in PBL is still a concept in the germination phase, I am thankful to begin working with a group of teachers who are also passionate about cognitive facilitation. Together, we would like to strengthen our partnership with more regular exchanges. Our mutual agreement is to design and share resources on how we can implement thinking strategies in the curriculum with the tools. We hope that though our collaboration, the long term value would be to provide a forum to build the tools and knowledge base.

The advent of information technology opens up a myriad of new possibilities to learning. Although Chen & Tan (2002) reviewed that these technologies remain largely untapped in advancing PBL, I am keen to explore how best to leverage on some Web 2.0 online tools as a start for casual connections. Hopefully, this may start to direct richer online discussions and information sharing. This may be done in partnership with friends from the Oracle Foundation (Singapore) that supports the use of technology in Project-based learning.

Building Programme Coherence

I plan to partner some Singapore schools to study how Thinking Tools as instructional strategies, can be integrated as part of their PBL unit plans. Through these curriculum partnerships, it would be meaningful to examine the extent to which these tools may be effectively infused as part of their PBL curriculum.

Future Opportunities

Tan (2004b) opined that the best way forward for PBL practices would be through the "psychological perspective" (p.208). He argued that PBL models should be developed and rooted in research on understanding of cognitive functions, metacognition, cognitive coaching, and problem solving (Gijselaers, 1996; Tan, 2003). My current thoughts would be to carry out two action researches by partnering with schools. Firstly, I wish to research on the effects of Thinking Tools on student's level of engagement during PBL lessons. In addition, I would like to carry out a qualitative study on how training workshops for teachers on *Thinking Tools for Facilitation* would enhance their facilitation skills.

Finally, to advance the concept further, I hope to share the findings through paper presentations in conferences. Two of the conferences worth considering would be the Singapore Republic Polytechnic's International PBL Symposium (refer to http://www.rp.sg/symposium/2009/) and the 14th International Conference on Thinking (refer to http://www.14ththinkingconference.com/) in 2009.

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APPENDICES

APPENDIX A

Concept Paper

Designing a Training Package Incorporating Thinking Tools in Problem-based Learning

Name: John Yeo   **Date Submitted:** 9 September 08

Project Type Use a Skill to Improve the Quality of Life for Others

What Is This Project About?

This project is about designing a training package that incorporates some of the Thinking Tools from CRS 614 to enhance effectiveness of facilitating Problem-based learning (PBL) for teachers and students. In the spirit of learning to be a reflective practitioner, I am synthesising an approach to increase flexibility of the teacher-facilitator by equipping them with a wider range of tools. Through the use of thinking tools, this package aims to foster new relationships between teacher-facilitator and students through the development of student-led enquiry-based learning activities. The overarching goal is to support young people's development of thinking skills through PBL to foster greater responsibility and autonomy in their learning.

Rationale for Choice:

I strive to utilize the rich learning from the Masters program in Creativity and Change Leadership to apply within a pertinent professional area. I am designing this project with direct relevance to my role as curriculum partner for the TLLM Research Activist scheme. My partnership with the RAs who have selected Problem-based Learning as curriculum innovation has led to opportunities to help them design and implement their research. Classroom observations of teachers facilitating the PBL process had also further deepen my understanding of the intricacies of 'operationalising' PBL in different classroom context.

Problem-Based Learning

Tan (2008) in his keynote speech address at the 7th Asia-Pacific Conference on PBL in Shenyang, China, noted that PBL is a highly learner-centred pedagogy. In his slides, he highlighted that PBL integrate advances in cognitive, psychoneurological and learning sciences. He also shared that PBL is able to demonstrated efficacy in knowledge construction and application with deeper awareness of the range of cognitive functions and allows students to apply them within rich and meaningful problem solving situation.

The use of PBL allows teachers to 'design new learning milieus and curricula that really encourage motivation and independence so as to equip students with learning, thinking and problem solving skills' through contextualization of content knowledge (Tan, 2003).

In a typical PBL process (Tan, 2002c) PBL schema will include the following stages:

➢ Meeting the problem
➢ Problem analysis and learning issues
➢ Discovery and reporting
➢ Solution presentation and reflection
➢ Overview, integration and evaluation

Most PBL practitioners introduce tools (usually as a template format) to map students' planning and guide for discussion. This is evidently, and generally very useful, to direct focus on the learning objectives during the second stage of problem analysis and learning issues. Working independently, students are encouraged to ideate and analyze the problem, followed by identifying the learning issues and formulating the learning objectives before coming together as a group to establish consensuses on their learning issues. The collective effort to think together, with appropriate peer feedback and evaluation, would further enhance their ideational and analytical ability.

Common tools/templates used in a typical PBL lessons include

➢ *KNL:*   What we **KNOW**, what we **NEED** to know, **LEARNING** issues
➢ *IFL:*   List of **IDEAS**, list of **FACTS**, **LEARNING** issues
➢ *SINI:*   What is the **situation in need of improvement**?
                    Formulating hypotheses, list of learning needs
➢ *KIND:*   We **KNOW**, our **IDEAS**, we **NEED** to know, our to **DO** list
➢ *FILA:*   **Facts, Ideas, Issues, Actions**
➢ *KWHLAQ:* What do we think we **KNOW**, what do we **WANT** to find out,
                    HOW will we go about finding out, what do we expect to **LEARN**,
                    how will we **APPLY** what we learn, what new **QUESTIONS** do we
                    have following our inquiry.

Ineffective Facilitation

Earlier workshops to train the RAs on the PBL pedagogy were useful- evident in their confidence to design PBL lesson plans incorporating some of the above tools. However, the workshops did not equip them with sufficient experience to effectively manage the thinking process. Lesson observations indicated strongly that many of these first time PBL teacher-facilitators exhibited behaviours of a 'consciously skilled' facilitator (Puccio et al., 2007). Many of the RAs were challenged in areas such as effective questioning skills, providing quality responses, managing students' ability to 'flow' in the process of interaction and reflection.

Though they had well prepared lesson plans, some of the lessons were clearly unable to reap the intended outcomes of engaged learning in the students. This is especially detrimental as PBL as an inquiry process places students as active learners with the role of "problem solvers confronted with an ill-structured problem that mirrors real-world problems" (Finkle and Torp, 1995). This poses potential problems of the perception of PBL as a pedagogy being ineffective if it is unable to help students attain the learning objectives,

and consequently affects the motivation and thus engagement to use PBL. Taking a broader perspective, Russell et al. (2005) listed the following factors that may enhance student engagement: nature of tasks, context, teacher-student relationships, pedagogy, classroom climate and support from school leadership – all critically affecting the success of a well designed and effectively implemented PBL lesson. This project aims to improve the problem of insufficient awareness of different thinking skills to meet the needs of different stages of PBL.

Many of the above factors could be addressed further by with more creative facilitation by raising the facilitation skills of the teachers, I am of the thinking that the problem could be co-owned by the students if they too are equipped with the 'know-how' for greater self-directed learning within the PBL process. This self direction could be driven if both teachers and students are able to identify the necessary thinking skill to match the appropriate corresponding stages during problem solving. . I addition, if students are well equipped with the range of thinking skills that can be developed with teacher guidance or peer collaboration, the learning may well exceed what can be attained alone.

Differentiating Types of Thinking

This project on Thinking Skills into PBL is a direct application of the Masters program as it aligns with Treffinger's (2002, p19) areas for 'research and development that will continue to "advance creativity in education'. One of the areas he highlighted was the need for studies on the effectiveness of contemporary CPS with young people. He noted that recent research on constructivist models of teaching and learning showed evidence that studentns learn more effectively and achieve better when challenged to construct meaning, process relationships among ideas, solve problems, and make decisions. He also cited the encouraging works of Puccio and Keller-Mathers done with primary grades (Puccio, 1994; Puccio, Keller-Mathers, & Treffinger, 2000).

According to Puccio et al. (2007), a Thinking Tool can be defined as "a structured strategy to focus, organise, and guide an individual or group's thinking. (p.95) Switalski, L.B. (2003) organised and categorised a set of thinking tools reviewed from a range of management and decision making processes in her Masters Project on 'Evaluating and Organising Thinking Tools in Relationship to the CPS Framework'. The table below list her definition of each of the Thinking Skills.

Thinking Skills	Definitions
Visionary thinking	Describing a vivid and concrete picture of the desired future
Diagnostic thinking	Examining situation closely by using this analysis to decide what process step to take next
Strategic thinking	Identifying the critical gaps and the pathways that need to be followed to attain the desired outcomes
Ideational thinking	Producing original mental images & thoughts that respond to challenges or opportunities
Evaluative thinking	Assessing the reasonableness and quality of ideas in order to develop workable solutions

| Contextual thinking | Understanding the interrelated conditions & circumstances that will support or hinder success |
| Tactical thinking | Devising a plan & measurable steps for attaining end & monitoring its effectiveness |

By explicitly highlighting these thinking skills in the PBL process, the team could further collaborate for developing cognitive interactions and iterations pertaining to scanning the environment, understanding the problem, gathering key data and analysing them, and elaborating on solutions.   These thinking skills may more meaningfully frame group dialogues to ensure that the students are not locked into their own limited or prejudiced perspectives, thus useful for developing creative and critical thinking, and purposeful reflection.

Project Design

Based on the Creative Problem Solving-Thinking Skills Model, I would like to tentatively propose the following operationalisation of this concept:

Stage of Problem-based Learning	Thinking Skills
Meeting the problem	Visionary thinking & Diagnostic thinking
Problem analysis and learning issues	Strategic thinking
Discovery and reporting	Ideational & Evaluative thinking
Solution presentation	Contextual thinking
Overview, integration and evaluation	Tactical thinking

Challenges

One of the key challenges identified would be to assess and ensure the age appropriateness of the language of each of the thinking types. This would require further thinking of whether there lies a need to simplify the terms for comprehension of upper secondary school students (15-16 year olds) and how scaffolding needs be considered for the child to relate and grasp meaning of each term.

