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Crossing Borders: New Frontiers for Educational Research

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EVALUATING CRITICAL THINKING PEDAGOGY TO SUPPORT PRIMARY SCHOOL PROJECT WORK USING AN ACTION RESEARCH APPROACH [CHN01325]

The research study describes the findings of an action research project conducted at a local primary school to overcome students’ "cut and paste" mentality when using information sourced from the World Wide Web for writing project reports. This paper reviews the introduction of self-organised learning (S-O-L) developed by Thomas and Harri-Augstein (1985) as an enabling framework for knowledge management. Based on the dual notions of social constructivism and reflective conversational learning, S-O-L offers the action researcher tools such as the Personal Learning Contract and the Purpose-Strategy-Outcome-Review grid for project management. For the student, Learning Plans built upon learning events designed as small tasks related to real life contexts allow for critical thinking to be modelled. As a flexible, content-free technology, students scaffold their own learning and manage the information which they encounter. As Knowledge Elicitation Systems (KES), these are learner-centred and systematic models of learning based on social constructivism that lead to the ease of knowledge management (Coombs, 1995). The use of S-O-L has been found to increase students’ interest in learning and critical thinking dispositions, such as a willingness to self-correct and persist. It is recommended that the sound integration of LPs into the curriculum require teachers to play their roles as facilitators more competently. As such a review of current professional development
practices is called for if teachers are to be competent in guiding critical thinking amongst students.

Introduction

This paper describes an action research project which was carried out at St Anthony’s Canossian Primary School (SACP) from the period August 1999 to May 2000. It was empirically reported by the Principal at SACP that the easy access and availability of a massive amount of curriculum resources on the World Wide Web (WWW) had reformed project work research. Students were expected to be able to utilize this rich curriculum resource bank but observations by teachers from grading earlier projects shows that students were unable to make sense of the chunks of downloaded information. As such they resorted to a "cut and paste" mentality when compiling and writing up project reports, that is, they simply copied whole paragraphs without any attempt to construct relevant meaning from the data gathered. The teachers were generally frustrated at the quality of educational outcomes and it was clear that action into the situation at hand was necessary. Following a literature review of the relevance of Self-Organized Learning (S-o-L) in developing students’ critical thinking dispositions, the project is described and some key findings and implications discussed.

Theoretical Background

S-O-L is based on several psychological learning theories, synthesizing social constructivism and collaboration with conversational cybernetics, culminating in a practical set of CT tools and templates. From these integrated psychological approaches, Harri-Augstein and Thomas (1991) define learning as the "conversational construction, reconstruction and exchange of personally significant, relevant and viable meanings with awareness and controlled purposiveness" (p.27). Deriving such structures of meanings is very much rooted in Kelly’s Personal Construct Theory. In constructing personal constructs, the individual through an inner reflective process arrives at a holistic worldview, linking one’s personal experience with societal influences and behaviours (Coombs and Smith, 1998). Senge (1990) describes this attitude towards systems thinking as looking at problems and goals as part of a larger structure. In order to achieve this ideal, he prescribes that a worldview mental model be adopted. Assumptions and mindsets need to be suspended to create an open, flexible and non-judgemental environment that allows for creative paradigm shifts to take place.

In S-O-L, systems thinking is defined by the learning conversation that has a dual nature carried out by the "conversational individual" or "C-indi". Thomas and Harri-Augstein (1985) explain that two conversations co-exist: one within ourselves with ourselves and another externally, with others. Such a notion of C-indi assumes "human beings as meaning, construing, negotiating and attributing organisms", resulting in personal learning which from other perspectives may not be possible (p.xxvii). According to Senge et al (2000), the essence of such social constructivism is much akin to team learning where a group thinks and acts as one. It results in the matching of one’s individual perspectives with a common shared vision. It is argued that the most effective practice for team learning is the conversational dialogue, "a sustained collective inquiry" of one’s experience in the immediate context. During the process of dialogue, the team comes to a "collective
sensibility, in which the thoughts, emotions, and resulting actions belong not to one individual, but to all of them together”. This shared vision if communicated well, results in increased ownership and an ease of communication (p.75).