Another challenge would be the change in interaction – ie. Teacher with tools, teachers communication to students, and students to tools, with the introduction of new tools. It is understood that although tools in itself are neutral, yet, the tools would change expectations of what the tools should deliver as well as how it should improve the learning process. Thus the conceptualization behind the package needs to lead to a clear framework to provide a meaningful learning experience for all.

Opportunities

This Masters project lends itself nicely to inform the educational practice with research on how the Thinking Skills will impact students ability to think better. Many have written that crtical thinking involves reasoning about ill-structured problems, whereas problem solving is perceived to be narrower in scope. The argument may persist, but in the interest of this project, the intended outcome aims to improve Trenffinger's idea of productive thinking- which would encompass critical thinking, problem solving and also decision making. A case in point is that some students have a tendency to jump quickly into solution finding once presented with the problem scenario in a typical PBL class. With a better awareness of the types of thinking, a student would better probably choose to assess the situation first based on the Thinking Skill Model of Creative Problem Solving (CPS). Thereafter, the person has a choice of deciding what thinking skill is most appropriate and plan appropriate interventions in their PBL learning cycle.

On the other hand, this project designed intentionally to introduce the CPS model briefly as the basis for a recommended sequence for the thinking skills as well as with short reference of how each of the Thinking Skills fit into a broader framework of CPS. The purpose of introducing Thinking Skills within PBL as the "building blocks" is to allow teachers and students to experience in depth what each of the tools can structure greater focus and organization of thoughts, thus allowing 'space' to scale up to higher levels of interactions between the Thinking Skills within CPS at a later stage. At the same time, this would permit teachers and students to clarify some misconceptions on creativity. For example, it is well known that people outside the creativity fraternity tends to asssociate creativity as just divergent thinking or even simply brainstorming. With proper introduction of Ideational Thinking, it would seem fitting then to explain that Alex Osborn's concept of brainstorming was more than a tool for divergent thinking- which entailed a conscious creative effort to bring about successful results.

A likely future development would be to integrate the tools into an elearning platform to enhance peer-to-peer teaching and supplemented through discussions over learning management systems. Reflection tools could also be further reinforced through sharing of synthesised information presented online thus extending the dialogue through online collaboration.

What Will be the Tangible Product(s) or Outcomes?

This project aims to deliver the following:
   A) A resource package
      - one set of training slides for teachers
      - Lesson plans for teachers
         o Each thinking skills would be provided with at least two thinking tools drawn from several areas of theory and practice within the CPS : Thinking Skills Model
         o Each to include the purpose and motivation in part by making explicit the skill set/attitude necessary for success

B) Conduct a sharing on Teaching Thinking Skills in PBL on 29 Oct 08 during the National Project Work Sharing Session.

C) Provide training to a group of teachers who have experience with PBL and to gain feedback for refinement.

What Criteria Will You Use To Measure The Effectiveness Of Your Achievement?

Content
- Literature review of PBL and other related curriculum design frameworks and post reflections in blog (http://think-learn-grow.blogspot.com)
- Trial out the model of Thinking Skills in PBL with at least 3 groups of teacher

Process
- Engage experts to provide feedback on model
- Develop lesson plans by using real case examples from Primary schools to JC
- Apply Thinking Tools in my other areas eg. work related areas in CPDD, parenting, bible study

Quality
- Gather timely feedback to show evidence of refinement in revised model
- To coach and assess how effective teachers are able to use the tools through case-based practice

Result
- Conduct a train-the-trainer sharing session with PW coordinators in Nov and integrate some of the tools in their lesson planning for 2009
- Training package to be trialed with RAs for feedback gathering.

Who Will Be Involved or Influenced; What Will Your Role Be?

With my experience as a curriculum partner to the TLLM Ignite 1 schools, I hope to gather more feedback to identify critical gaps they faced during their PBL implementation. Thereafter, I hope to source a selection of Thinking Tools that are used in organizations for knowledge management purposes and select those that are appropriate in terms of enhancing each PBL stage with considerations on appropriateness for classroom use.

I hope to tap into Dr Keller Mather's rich experience with research on the impact of CPS taught in the US schools. At the same time, I hope that the collective wisdom of the class, especially that of Ami Henriques, my sounding board partner, would shape the project to be of greater value to that of the creativity community.

I would be working alongside Mdm Irene Tan, Master Teacher to gather her feedback on the design of the lesson package for implementation in Jurong Secondary School in 2009 as well as to co-write the research paper for next year's PBL symposium. At the same time, feedback would be sought from my Assistant Director on the relevance and impact of the project as well as support to provide time and space to design and investigate the intended effects.

It would be great to collaborate with experts in the field- i.e. National Institute of Education (Prof Tan Oon-Seng), Temasek Polytechnic Learning Academy (Dr Moira Lee), Republic Polytechnic.

When Will This Project Take Place?

The design phase (Phase 1) of the project should be completed by end September; and phase 2 will feature a full-day workshop that will test the use of some the Thinking Tools for teachers with some PBL experience, thereafter active gathering of feedback and refinement to the product. As part of the larger initiative (beyond the scope of this project) a more complete workshop package will be ready to use in workshops by January. The entire initiative will be completed by June 2009 so that it can be presented at the International PBL Symposium in Republic Polytechnic, Singapore.

Where Will This Project Occur?

This project will culminate into deliverable resource package to be considered for workshop materials for Process Skills unit in the Curriculum Planning and Development Division, MOE Singapore. Focus group discussion with the RAs and their team will be school-based during post lesson evaluation sessions.

Why Is It Important to Do This?

This Masters project would deepen my capacity as a curriculum partner to better support schools implementing PBL as their school-based innovation a part of their RA scheme.

The aims of the proposed Masters project are
- To see myself as a co-researcher with the PBL RAs;
- To further develop the theory and practice of PBL in ways which reflect lessons learnt from the PBL community of practitioners.

Personal Learning Goals:

- To be proficient with PBL and leverage it as a pedagogical approach to help students internalize learning through self-discovery;
- With the completion of the package and training sessions to taste the joys of becoming 'unconsciously skilled' so that I may be able to work within, and without the Thinking Skills so that I can better impact others with creative thinking in every interaction;
- To model research and share their own research with other teachers.

How Do You Plan to Achieve Your Goals and Outcomes?

Design criteria to be assessed through rubrics:

I aim to develop performance rubrics to measure development of learning in PBL, Thinking Skills, and facilitation. The rubrics would serve to enable myself to gauge my own levels of achievement for particular skills or tasks and thereafter to be incorporated as part of the resource package.

This is especially useful since the development of resource package can only serve as instructional guides. Yet, as a practitioner, we understand that thinking cannot be formulated naively as a lesson objective that can be taught, learnt and evaluated. Noddings (2008, p.12) noted that since "thinking involves planning, ordering, creating structural outlines, deciding what is important, and reflecting on one's own activity", then a full disclosure of the specific learning outcomes may possibly lead to a foreclosure of the learning process. Thus, the use of criteria-based rubrics would be helpful to address the limitations of evaluating learning by means of specifying the outcomes. The implicit advantage of using the rubrics would be that some of the observables should be exemplified during facilitation by the teachers. The rubrics will also take into consideration the different levels of the revised Bloom's taxonomy to help teachers better reflect upon their practice and enhance their competence.

With refinement, these rubrics should be incorporated to help teachers apply them as formative assessment to promote better conversation as ongoing feedback to promote learning while using the tools. The rubrics would allow personalization of the criteria with explicit descriptors to guide students in different domains of learning. For example, in ideational thinking, two criteria to assess different skills may include "Generation of ideas" which requires students to demonstrate their creativity in coming with novel ideas while "Substantiation of ideas" will require students to support their claims, views and conclusion with the information that they have gathered.

Focus Group Discussions:

I intend to organise focus group discussions (FGD) with teachers in Sep to Oct 08 to gather feedback on the challenges they faced during their own cycle of PBL implementation. These sessions would serve as a useful platform to consult these teachers on the applicability and relevance of the tools to circumvent some of the challenges they faced. The discussion will examine issues such as teacher-facilitator interaction with students, teachers' capacity as a facilitator, teachers' readiness to adapt the PBL model, etc.

Two critical concerns I hope to address during the FGDs are training to 'open' teachers' attitudes to such curriculum innovations as well as training on assessment to measure impact students' learning. I recognize that the subjectivity that is inherent in any attitudinal form of study, particularly when the observable behaviour that serves as evidence is ephemeral in nature. In consultation with Dr Keller-Mathers, I hope to particularly focus on drawing up a list of common observable behaviours for engaged thinking which the teachers could use as a guide when assessing.

Evaluation:

My plan to evaluate this project is twofold. First, I will gather feedback on the quality of the resource package developed. This package would be shared with the cohort of RAs that I am working with, who may be keen to consider further developing PBL lessons next year. I aim to produce a coherent package that may be accepted by the community of PBL practitioners.

The second part of the evaluation is with regard to my performance as a facilitator of the Thinking Skills Model and to be able to further refine the project to integrate CPS Thinking Skills Model as a pedagogical approach that can complement the PBL model effectively in terms of teaching and learning.

Prepare Project Timeline:

	Phase 1	Phase 2	Phase 3
Dates	Sep – Oct 08	30 Oct – 15 Nov 08	17 Nov– 30 Dec 08
Project planning	**Scoping & project design:** - Research on the principles of PBL and Thinking Skills; - Complete teaching slides; - Prepare draft of training package; - Research Activists to provide feedback	**Concept Development:** - Test package with PBL teachers with teachers who are keen to explore (collate 10 names for PW sharing on 29 Oct) - Trial in phases the lesson plans of each thinking skills - Gather feedback on their the concept plan and training package (19 Oct)	**Communication of Results:** - Evaluate and identify new possibilities - Contract with schools who are keen to do action research with Thinking Skills in PBL/PW - Present paper to TLLM Ignite committee to evaluate processes necessary (i.e. support, value, capacity) for

	on their implementation challenges (1-19 Sep) **Write-up deadline:** - Chap 1 by 30 Sep - Chap 2 by 11 Oct - Chap 3 by 25 Oct	**Write up deadline:** - Chap 4 by 1 Nov - Chap 5 by 8 Nov - Chap 6 by 15 Nov	scaling up the project
Milestones	29 Oct – PW coordinators Sharing 27 Oct – Submission of draft of Chap 1-3	5 Nov- Test package with interested teachers 17 Nov – Submission of draft of Chap 4-6	30 Nov – Send by courier Project Write up

Pertinent Literature or Resources:

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APPENDIX B

21st Century Skills Comparison

NCREL 'enGauge' 21st Century Learning	Partnership for 21st Century Skills	OECD's Definition and Selection of Competencies	Singapore's Desired Outcomes of Education

• Digital-Age Literacy
  o Basic, Scientific, Economic and Technological Literacies
  o Visual and Information Literacies
  o Multicultural Literacy and Global Awareness
 	
• Inventive Thinking
  o Adaptability, Managing Complexity, and Self-Direction
  o Curiosity, Creativity, and Risk Taking
  o Higher-Order Thinking and Sound Reasoning
 	
• Effective Communication
  o Teaming, Collaboration, and Interpersonal Skills
  o Personal, Social, and Civic Responsibility
  o Interactive Communication
 	
• High Productivity
  o Prioritising, Planning, and Managing for Results
  o Effective Use of Real-World Tools
  o Ability to Produce Relevant, High-Quality Products
	• Core Subjects and 21st Century Themes
	
	• Learning and Innovation Skills
	  o Creativity and Innovation
	  o Critical Thinking and Problem Solving
	  o Communication and Collaboration
	
	• Information, Media and Technology Skills
	  o Information Literacy
	  o Media Literacy
	  o ICT Literacy
	
	• Life and Career Skills
	  o Flexibility and Adaptability
	  o Initiative and Self-Direction
	  o Social and Cross-Cultural Skills
	  o Productivity & Accountability
	  o Leadership & Responsibility
		• Using Tools Interactively
		  o Use language, symbols and text interactively
		  o Use knowledge and information interactively
		  o Use technology interactively
		
		• Interacting in Homogeneous Groups
		  o Relate well to others
		  o Co-operate, work in teams
		  o Manage and resolve conflicts
		
		• Acting Autonomously
		  o Act within the big picture
		  o Form and conduct life plans and personal projects
		  o Defend and assert rights, interests, limits and needs
			All post-secondary and tertiary students should:
			• Be morally upright, be culturally rooted yet understanding and respecting differences, be responsible to family, community and country
			
			• Believe in our principles of multi-racialism and meritocracy, appreciate the national constraints but see the opportunities
			
			• Be constituents of a gracious society
			
			• Be willing to strive, take pride in work, value working with others
			
			• Be able to think, reason and deal confidently with the future, have courage and conviction in facing adversity
			
			• Be able to seek, process and apply knowledge
			
			• Be innovative – have a spirit of continual improvement, a lifelong habit of learning and an enterprising spirit in undertakings
			
			• Think global, but be rooted to Singapore

- The above bullets are colour coded to match similar skills across the different models.

- The documents can be downloaded from the following weblinks –

    ✚ **NCREL 'enGauge' 21st Century Learning:**

    http://www.unctv.org/education/teachers_childcare/nco/documents /skillsbrochure.pdf

    ✚ **Partnership for 21st Century Skills:**

    http://www.21stcenturyskills.org/index.php?Itemid=120&id=254& option=com_content&task=view

    ✚ **OECD's Definition and Selection of Competencies:**

    http://www.oecd.org/dataoecd/47/61/35070367.pdf

    ✚ **Singapore's Desired Outcomes of Education**

    http://www.moe.gov.sg/education/desired-outcomes/

APPENDIX C

Presentation slides for Project Work Sharing on 29th October 2008

Presentation slides for Project Work Sharing on 29th October 2008

Slide 1

PBL <Chart 1>
Vote- which stage does students and teachers struggle most and why (in 2 column)
<personal note: improvised targeting tool>

Post workshop chart:
Most participants tagged <u>Stage 1: Meeting the problem</u> for highest level of challenge for **teachers**
And <u>Stage 2: Problem analysis & Learning Issues</u> highest level of challenge for **students**

Slide 2

Q: What are tools to you?
Participants to name some of the tools they are familiar with

Slide 3
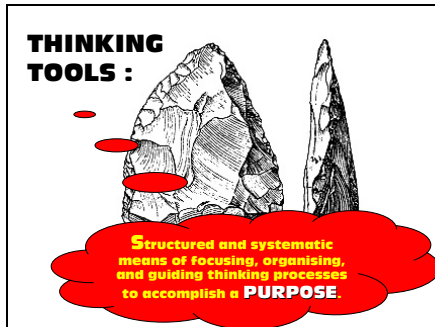
The earliest and asiest tool of all - **Acheulian hand axe**
Design is not accidental-
It was the dominant technology for the vast majority of human history and more than one million years ago it was Acheulean tool users who left Africa to first successfully colonize Eurasia. (Wikipedia)

<u>**Q: WHAT DO YOU THINK ARE THINKING TOOLS?**</u>

Helps in understanding & organizing thinking; technique to isolate each thinking; unleashing about potential
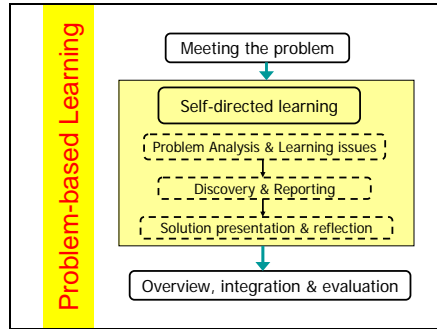
Slide 4

Acknowledge that there are different variations of PBL;
However the following are the most common (and essential) stages.

Briefly walk through the stages and differentiate roles of teachers and students.

Slide 5
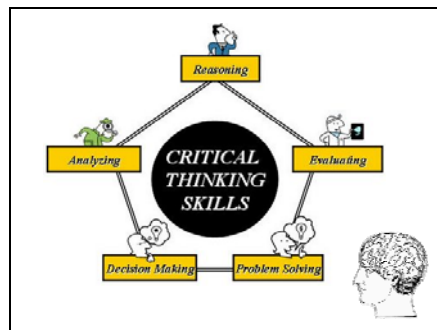
How is Critical Thinking taught/ learnt in a PBL curriculum?

Discuss importance of Thinking Skills

Slide 6
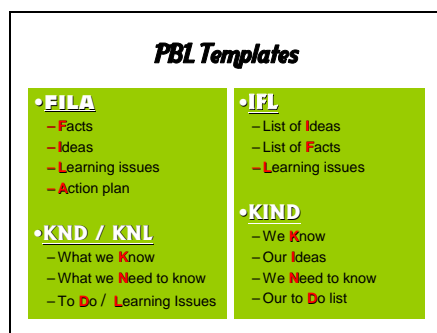
Templates are used to help students develop a more systematic way of approaching problems

Purpose of templates:
- Clarify facts (what we know) from ideas
- Identify what further data or info we need
- Identify knowledge gaps
- List new learning we need to attain (learning issues)
- Clarify things to be done

Slide 7
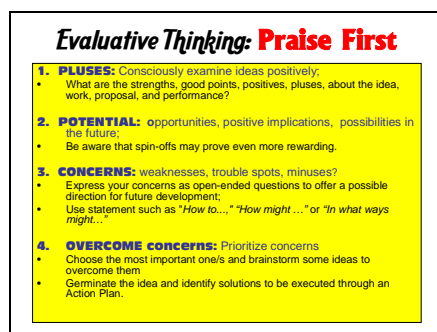
With reference to pre-session activity:
Reflecting on your use of PPCO – how did it help you
Eg. channel and organize your thoughts, visual
<explain that a tool can be bring about metacognitive engagement for reflection and evaluation>

Slide 8

Connectivity in Thinking …
with tendency towards **tunnel perception**
and **weak connection to context**

Narrow perspective

Theory ← → Real-world context

Tan, O. S. (2003, p.62)
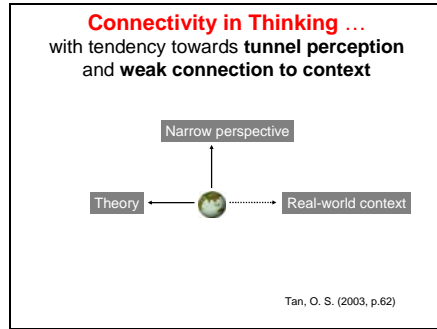
A pedagogy of participation (from New structures and spaces of learning: The systemic impact of connective knowledge, connectivism, and networked learning).

Explain rationale of project design- use of real-world tools to enhance the real-world context.