For learning based on social collaboration and personal reflection to take place, there must be personal mastery in distinguishing between personal vision and reality. This also encompasses the skills needed to mediate between the distinct "social episodes" of personal learning evident in the internal conversational process (Coombs, 1995). To facilitate the process of self-awareness, Coombs (1995) developed a "personal management system" based on S-O-L described by Harri-Augstein and Thomas. While it is the role of schools and teachers to facilitate the process where students make the choices that will help them reach this level of personal mastery in reconciling the differences between varying experiences, S-O-L helps learners to help themselves. This is achieved through conversational learning techniques that can be developed as reflective tools and technologies (Coombs, 2000). Coombs (1995) describes such forms of knowledge creation using ‘content free’ technology both to manage and elicit information as Knowledge Elicitation Systems (KES). As a person-centred approach to learning, one is also responsible for monitoring one’s own actions and directions.

Self-Organized Learning as a Project Management Tool

Based on the principles of S-o-L, Coombs (1995) developed Learning Plans (LPs) as a project management tool to work as project blueprints. In such an approach, ownership is shared equally between teacher and student through jointly negotiated and agreed upon objectives. Coombs (in press) describes a LP as a self-organized conversational tool where learners working in small groups apply CT skills in solving practical tasks simulating the real world. From the perspective of systems-based thinking, students are actively constructing knowledge from the application of concepts in as real an environment as possible. Such a controlled reflective process also gives voice to prior knowledge, possibly resulting in increased linkages between learning past and present, increasing meaning making to a greater depth. Situating cognitive experiences in authentic tasks increases transfer of critical thinking (CT) skills across the diverse contexts of school and real world (Jonassen, 1996).

It needs to be pointed out that the emphasis is not on the acquisition of new knowledge per se but rather on the personal learning and articulation and transfer of pedagogic thinking process skills that are geared towards real world problem solving in a technological age. Acknowledging that cultural and social aspects also differ between different people implies that in a shared, social construction of knowledge, there will be many ways in which to structure the world. Many meanings and perspectives for any event or concept exist and there is no one or correct meaning that learners should accept (Duffy and Jonassen, 1992). But while personal meaning may be unique, Coombs (2000) argues that the thinking process scaffolds defined by tools such as LPs are generic and experientially ‘content-free’, thus capable of being recruited by teachers into any curricular learning situation. Thus, LPs include these reflective learning procedures so as to act as a personal scaffold for enabling useful and focused CT of any directed task or subsequently discovered learning event.

As a student-centered and systematic approach of learning based on constructivism, LPs offer a flexible, content-free technology allowing students to scaffold their own learning. This is possible as the learning points are derived from small tasks and activities related to real life applications of the concepts, principles and theories presented. The various tasks show incremental increases in the difficulty level (see Appendix 1). Task 1 reviews prior knowledge in student’s comprehension of the scientific concept evaporation using
photographs illustrating situations in which evaporation commonly takes place. Task 2 requires students to engage in the higher order thinking skill of inference by studying the data from the experimental set-up to identify the factors that affect evaporation. Where necessary, additional learning tasks can also be designed and scaffolded into the student’s thinking process within the self-instructional LP which also acts as a project management organizer.

Conceptual learning is achieved through guiding the learner to reflect upon one’s actions. More than just passive ‘happenstance’ discovery learning, there is an attempt to steer systematic reflective problem solving organized within an activities-based experiential-learning environment such as the experimental case study presented. The hands-on concrete approach to learning appeals to concrete learners who are usually less comfortable with abstract conceptualisations without such learning aids.

To support such student-centered learning, the teacher plays the role of a Learning Coach who scaffolds learning to help focus the thinking actions. They help students come to an awareness of their CT process and problem solving skills necessary for independent learning. Learning Coaches and students can also negotiate LPs to arrive at individualized, customized solutions which promote self-directed learning whilst keeping curriculum goals in mind. More than just a "Learning Coach", teachers are also described as "Task Supervisors" and "Intentionality Managers" (see Appendix 2). As "Task Supervisor", the teacher organizes the social domain where learning takes place. The "Intentionality Manager" is the role of subject expert who creates the learning opportunities and authors the conversational tools, in this case the LPs and other supporting course materials, such as worksheets (Coombs and Smith, 1998).

The S-O-L approach towards guiding thinking is re-assuring as it provided a solution for how one could teach CT skills and ensure transference across curricular disciplines. In teaching CT, there are pedagogic implications in the aspect of preparation, delivery and assessment. Fischer and Scriven (1997) advocate that the ‘internal’ approach to teaching CT leads to greater transfer of learning across different fields of study. They argue that the best approach to teaching CT is to involve a combination of the internal (infusion into curriculum) and external (stand alone CT curriculum) approaches. However, no one can become a better thinker by reading a book. An essential component of critical thinking is developing the attitude and disposition of a critical thinker. Good thinkers are motivated and willing to exert the conscious effort needed to work in a thoughtful manner, to check for accuracy, to gather information, and to persist when the solution is not obvious or requires several steps (p.10-11).