Slide 9

Enhanced Connectivity in Thinking …
with **multiple & helicopter perceptions** and **harnessing of resources**

Prior knowledge — Real-world context
Prior experience — Theory
New facts and ideas — Other people's perception

Tan, O. S. (2003, p.62)
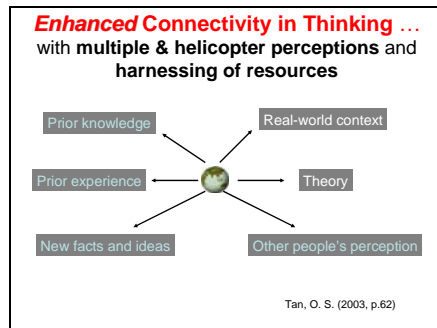
Need to emphasize the learning of problem solving through facts and rationality- building upon prior knowledge.

PBL process and coaching help develop flexibility and helicopter views by enhancing connectivity.

Slide 10

Diagnostic Thinking
Examining a situation closely & using this analysis to decide what process step to take next
Visionary Thinking
Describing a vivid and concrete picture of the desired future
Strategic Thinking
Identifying the critical gaps and the pathways that need to be followed to attain the desired outcomes
Ideational Thinking
Producing original mental images & thoughts that respond to challenges or opportunities
Evaluative Thinking
Assessing the reasonableness & quality of ideas in order to develop workable solutions
Contextual Thinking
Understanding the interrelated conditions & circumstances that will support or hinder success
Tactical Thinking
Devising a plan in specific & measurable steps for attaining a desired end & monitoring its effectiveness

Puccio, G. J., Murdock. M. C., & Mance, M. (2007)

*<**Where the thinking comes in creativity**- show Creative Leadership book>*

Slide 11

Meeting The Problem
Diagnostic Thinking
Visionary Thinking
Strategic Thinking
Problem analysis & learning issues
Ideational Thinking
Discovery and Reporting
Evaluative Thinking
Contextual Thinking
Solution Presentation
Tactical Thinking
Overview, integration & evaluation
Thinking Tools

Qn: Why assoc thinking skill to each of the steps?
allows flexibility to open to variety of tools
no two problems are alike so tailor to situation
Skill development- need to connect creative thinking to leadership development
Framework to develop creative thinking – sharpen, reinforce, targeted tools, strengthen

Slide 12

Diagnostic Thinking

- Examining situation closely by using this analysis to decide what process step to take next

cast a wide net to gather thinking broadly about the content data

Common- 5 Ws and an H- provide fundamental questions for data identification and management

Typical PBL templates used to diagnose problem- FILA, KND, etc

Slide 13

Diagnostic Thinking: Affinity Diagram

- Tool designed to help gather large amount of data and organise them into groups based on their natural relationship.
- Developed in 1950s as a Quality Management tool also known as KJ Method by Kawakita Jiro.

Diagnostic: Affinity Diagram

Ability to bypass mental traps (prejudices, biases) : looking at a situation from multiple perspectives, shifting perspectives, avoiding stereotypes, and checking assumptions

Slide 14

Affinity Diagram

- Process performed by group / team
- Applied to **large amount of data**
- Best for situations that seem confusing, uncertain or disorganised, etc.
- Allow **clarification of issues** and **unifying teams**
- Used effectively after a brainstorming to quickly **organise ideas into clusters**.

Diagnostic: Affinity Diagram

Formulating relevant questions: an ability to formulate questions that go to heart of the situation, using questions to draw out information; asking the questions in the moment *Learning when to dive deep-* seize opportunities to find new info

Drawing out what they don't know- customization for consumers; asking sufficient questions that draw out "what is going on" that is not told**.**

Slide 15

http://www.outside-in-development.com/foundation/consolidate_data.html

http://opim.wharton.upenn.edu/~ulrich/documents/ulrich-KJdiagrams.pdf

Diagnostic: Affinity Diagram

Identify structures and patterns that underlie a complex situation: Seeing trends in data, seeing patterns, understanding the meaning associated with identified patterns
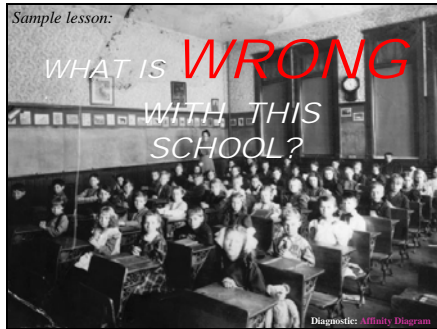
Slide 16

Lesson activity begins: provide context, & instructions

Give participants 3 minutes to glimpse through KJ Diagram handouts

Slide 17

Slide 18

Slide 19

Slide 20

Slide 21

Summary of Purpose

- Organise **large volume of data**
- **Collective exploration** of opinions, perspective and insights
- **New patterns of thoughts**
  - ➢ Non-traditional connections
  - ➢ Stimulate 'gut-level' reactions
- Natural **emergence of breakthrough data**
- **Overcome team paralysis**
  - ➢ Reduce endless verbal discussion
  - ➢ Encourage ownership of results

Diagnostic: **Affinity Diagram**

My thoughts:
process liken brainwriting then hits, clusters
Good warm-up then enter into process

Facilitator to drill down- make clarity of language "What does this mean?"
Silence allows task to faster and less debate from the start
Engaging different energy
Kinesthetic
Students to create own meaning
Facilitator to extract and take to next level
Further refinement: Converge within the clusters
Could start with *"What do we know about …"*

Slide 22

*The learner is **motivated** to use visual thinking tools because he or she **enjoys the intellectual challenge of active visual construction of ideas**, both as an individual and as a participant in group activity.*

*The chances for **successful problem solving** are enhanced by application of visual thinking tools, and increase the learner's satisfaction as a result.*

http://coe.sdsu.edu/eet/articles/VisThinTools/start.htm

Connecting MINDS to HEARTS- cognitive and affective skills.
Constant exploring- continuous discovery- dismayed by anomaly, attracted to novelty, compelled to mastery, intrigued by mystery, curious about discrepancy
Derive personal and concrete feedback from own tactile/ kinesthetic adventure

Slide 23

Next Steps ???

- **Facilitative inquiry** for deeper learning
- Tools to mediate **self-directed learning** – metacognition & self-regulation
- **Collaboration**– ensuring higher level of interaction for peer learning, peer teaching and group presentations
- **Language** of the Thinking Tools to PBL

Shift in Teaching Paradigm
Facilitative inquiry for deeper learning- creative application of our thoughts especially if the problem scenarios are roots in reality
Need then to cultivate these qualities of mind
Selection of task- meaningful only when both authentic experience and curriculum content meet the task design and **student interest** are addressed.

Tools to mediate **self-directed learning** – metacognition & self-regulation
Formative assessment as self-assessment: spiralling process of continuous renewal: Self-managing, self-monitoring, self-modifying
Evaluation: highest level in Bloom's taxonomy- means generating, holding in head and applying set of internal and external criteria
PBL / PW gives students capacity for self-analysis, self-referencing, and self-modifying.

APPENDIX D

Presentation slides for Thinking Skills in PBL Workshop on 11th November 2008

Problem-based Learning &
Thinking Tools

<table>
<tr><td colspan="5" align="center">Thinking Tools in Problem-based Learning Workshop
Facilitation Plan</td></tr>
<tr><td colspan="5">At the end of the workshop, participants should be able to understand:
❖ the reasons for integrating thinking tools in PBL
❖ make use of visual tools to facilitate learning</td></tr>
</table>

Time	Duration	Programme	Details	Resources
8.30		Registration	❖	Attendance sheet
9.00	10 min	Welcome	❖ Invite all participants to sit in groups according to schools	Notes Photos
9.10	30 min	Introduction	❖ Activity 1: *VIR Visual Identified Relationship* ❖ Grouping ❖ Workshop outline	Photo cards PowerPoint slide
9.40	35 min	Activity 2 Problem Statement: THIRST Activity 3	❖ Tool: *Affinity Diagram* ❖ **Meeting the Problem** o Global warming & water pollution has led to water crisis in many parts of the world. o You are part of a team of environmental ambassadors in your school. Your task is to design a proposal for water conservation. o Problem trigger: THIRST ❖ Tool: *Fish bone diagram*	PowerPoint slide ❖ TSPBL ❖ THIRST
10.15	15 min	Tools breakout 1	❖ **Meeting the Problem** o Affinity Diagram o Fish bone Diagram	Groups' Incubating Corner
10.30	30 min	Activity 4: PBL templates	❖ **Problem Analysis & Learning Issues** ◆ Introduce templates- FILA & KWL *(different groups)* ◆ Invite participants to analyse problem scenario using the template ◆ Invite groups to share their templates	
11.00	15 min	Activity 5	❖ Discovery & reporting (Part I)	PowerPoint slide

11.00 Activity 5 **Discovery & reporting** (Part I) Tool: **Excursion** Information Gathering- Research @ Library 0060 min LUNCH 1.00 Activity 6 **GameGameGame** Tool: *Targeting* *Identify 1/2 pushes and 1/2 pulls* Target boards 1.20 20 min Activity 7: Sharing **Discovery & reporting (Part II)** Invite participants to share their discussions Excursion Learnings from excursion & info gathering propose 3-5 action plans for conservation Record their discussions on mahjong sheets 1.40 Activities 8 & 9 **Discovery & reporting (Part III)** Tool : **Card Sort** *(whole group)* Tool : *Success Zone* *(whole group)* Record their discussions on White board 2.10 Tools breakout 2 **Discovery & reporting (I- III)** Excursion Card Sort Search for Success Zone Groups' Incubating Corner 2.30 Activities 10 & 11 **Discovery & reporting (Part IV)** Tool : *PMI* *(small group)* Tool : *SWOT* *(small group)* World café

VIR Visual Identified Relationship

5 Es	Students …		"Teacher-facilitator"
	Physically	Mentally	
Engage			
Explore			
Explain			
Elaborate			
Evaluate			

THINKING TOOLS :

Structured and systematic means of focusing, organising, and guiding thinking processes to accomplish a **PURPOSE**.

Connectivity in Thinking …
with tendency towards **tunnel perception** and **weak connection to context**

Narrow perspective

Theory ← 🌍 ⋯⋯> Real-world context

Tan, O. S. (2003, p.62)

Enhanced Connectivity in Thinking …
with multiple & helicopter perceptions and harnessing of resources

Prior knowledge — Real-world context
Prior experience — Theory
New facts and ideas — Other people's perception

Tan, O. S. (2003, p.62)   7

Problem-based Learning

Meeting the problem
Self-directed learning
Problem Analysis & Learning issues
Discovery & Reporting
Solution presentation & reflection
Overview, integration & evaluation   8

Problem-based learning process

Problem presentation
Problem triggers inquiry

PBL stages
✓ Initial analysis
✓ Generation of learning issues
✓ Iterations of independent & collaborative problem solving
✓ Integration of new knowledge

Solution presentation & evaluation

Tan, O. S. (2004, p.10)   9

Problem-based learning & Cognition

Problem

Examples of psychological happenings:
□ Context for engagement
□ Curiosity
□ Inquiry
□ Quest to address a real-world issue

Examples of learning & cognition:
□ Confronting unstructuredness, ill-structuredness, and novelty
□ Active search for information
□ Proactive immersion in task
□ Conscious & subconscious investment of time on task
□ Motivation to solve the problem: need for meaning & explanation
□ Goal orientation
□ Need for generative thinking, analytical thinking, divergent thinking, and synthesis

Tan, O. S. (2004, p.11)

Diagnostic Thinking
Examining a situation closely & using this analysis to decide what process step to take next

Visionary Thinking
Describing a vivid and concrete picture of the desired future

Strategic Thinking
Identifying the critical gaps and the pathways that need to be followed to attain the desired outcomes

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Tactical Thinking
Devising a plan in specific & measurable steps for attaining a desired end & monitoring its effectiveness

Puccio, G. J., Murdock. M. C., & Mance, M. (2007)   11

Slide 13

Stages of PBL	Tools	What were you doing?	Where was the thinking?
Meeting the problem	Affinity Diagram		
	Fishbone		
Problem Analysis	FILA & KWL		
Discovery and Reporting	Excursion		
	Card sort		
	Searching for Success Zone		
	PMI		
	SWOT		
Presentation and Reflection	Performance dashboard		
	Targeting		

Slide (3-2-1-1)

3-2-1-1

3 tools I prefer:

2 tools I would use in my PBL lessons:

1 tool I would like to share with my colleague: 1 tool I would like to know more about:

Slide

Water Issue

Global warming & water pollution has led to water crisis in many parts of the world.

Slide

Your Mission:

You are part of a team of environmental ambassadors in your school. You are to propose a plan of action for water conservation.

Slide 17

Websites on Water Conservation

- http://www.eartheasy.com/live_water_saving.htm
- http://www.h2ouse.org/tour/index.cfm
- http://www.wateruseitwisely.com/
- http://www.sahra.arizona.edu/programs/water_cons/home/home2.htm

Slide 18

Affinity Diagram

http://www.outside-in-development.com/foundation/consolidate_data.html

- Tool designed to help gather large amount of data and organise them into groups based on their natural relationship.

Step 1. Diagnostically....

Lets gather your *thoughts, facts, opinions, issues, insights*

Post-IT! onto the charts on the wall

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Step 2: SORT IT...quietly

- Sort the post-its into related groups
- *NO TALKING* please...
- Go by your *GUT* feel

20

Step 3: Connections!

- Create *Headers* for each group
  - *Concise statement* that captures central theme
  - *Divide large groups* into subgroups if necessary
  - Draw *meaningful connections*

21

Summary of Purpose
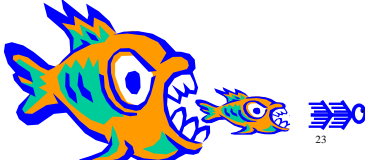
- Organise **large volume of data**
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22
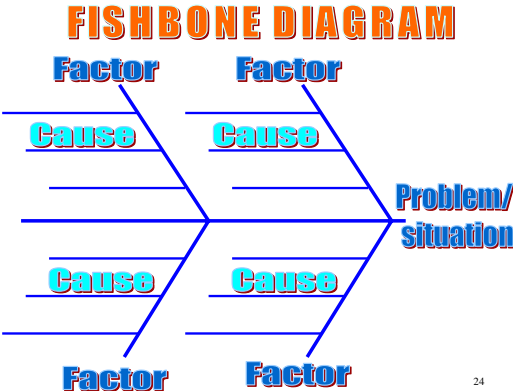
FISHBONE DIAGRAM

- Tool designed to help people analyze a problem situation by breaking it down into manageable parts

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FISHBONE DIAGRAM

Factor   Factor
Cause   Cause
Problem/situation
Cause   Cause
Factor   Factor

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FISHBONE DIAGRAM example

Resources

Wordy worksheets

Time: too short

Lack of guidance

Product centred

O/s curriculum time discussion

Too '*free-for-all*'

People

Teachers training

Students' attitude

Vendor's staff

Classroom bound

Seating arrangemt

Poor timetabling

Students not motivated in PW

Process   **Environment**

25

PBL Templates

- **FILA**
  - **F**acts
  - **I**deas
  - **L**earning issues
  - **A**ction plan

- **KND / KNL**
  - What we **K**now
  - What we **N**eed to know
  - To **D**o / **L**earning Issues

- **IFL**
  - List of **I**deas
  - List of **F**acts
  - **L**earning issues

- **KIND**
  - We **K**now
  - Our **I**deas
  - We **N**eed to know
  - Our to **D**o list

FILA Chart

Facts	Ideas	Learning issues	Action plan

K W L Chart

What we Know	What we Want know	What we Learnt

The How-How/ Why-Why Diagram and the Socrates Thought

- Drawing upon the deeper resources and hidden ideas

- Socrates's method of inquiry - explore deep-seeded thoughts and beliefs and bring them to new understandings

Image: http://en.wikipedia.org/wiki/Image:Plato-raphael.jpg

Adapted from http://crystalking.wordpress.com/2007/09/06/creative-writing-tool-whywhy-howhow-diagrams/

29

How-How diagram: Purpose

- To generate steps or actions needed to implement a solution, by repeatedly responding to the open ended question "How?"

- To identify the most crucial stages to focus on in the process of implementation.

- To force individuals to confront the practical issues involved in implementation and highlight possible problems or discrepancies that need to be overcome.

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Tactical: How-How Diagram

How-How Diagram: Directions

1. Place the solution on the left side of a piece of paper or flip chart
2. Identify the initial steps needed to implement the solution and write them in the appropriate blanks to the right of the solution
3. Consider each step individually breaking it down into its detailed stages, by **repeatedly asking "How"** it might be achieved. Record each stage in the appropriate blanks to the right of the diagram.
4. Continue the process until each step has been drawn out to its logical limit
5. Examine the complete diagram for recurring elements which tend to indicate the most crucial stages in the process of implementation.

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Tactical: How-How Diagram

How-How Diagram

http://syque.com/improvement/images/image344.gif

32

Why-Why Diagram
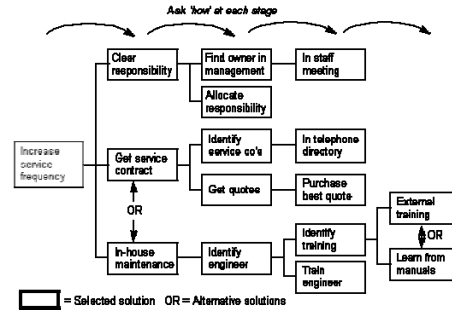
http://syque.com/improvement/Why-Why%20Diagram.htm
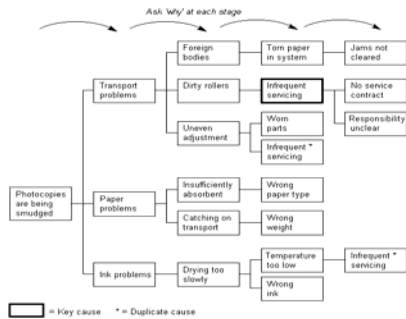
33

Excursions: *Field Trips*

A creativity technique that invites people to seek inspirations outside of the context of their 'challenge' in order to generate new and original ideas.

34

Field Trip - Purpose

An experiential activity whose purpose is to:

- Create a diversion that 'physically' takes people away from the 'challenge' they are working on (and their working environment)
- Provoke the senses *(seeing, listening, touching, smelling, tasting...)* and create a state of alertness and receptiveness to external stimuli.
- Encourage individual 'observation', reflection and incubation
- Find analogies or establish meaningful connections between the observations and insights gained through the 'excursion' in the field and the challenge at hand.
- Use this experience, and the related connections with the challenge, as a springboard for generating ideas.

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Field Trips – Where and When

- It can last half an hour or half a day depending on the task and the challenge at hand.
  - Short field trips are generally used within an idea generation session to physically 'break' from the challenge and to stimulate a fresh wave of creative thinking.
  - Longer field trips (i.e. shopping tours) are generally used as a warm-up/ inspirational activity to prepare the group for an intense day of idea generation (or as a 'break' activity after the first day that can get people 're-ignited' for the second day).

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Field Trips - Directions

- Give participants 'broad yet specific' instructions about the task: where, how long, what to do (i.e., observe, take notes, etc.) as well as what is expected from them (making connections, sharing reflections and insights, etc.)
- Provide each participant with a small potable journal that can be used to record observations, thoughts, reflections, insights,…
- In some cases, it might be productive to give an assignment: for example, taking pictures with a disposable camera or buying an 'object' that is considered intriguing and inspiring.