The notion of "performance-competence distinction" is described by Halpern (1997) explained that there often exists a gap between what people can do and what they actually do. Halpern suggests that the difference between good and bad students is to be found in their attitude. Six attitudes were identified: willingness to plan, flexibility, persistence, willingness to self-correct, being mindful and consensus seeking (pp.11-12). It is modeling such attitudes and dispositions that expose students to good thinking practice that also makes personal sense. Successful transfer of learned CT is when a student naturally exhibits these good and universal attitudes in all problem-solving situations throughout life. Thus, LP scaffolds need to also help students change their attitudes toward critically thinking through and managing a learning task. Procedures that emulate and develop competences in these required social performances become part of the natural psychological repertoire of the student. Thus, new attitudes can be formed and encouraged by instructional scaffolds in LPs that guide appropriate thinking behaviours.
The Process of Change

Following the preliminary conversations with the Principal and teachers within the first month of initiating the project, the team decided that students needed to be engaged in a new form of critical thinking when confronted with information derived from online communication sources. Indeed, what they needed were some organizational thinking skills suited to tackling educational tasks. They needed to be able to analyse and conversationally articulate the usefulness and relevance of the information acquired, reflecting upon and sieving out what would be pertinent for their project needs while also being able to record and report their focused construing experience. This pedagogic vision stimulated the educational action research goals of this project. The initial learning commitment at this stage was articulated through the use of a Personal Learning Contract (PLC) with an in-built problem-solving heuristic in the form of the Purpose-Strategy-Review-Outcome (PSOR) cycle (see Appendix 3).

The pedagogic CT principles provided a practical protocol for curriculum implementation and was followed by the design of a teachers’ authoring kit so as to transfer the generic design process of what makes a good CT lesson (Coombs, 2000a). In providing a set of clear rules of how to design a CT lesson, teaching CT became a transparent process that any teacher could adopt and integrate into his/her subject area. The approach of using real-life examples to support the curriculum provides a more authentic learning environment where skills in information management are integrated into the pedagogic process.

More than just attempting to teach CT skills, this pilot project built in learning tasks that would mould and positively engender students’ attitudes towards CT that would be imparted through appropriate constructivist modeling activities (Jonassen, 1996). The LP template developed for this project was universal because of its curriculum "content-free" design. Greater transfer of CT across disciplines can be achieved by virtue of using this standard LP design template. It was also decided that the teachers involved in this project would be free to apply the LP thinking framework to any subject of their choice, rather than simply using it as a learning tool to support only Social Studies.

The teaching team participants of nine teachers involved in the teaching of English, Mathematics and Science to the Primary 5 cohort in 2000 attended the teachers’ workshop. The LPs were introduced to the whole Primary 5 cohort in March 2000. The students were 10 to 11 year olds of varying academic abilities. A half-day workshop was organized for the teachers to introduce them to the new curriculum technology and the pedagogical and practical aspects of authoring their own LPs. The teachers were given hands-on opportunity to design and evaluate their own LPs. The LPs were designed to be used by teachers in view of their own classroom needs within a two-week time frame. Five of the teachers, worked on a Mathematics LP while the other four teachers chose to author a Science LP. These groupings came about naturally as teachers came to a rather prompt and unanimous agreement as to what were troubling aspects of the curriculum which required improvement in teaching.

Following the implementation of LPs in class, each of the nine teachers got the students in the class to complete an evaluation questionnaire. A total of 317 completed student questionnaires were returned. In addition, a semi-structured interview approach was adopted to interview 9 teachers and an additional 9 students.

Following the interviews, I used several information management tools developed by Coombs (1995) to analyse the research data gathered from the interviews: namely the Spidergram, the Talkback Record Sheet for Key Focus Issues and the Talkback Record Sheet for Cross Focus Issues. The pedagogic descriptors of LPs were identified using the
Spidergram. Following the identification of theoretical constructs, the research data gathered from the Mathematics and Science curriculum groups were separately analysed using the Talkback approach. The personal construct evidences elicited from the qualitative data collected was further organized and qualitatively analysed by categorizing them into one of the theoretical categories identified using the Spidergram. An additional construct, 'Management', previously not identified as a theoretical construct, but experienced first hand by the teacher participants, was also identified as a pertinent point as Table 1 summarizes.