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Excursion to New York Theatre

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Welcome Back!

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Card Sort

An evaluative thinking tool designed to help *prioritize a set of options* that are deemed to be acceptable.

40

Card Sort - Purpose

- Card Sort is a convergent tool that helps you compare, rank or prioritize options
- It can be used
  - When you have a number of options (up to 15 options)
  - To compare and rank ideas, solutions, problem statements or criteria.
  - To generate group consensus, by comparing each individual ranking and discussing the results

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Card Sort: Directions for Individual Ranking

1. Write options on cards (or Post-its™), one per card
2. Count the number of options (e.g., 12)
3. Select least liked option and write a '12' in the upper right corner of the card, set aside
4. Select most liked option from those that remain and write a '1', set aside
5. Select least liked option and write a '11', set aside
6. Repeat alternating between least and most liked options until all options have been ranked

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Example of Card Sort

- Complete Card Sort **individually**
- Create **group matrix** showing individual results
- Total score for each item and discuss results
- **Finalize ranking**

Options for to enhance lessons	Nat	Pat	Chris	Total
Cooperative learning package	1	2	1	4
Engage consultant	3	1	2	6
Purchase more IT softwares games	4	4	4	12
Modularise lesson units	2	3	3	8

43

Sorting group values

44

Searching for Success Zones

- Tool designed to formulate a clear picture of the future state and offers the most promising action to pursue

45

Searching for Success Zones

- Define **two judging criteria** with reference to situation (i.e. *degree of importance & probability of success*) ▶
- **Evaluate each option**, typically future states against the selected criteria by using scale ranging from 1 *(low)* to 9 *(high)* ▶
- **Locate options** on Searching for Success Zones matrix
- **Identify** option(s) most important and promising to pursue

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Example of Evaluation of Options for *"WHO should I date?"*

Options – Future States Evaluation range: 1 *(low)* to 9 *(high)*	Degree of **stability** he can provide	Degree of how much I am **attracted** to him
Billy *Quiet, sensitive, cute when serious looking, rich but 'weird' parents*	8	6.5
John *Hardworking, clever, good in studies, great abs, show off, big FLIRT*	4	9
Norman *A little gayish, funny, great company, sensitive, temperamental*	2	4

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Searching for Success Zones

	Low	Moderate	High
High	Creative Challenge		Promising Opportunity
Moderate		Grey Area	
Low	Self Abuse		A Distraction

Degree of importance

Probability of success

Key:
Low 1-3
Mod 4-6
High 7-9

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Slide 49

Searching for Success Zones
"WHO should I date?"

Degree of **stability** he can provide

High
Moderate
Low

Key:
Low 1-3
Mod 4-6
High 7-9

Low   Moderate   High

Degree of how much I am **attracted** to him

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Visionary Thinking: Searching for Success Zones

Slide 50
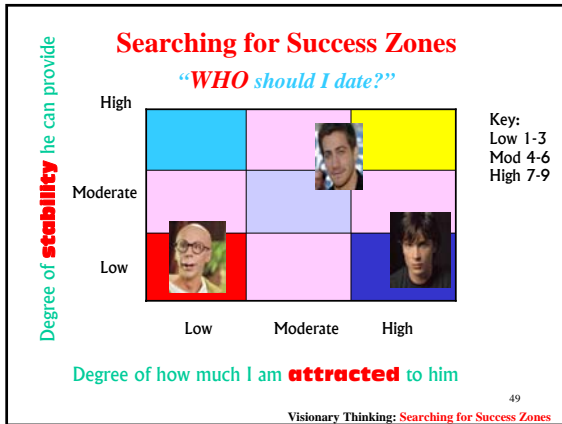
PMI Chart

- This is an alternative pro/cons method used to weighing the positive and negative possibilities from a particular course of action and evaluating the overall outcome and implications.

- Useful to see if pursuing a particular course of action is overall beneficial.

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Slide 51

PMI Chart

P(+)	
M(-)	
I(?)	

51

Slide 52

PMI : Altered group structures – children's response

Interesting
- Could swap around groups next time
- Would like to do the activities again
- Keep homework relevant to the activities in school
- Do it for longer blocks of time, maybe all day
- Put name down of someone you'd like to be with to form groups
- Perhaps a different focus next time – cooking, craft, media

Plus
- Enjoyed the "celebration day" at the beach
- Smaller groups allowed us to get more help
- Learnt some really interesting concepts
- Enjoyed making/building things
- Got to interact with the other classes a bit more
- Enjoyed starting an activity and finishing it within the one day
- Fun/Interesting
- Liked working with the other class
- Loved building, testing and planning
- It was great just working with the girls
- With friends
- More variety
- Learnt about architecture which I didn't know anything about before and we normally wouldn't look at
- Found out information about countries, time differences, currencies
- Learnt other languages
- Prepare me for future travel

Minus
- Would have liked more activities to choose from on each day and more resources
- We seemed to do the same thing over and over
- Spent a lot of time on the one subject, some activities were a bit much the same - boring
- Not enough time to finish off
- Had a lot of homework (to finish work off)
- Found the work too difficult
- Some people were unco-operative
- Didn't finish work always – ran out of time
- Not with many friends
- Noisy sometimes
- Difficulty finding answers sometimes
- Not enough variety
- Not enough space

http://www.education.tas.gov.au/curriculum/needs/inclusive/phase2/forth/reflection   **Diagnostic: PMI Chart**

Slide 53

PMI example

Plus	Minus	Interesting
More going on (+5)	Have to sell house (-6)	Easier to find new job? (+1)
Easier to see friends (+5)	More pollution (-3)	Meet more people? (+2)
Easier to get places (+3)	Less space (-3)	More difficult to get own work done? (-4)
	No countryside (-2)	
	More difficult to get to work? (-4)	
+13	**-18**	**-1**

Question:
Should I move to the big city?

PMI SCORE: (+13) + (-18) + (-1) = -6

Outcome:
Comforts of a settled rural existence <u>outweigh</u> the call of the 'bright lights' - it would be much better to live outside the city, but close enough to travel in if necessary.

http://www.mindtools.com/pages/article/newTED_05.htm

53

Slide 54

SWOT Analysis

A diagnostic framework that helps analyze
- ❖ the **internal and external environment** *and*
- ❖ identify the **most promising strategies** for the organization

S - Strengths
W - Weaknesses
O - Opportunities
T - Threats

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SWOT Analysis

- **INTERNAL** env. of an orgn./ concept, etc and identify its strengths and weaknesses

- **EXTERNAL** env. and identify its opportunities and threats that it poses to the orgn./ concept, etc .

S Strengths W Weaknesses
O Opportunities T Threats

55

SWOT Analysis

- To provide information that helps **match the org/ concept's resources & capabilities** to the competitive environment

- To identify where **more information is needed and external data/insights** are lacking and need to be gathered

S Strengths W Weaknesses
O Opportunities T Threats

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SWOT Analysis: STRENGTHS

Examples:

Advantages of proposition?
Capabilities?
Competitive advantages?
USP's (unique selling points)?
Resources, Assets, People?
Experience, knowledge, data?
Financial reserves, likely returns?
Marketing - reach, distribution, awareness?
Innovative aspects?
Location and geographical?
Price, value, quality?
Accreditations, qualifications, certifications?
Processes, systems, IT, communications?
Cultural, attitudinal, behavioural?
Management cover, succession?
Philosophy and values?

strengths

Resources & capabilities that can be used as a basis for developing **competitive advantage.**

Questions:
- *What advantage do you have?*
- *What relevant resources do you access to?*
- *What do you do well and better than others?*

http://worldwideassociates.co.uk/images/SWOT_analysis_template.jpg

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SWOT Analysis: WEAKNESSES

weaknesses

Absence of certain strengths (i.e. weak reputation, high cost structure) **or flip side of a strength** (i.e. a large manufacturing capacity might entail high investment that prevent from quick reactions to changes).

Questions:
- *What could you improve?*
- *What should you avoid?*
- *What do you lack?*

Examples:

Disadvantages of proposition?
Gaps in capabilities?
Lack of competitive strength?
Reputation, presence and reach?
Financials?
Own known vulnerabilities?
Timescales, deadlines and pressures?
Cashflow, start-up cash-drain?
Continuity, supply chain robustness?
Effects on core activities, distraction?
Reliability of data, plan predictability?
Morale, commitment, leadership?
Accreditations, etc?
Processes and systems, etc?
Management cover, succession?

http://worldwideassociates.co.uk/images/SWOT_analysis_template.jpg

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SWOT Analysis: OPPORTUNITIES

Examples:

Market developments?
Competitors' vulnerabilities?
Industry or lifestyle trends?
Technology development and innovation?
Global influences?
New markets, vertical, horizontal?
Niche target markets?
Geographical, export, import?
New USP's?
Tactics: eg, surprise, major contracts?
Business and product development?
Information and research?
Partnerships, agencies, distribution?
Volumes, production, economies?
Seasonal, weather, fashion influences?

opportunities

External factors: unfulfilled customers' needs, arrival of new technology, change in policies and regulations, etc.

Questions:
- *What are the interesting trends you are aware of?*
- *What are some good opportunities for profit and growth in the market?*

http://worldwideassociates.co.uk/images/SWOT_analysis_template.jpg

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SWOT Analysis: THREATS

threats

External factors: changes in envmt such as shift in consumer's tastes/lifestyles, emergence of competitive products/ services, new regulations/ technologies, etc.

Questions:
- *What has changed lately in the market? Increased competition ?*
- *What technological advancement can threaten your position?*

Examples:

Political effects?
Legislative effects?
Environmental effects?
IT developments?
Competitor intentions - various?
Market demand?
New technologies, services, ideas?
Vital contracts and partners?
Sustaining internal capabilities?
Obstacles faced?
Insurmountable weaknesses?
Loss of key staff?
Sustainable financial backing?
Economy - home, abroad?
Seasonality, weather effects?

http://worldwideassociates.co.uk/images/SWOT_analysis_template.jpg

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SWOT Analysis

Identify the most promising strategies by considering the interaction between internals and external factors:

- **S-O :** Pursue opportunities that are good fit to org.'s strengths;

- **W-O :** Overcome weaknesses in order to pursue opportunities;

- **S-T :** Identify in what ways the org. can use its strengths to reduce its vulnerability to external threats;

- **W-T :** Establish a defensive plan to prevent org.'s weaknesses from making it highly susceptible to external threats.

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SWOT Analysis

"How might we" statements examples

- HMW leverage our cultural competency to increase work with global clients?

- HMW develop projects that can be marketed to new clients?

- HMW leverage the international partnership in a direction we want to work in?

- HMW develop a 'bench strength' through our network of colleagues?

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Diagnostic Thinking: SWOT Analysis

Example

STRENGTHS

Internal factors (example):
- a new innovative product or service
- resources (financial, intellectual, location)
- quality processes and procedures
- any other aspect of your business that adds value to your product or service

WEAKNESSES

External factors (example):
- lack of expertise
- poor quality
- damaged reputation
- regulation regarding the business
- competitive capabilities

OPPORTUNITIES

External factors (example):
- strategic alliances
- moving into new market segments
- economic condition
- market trends
- any other aspect of external factors that adds value to your business

THREATS

External factors (example):
- competitors and competitive actions
- poor public relations development
- criticism
- price wars
- any other environmental conditions that are unfavorable to your business

http://www.go4decision.com/index.php/benefit-and-utilise-for-free/explore-the-benefits

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Performance Dashboard

- Tool designed to visually monitor the progress and success of a plan by providing a 'dynamic feedback mechanism'

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Performance Dashboard

- Designed to :
  - Offer visual representation of progress and potential trouble spots in a plan
  - Develop a multiple-gauge format dashboard that can function as key-feedback mechanism
  - Include "soft measures" which allow to monitor qualititative parameters such as motivation, commitment, etc

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Performance Dashboard

- Develop <u>set of indicators / criteria</u> that can be effective for monitoring progress of plan
- Select & combine <u>most important indicators</u>
- Create a <u>visual dashboard</u> and make it visible
- Meet regularly with team to <u>review the measurement and update</u> the dashboard

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Proficiency of Thinking Skills

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"Ass gauge"

69

Gap Analysis

MIND THE GAP
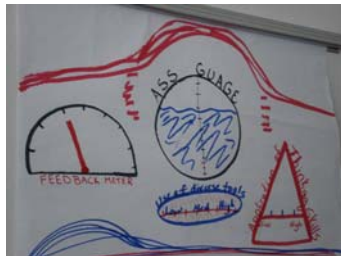
A tool designed to help people identify **critical gaps** between **current reality and desired future state**.

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Gap Analysis – *Purpose*

- Explore the **missing steps** between where you are and where you want to go
- Take a **realistic look to the 'present'**
- Identify **strategic pathways** towards the desired future

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Gap Analysis – *Directions*

1. Identify the **future state** *(use visioning tools- illustrate a vivid and detailed description of the desired state). .*
2. Identify the **present state**: *How are things now?*
3. **Focus on the gaps.** Ask people to work in pair and discuss: *"What are the gaps?", "What are other possible barriers?" "What' is missing?"*

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Gap Analysis – *Directions*

4. Share the gaps that have been identified as a group and post them on the wall between the "present" and the "future".

5. Converge and reach consensus on the critical gaps you want to address first. You might want to convert the selected gaps into *"How to/ How might we…" questions (as a springboard for ideation).*

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Example

Current Reality	Gaps	Desired Future
PW symposium attracts a diverse educators, mostly from primary and secondary teachers. Only partially addresses the needs of PW teachers in the field. Not enough depth in sharing- too much show-and-tell.	How might we increase spaces for more teacher to attend? How to enhance focus on curriculum leadership? How to pursue deliberate innovation on PW programmes across schools? How to broader variety of process-based methodologies?	By the end of 2009, Project Work Symposium will be the point of reference for the community of practitioners in education
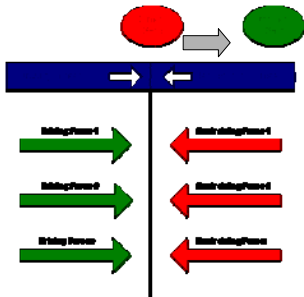
74

Force Field Analysis

- Tool used to evaluate and determine the feasibility of the attainment of a goal or plan of action.

- This is done through listing all driving and resisting factors affecting the goal or 'change'.

- By doing this, it is possible to clearly see the viability of such a plan of action and improve on reducing or solving the resisting factors and increasing or improving the possible driving factors to bring about a tangible change.

75
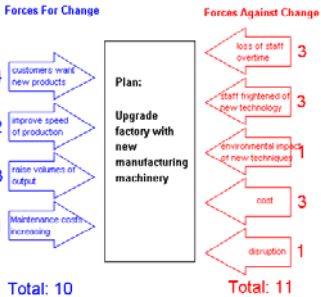
Force Field Analysis

- All driving forces for change is drawn on the left, and the resisting on the right.
- The more driving forces, the more feasible it is.
- Further evaluation of factors into degree of strength - 1(weak) to 5 (strong), is also possible and optional.

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http://home.att.net/~nickols/changing_behavior.htm

Force Field Analysis Example

http://www.psychwww.com/mtsite/forcefld.html

Targeting

designed to visually depict the evaluation and development of an idea.

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Purpose & Intended Benefits

- Provide users with an evaluative tool that is <u>intuitive, visual and kinesthetic</u>

- Reflects Fritz's <u>creative tension model</u> (i.e., the tension between the desired future state and the current reality)

- Allows users to <u>physically track progress</u> as a solution is developed into an ideal outcome

- Tends to <u>uncover deeply rooted barriers</u> as a result of the analysis of pulls and pushes

- <u>Multiple applications</u> (from single options to competing options, individual to group use, etc)

79
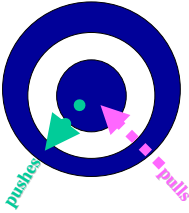
The Essence of Targeting

- Define the **bull's eye** *(ideal solution or outcome)*

- Evaluate option(s) based on <u>how close they come to the</u> <u>ideal state</u> (***physically*** place options on target)

- Identify **pulls** and **pushes**

- Seek to overcome pushes

- Then, physically move option(s) based potential success for overcoming pushes

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Targeting: Directions for Use

"How to ..."

1. Define the bull's eye
2. Locate option(s) on the target
3. Generate pulls and pushes
4. Transform pushes into problem statements (e.g., ***How to…)***
5. Generate ideas to overcome pushes
6. Identify actions and insights

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Personal Example: Improving Your Health

1. Describe your **ideal physical state**
2. Locate on the target where you **current physical condition** in relationship to your ideal
3. Create a **list of forces** that–
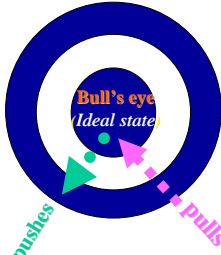   a) move you in direction of the ideal state (**pulls**) and
   b) prevent you from being on target with the ideal (**pushes**)
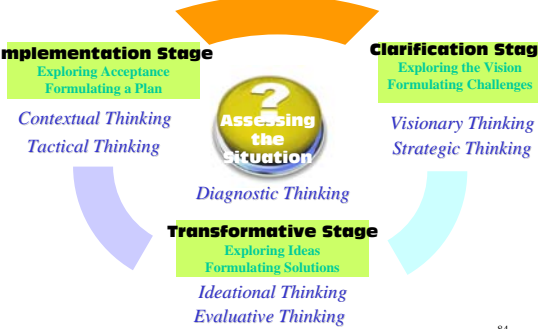
82

Personal Example: Improving Your Health

4. Phrase the **major forces** that need to be addressed to move you towards your ideal as problems statements. E.g. *"How to have more discipline to jog everyday?" "How to snack less frequently?"*

5. Start with **biggest push**, generate ideas to overcome. Ask, *if I pursue these ideas and overcome this push, how much closer am I to my ideal?* **Move option** accordingly. Repeat for other pushes.

6. **Record insights and next steps** revealed by this tool. Complete the statement, *"What I see myself doing now is…"*

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CPS Stages & Related Thinking Skills

Implementation Stage
Exploring Acceptance
Formulating a Plan
Contextual Thinking
Tactical Thinking

Clarification Stage
Exploring the Vision
Formulating Challenges
Visionary Thinking
Strategic Thinking

Assessing the Situation

Diagnostic Thinking

Transformative Stage
Exploring Ideas
Formulating Solutions
Ideational Thinking
Evaluative Thinking

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WEBLINKS

PMI
http://www.mindtools.com/pages/article/newTED_05.htm
http://wwwfp.education.tas.gov.au/english/pmi.htm

SWOT
http://www.mindtools.com/pages/article/newTMC_05.htm
http://www.quickmba.com/strategy/swot/

Card Sort
http://www.infodesign.com.au/ftp/CardSort.pdf
http://www.boxesandarrows.com/view/card_sorting_a_definitive_guide

Webbing
http://olc.spsd.sk.ca/DE/PD/instr/strats/webbing/index.html
http://virtualinquiry.com/inquiry/webbing.htm

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Tool Weblinks
Fishbone Diagram: **http://web2.concordia.ca/Quality/tools/12fishbone.pdf** **http://www.mycoted.com/Fishbone_Diagram**
Cartoon Storyboard **http://www.mycoted.com/Cartoon_Story_Board**
Affinity Diagram **http://mot.vuse.vanderbilt.edu/mt322/Affinity.htm** **http://www.balancedscorecard.org/Portals/0/PDF/affinity.pdf** **http://www.mindtools.com/pages/article/newTMC_86.htm**
KWL **http://www.ncrel.org/sdrs/areas/issues/students/learning/lr2kwl.htm** **http://www.eduplace.com/graphicorganizer/pdf/kwl.pdf**
Force-field Analysis **http://www.mftrou.com/Lewins-force-field-analysis.html** **http://www.mindtools.com/pages/article/newTED_06.htm**

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THANK YOU !