**Table 1: Key pedagogic focus issues identified from using**
**LPs as a curriculum learning scaffold**

<table>
<thead>
<tr>
<th>Theoretical Construct</th>
<th>Real World Evidences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independence</td>
<td>Interest (and hence, a motivational boost) in learning</td>
</tr>
<tr>
<td></td>
<td>Lacking experience in independent work</td>
</tr>
<tr>
<td></td>
<td>Inability to comprehend instructions</td>
</tr>
<tr>
<td></td>
<td>Students lacking maturity to manage learning</td>
</tr>
<tr>
<td>Pace of Learning</td>
<td>Students’ ability to manage pace of learning because scaffolding helps students tackle difficult tasks</td>
</tr>
<tr>
<td></td>
<td>Unable to manage pace of learning</td>
</tr>
<tr>
<td>Content</td>
<td>Grasping wrong content</td>
</tr>
<tr>
<td></td>
<td>Lacking prior knowledge to self-organise learning</td>
</tr>
<tr>
<td>Collaborative Learning</td>
<td>Students learn how to manage and contribute to groups</td>
</tr>
<tr>
<td>Real-life Contexts</td>
<td>Learning plans teach skills that prepare one for life</td>
</tr>
<tr>
<td>Thinking</td>
<td>Learning plans encourage focused thinking that is both convergent and divergent</td>
</tr>
<tr>
<td></td>
<td>Open-nature of LPs allow for exploration and self-discovery</td>
</tr>
<tr>
<td>Management</td>
<td>Time consuming exercise using LPs in class</td>
</tr>
<tr>
<td></td>
<td>Teachers lacking experience as facilitators</td>
</tr>
</tbody>
</table>

**Source:** Lee (2001).
Following the preliminary identification of themes, different focus areas were compared and links elicited from the teacher and student focus groups, a process that Coombs (1995) describes as "laddered up" comparative thoughts (p.233).

**Major Findings**

Six cross focus issues were derived from the Mathematics curriculum group while only three cross focus issues were derived from the Science curriculum group. One cross focus issue was common to both subject curriculum groups and that is the issue of students’ dislike of the little reliance on the teacher as opposed to the benefits to be gained from more exposure to independent learning. This, however, is an issue that can be resolved over time. With more opportunities for working independently, students would experience first-hand the benefits of doing so and would naturally seek less help from their teachers.

However, a closer analysis of the four cross focus issues derived from the Mathematics curriculum group shown in Table 2 below suggest that the core theme underlying all issues is that teachers do lack skills and experience as facilitators in managing learning tasks. Whether as Intentionality Manager, Task Supervisor or Learning Coach, there appears to be certain skills that need to be honed. A competent and skilled facilitator of CT would be able to (i) guide students towards an awareness of the process skills in problem solving, (ii) manage a conducive environment for learning, (iii) ensure the learning of content by scaffolding learning tasks, (iv) motivate students to adopt good CT attitudes and (v) ability and willingness to entrust learning outcomes to students; all of which were cross focus issues uncovered from the Mathematics curriculum group. This lack of facilitation skills was also attributed to be the cause of students’ over reliance on teachers in the Science curriculum group.

Another thread of commonality running across two different cross focus issues as shown in the last row of Table 2 is the teacher’s perception of students’ readiness and ability to work with LP as compared to students’ own positive perceptions. Teachers give students less credit for what they are worth to make decisions and judgements about their own interest in learning and ability to monitor their own progress. This again points to the need to acquire experience as a Learning Coach.

From qualitative analysis of the key focus and cross focus issues, two needs for teachers and students arise:

i. Students need more experience in working independently in situations requiring CT, so as to gain confidence and hence reducing reliance on their teachers.

ii. Teachers need further development of skills and experience to play their role as facilitators of CT more effectively and efficiently; and give credit to students with an ability to take ownership of their learning.
Table 2: Key Cross Focus Issues Identified Related To Facilitator Competency in a S-O-L Task Management Domain

<table>
<thead>
<tr>
<th>Cross Focus Issue - Mathematics</th>
<th>Facilitator Competency</th>
<th>Cross Focus Issue - Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opposing objectives of ensuring students learn the right content versus students learning life skills from the process of learning.</td>
<td>Intentionality Manager</td>
<td>Students’ apparent over-reliance of teachers attributed to teachers’ inexprience and lack of skills as facilitators.</td>
</tr>
<tr>
<td>Engagement in activity, discussion-based discovery learning at the expense of getting a class that is difficult to control.</td>
<td>Task Supervisor</td>
<td></td>
</tr>
<tr>
<td>Teachers conflicted between intervening to teach content or intervening to provide hints and guidelines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students lacking persistence to work independently as opposed to teachers who are too eager to offer guidance</td>
<td></td>
<td>Students’ perception of their readiness to work with LPs as opposed to teachers’ perception of students’ readiness.</td>
</tr>
<tr>
<td>Students’ perception of the help that a LP provides as opposed to teachers’ perception that students do not comprehend instructions</td>
<td>Learning Coach</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Lee, 2001).

Recommendations for Building Schools as Learning Organizations

From the two points previously raised, it appears that the more urgent of these appeared to be the need to develop the facilitation skills of the teachers which appear to be inhibiting their students’ from naturally applying their critical thinking abilities. As Coombs (2000) explains, LPs constructed in a manner that is user-friendly would enable “the user to interact in a meaningful and conversationally fluent manner, so as to maximize one’s creative
learning potential” (p.21). Distinguishing reflexive skills from reflective skills, Coombs and Smith (1998) describe reflexive skills as in-built responses automatically triggered by situations calling for a standard response. Reflective skills, on the other hand, imply a "conversational constructivist effort" to derive new meaning (p.21). It is this latter skill, the fluency of conversational thinking strategies that is a prerequisite of a user-friendly reflective learning system, which is within the control and influence of our teachers.

As such a recommendation that can be made for the effective authoring and use of LPs is teachers should diagnose the students, subject matter and environment to design an educationally sound lesson. As thinking professionals engaged in active scrutiny of how situations can be improved, they bring with them practical know-how for the customisation and adaptation of pedagogical theory to the needs of students whom they know best, setting appropriate curriculum activities and adopting suitable teaching strategies.

However, more than just a diagnosis of the students, subject matter and environment, Solomon and Morocco (1999) also caution the need to diagnose pedagogy. As educators in professional practice, pedagogical knowledge should also be constantly updated. This is a valid point as on reflection, there perhaps might have been a more passionate adoption of LPs to deliver the curriculum at SACP if teachers had the pedagogic knowledge base to support their design and implementation of LPs. Appendix 3 illustrates the task management roles as key facilitator competencies.

Clearly then, there is a need to review and re-structure the professional development programs available for teachers. It is that keep updated and innovative. A paradigm shift is needed for educators to acknowledge that their role in the classroom is changing. This calls for the acquisition of new skills, specifically facilitation skills that work in student-centred environments focused on developing critical and creative thinking. Teachers now multi-task, playing the role of Learning Coach, Task Supervisor and Intentionality Manager as student, subject, management and pedagogical experts.

Finally, as a content-free technology, S-O-L conversational tools are easy to use and findings from the Mathematics and Science curriculum groups do indicate that the conversational tool of the LP is indeed easy to apply across disciplines and cultures. The easy application of S-O-L tools is based on the process of reflective learning that draws on the specifics of each user's experience as their own unique and necessary resources for personal growth and development. As such S-O-L can have wide appeal, being easily adaptable to the specific needs of each user (Thomas and Harri-Augstein, 1985).

Conclusion

With its flexibility, the use of LPs has resulted in students' increased interest in learning. These motivational outcomes are possible as the use of LPs scaffold personal learning and increase the learner’s self-esteem. By making learning objectives as simple and clear as possible, students are able to take control of their own learning experiences to ensure greater critical thought. By presenting learning tasks in bite-size, stepwise portions, students will be able to systematically review their own progress and reflect upon each step taken. In a wider context, this AR project should have begun to equip students the essential life skills of information management. The increased confidence and CT competency should be transferable to all fields of learning over the long term.

Such is the nature of S-O-L, in that it is relevant and has the potential to empower learners whilst building upon their confidence to take control of their own learning through systematic
and critical reflection. In a borderless world, where many possibilities for information exchange and intellectual globalization continue to exist, Harri-Augstein and Thomas (1991) stress that teachers and students in learning organizations must be prepared for the quest to play their role as reflective social constructivists for

the learner cannot, by definition, know what they have yet to learn, but they can reflect upon their experience, anticipate possibilities, act on the basis of these and reflect again upon each new experience. This process can be encouraged and enabled through the practice of Learning Conversations (which) is both a philosophy and a technology which grows and expands the more your use it (pp.3-4).

References


APPENDIX 1 SAMPLE OF LEARNING PLAN FOR SCIENCE

Learning Objectives

By the end of this workshop, you should be able to:

1. List examples of evaporation.
2. Infer that when water evaporates it goes into the air as water vapour.
3. Explain how wind affects the rate of evaporation.

Tasks 1 and 2 are to be completed with your partner. Complete Task 3 individually.

Task 1: Review of concept

Collect the