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APPENDIX E

Praise First with PPCO Thinking Tool

Praise First

Thinking is an art, with its own purposes, standards, principles, rules, strategies, and precautions. And it is an art well worth learning, for every important thing we do is affected by our habits of mind.
–Vincent Ryan Ruggiero

After a recent workshop, a teacher asked me in private, *"Are we SERIOUSLY serious about fostering creative thinking in our curriculum?"* A student jokingly commented that teachers are '2 fast 2 furious' to point out flaws and judge ideas. A colleague felt proud that she has a brilliant idea to present to her team leader but at the same time felt a sense of vulnerability.

Transformational leadership (Downton, 1973) focuses on developing others to their fullest potential. In recent developments, Northouse's (2004) listed intellectual stimulation as one of the main characteristics of transformational leadership. Based on his description that transformational leaders "stimulate followers to be creative and innovative", are we - leaders shaping Singapore's education landscape - providing sufficient room to "try new approaches and develop innovative ways of dealing with organizational issues" (p.177)?

What's wrong with MY ideas *?!@#!*

Do you know that you have a *reptile* living in your brainstem? Our *"gator brain"*, like that of the entire brain of an alligator is solely concerned with survival - food, protection, turf guarding , and yes…. reproduction. Animals comfortable in their natural environment will regard any change as a threat. Thus, their natural instinct in dealing with "newness" will include the following: kill it, eat it, and run from it (or mate with it).

If you want to think creatively, then you had better break away from old mental habits - think 'out of the box'! Many people automatically kill new ideas when they start thinking "*Mine-is-better"* and it does not help that our tendency to over-rationalize (even at the expense of compounding a mistake), or simply to give in to irrational prejudice by way of stereotyping. Unfortunately, they also destroy the possibility of innovation, creativity, or improving morale with such early closures.

Back to our *'gator brain'*: Thankfully, we are blessed with a neo-cortex (the "innovative brain") which has the capacity to override the primitive instincts of the brainstem. That means, MAN can be creative by treating "newness" with curiosity, defer judgment and identify possibilities

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in new ideas. In short, we can be smarter than gators- *if we choose to be.* Instead of dampening the spirit of creativity, if you spot the "holes" in the ideas first- ideas that seem too "fresh" or dangerously too risky, use **Praise First** to evaluate and strengthen an idea to give it extra bite!

Praise First- Pluses, Potentials, Concerns, Overcome Concerns (PPCO)

Praise First is founded on the principle of affirmative judgment. The technique allows the expression of both positive and negative responses to an idea without crushing its potential – or its originator. Instead of jumping in to critique an idea, seek first the value in it. Express what you like about it. Think about what might be possible if it worked. THEN, present your concerns as questions to invite further thinking. **Praise First** is a great way to strengthen the idea (and the originator) by identifying key shortcomings and highlighting key advantages by laying the cards on the table. It is also a powerful tool for the team to brainstorm on how to overcome concerns together.

Praise First is not only a great tool to analyze and improve ideas by transforming them into workable solutions, it is also very useful to provide feedback on behaviour products or proposals. Thomas Edison once said, "Opportunity is missed by most people because it is dressed in overalls and looks like work." The deliberate work to affirm new ideas is such an opportunity.

The Future is in Your Mind

I bought a shapes chunky puzzle for my 10 months old daughter. While she was toying with the pieces, my wife with all good intentions commented, "Darling, you cannot fit a round block into a square hole." Shortly after, the baby amazingly took some scrap cloths to pad the base of the block and managed to make that supposedly impossible fit. The point is, to envision the possibility of change, evaluate ideas in an affirmative and developmental approach. As the former UCLA basketball coach John Wooden said, "Don't let what you cannot do interfere with what you can do."

References:

Downton, J. V. (1973). *Rebel leadership: Commitment and charisma in a revolutionary process.* New York: Free Press.

Miller, B. J., Vehar, J. R.; Firestien, R. L. (2001). *CPS facilitation: A door to creative leadership* (3rd Ed.) . Williamsville, NY: Innovation Systems Group.

Northouse, P. G. (2004). *Leadership: Theory and practice* (3rd ed.). Thousand Oaks, CA: Sage.

Puccio, G. J., Murdock, M. C., & Mance, M. (2007). *Creative leadership: Skills that drive change.* Three Oaks, CA: Sage Publications, Inc.

PRAISE FIRST with the following steps:

1. **PLUSES:**
   - ❖ Consciously examine ideas positively;
   - ❖ What are the strengths, good points, positives, pluses, about the idea, work, proposal, and performance?
   - ❖ Be direct, honest and specific.

2. **POTENTIAL:**
   - ❖ Look for the opportunities, positive implications, possibilities in the future;
   - ❖ Be aware that spin-offs may prove even more rewarding.

3. **CONCERNS:**
   - ❖ What are your concerns- weaknesses, trouble spots, minuses?
   - ❖ Express your concerns as open-ended questions to offer a possible direction for future development;
   - ❖ Use statement such as "*How to...,*" *"How might …"* or *"In what ways might…"*

4. **OVERCOME concerns:**
   - ❖ Prioritize concerns- choose the most important one/s and brainstorm some ideas to overcome them;
   - ❖ Germinate the idea and identify solutions to be executed through an Action Plan.

APPENDIX F

Feedback Form for Teachers

INCORPORATING THINKING TOOLS TO ENHANCE THE FACILITATION OF

PROBLEM-BASED LEARNING

Feedback Form for Teachers

We are seeking your feedback about your teaching experience on PBL.
Your thoughts will help us to strengthen our concept framework on the use of Thinking Tools to enhance students' thinking skills.

Thank you for your time and for your comments.

Name/ School : _____

Please reflect on the most recent PBL lesson you conducted and answer the following questions.

1. Describe an aspect of the lesson which has been MOST useful/ easy in terms of how you facilitated the session.

2. Describe an aspect of the lesson which has been LEAST useful/ easy in terms of how you facilitated the session.

3. Indicate (on the scale) how confident you would feel in terms of facilitating PBL *(prior to attending the workshop conducted by CPDD)*

_____

Not very confident   *Very confident*

What leads you to mark your level of confidence where you have on the above scale?

4. Any other comments?

Please note that you are not obliged to complete the form; however, we are grateful to those who do. Once completed, please email your completed form to john_yeo@moe.gov.sg

APPENDIX G

Permission to Use Images of Zhonghua Secondary School's

Boys Brigade Students for Figures 7 and 8

From: **Dolly ONG/MOE/SINGOV**
03 Dec, 2008 02:24 PM
To: John YEO/MOE/SINGOV@SINGOV
Cc: davidwws_98@yahoo.com , keong1111@hotmail.com,
lawrence_tang_kok_onn@moe.edu.sg

Dear John

Thank you for your email as well as your years of service as a BB volunteer. It's fine and good that you have captured the processes of our boys in action. You may proceed to use the photographs for your masters project.

Regards
Mrs Dolly Ong
Principal
Zhonghua Secondary School
13 Serangoon Avenue 3, Singapore 556123   Tel: 62824339 Fax: 62823472

John YEO/MOE/SINGOV

12/03/2008 02:10 PM
To: Dolly ONG/MOE/SINGOV@SINGOV
Cc: davidwws_98@yahoo.com, keong1111@hotmail.com, lawrence_tang_kok_onn@moe.edu.sg

Dear Mrs Ong

Thank you for the quick check in earlier. As mentioned, I am writing a project report on a proposed training package 'Thinking Skills to Enhance the Facilitation of Problem-based Learning' and would like to include some photographs of students using the Thinking Tools during the Life Skills workshop that I conducted for the Boys Brigade in their Leadership Development Camp on the 13th and 14th November. As the US university needs clearance for the use of images of students under 18 and as far as I know, any written permission from the Principal would suffice, I am writing for your permission to accede this request via an email reply.

I have attached the two page write up on the Life Skills lessons I conducted as well as the photos that I would be attaching as part of the report. If you are keen to read the complete report, I will be most happy to share further.
[attachment "BB 13&14 Nov.doc" deleted by Dolly ONG/MOE/SINGOV]
Looking forward to your favorable reply. Please feel free to contact me at 9846 0880 for further clarification.

cc. Teachers in charge- David and Lawrence; 48th BB Coy captain- Kok Keong

Regards
John Yeo
Curriculum Planning Officer/ Process Skills, Curriculum Planning and Development Division • Tel: +65 6879 6683 • Fax: +65 6775 8752
Ministry of Education • 1 North Buona Vista Drive, Singapore 138675 • http://www.moe.gov.sg

APPENDIX H

3-2-1-1 Reflection Sheet

3-2-1-1

3 tools I prefer:

2 tools I would use in my PBL lessons:

1 tool I would like to share with my colleague:

1 tool I would like to know more about: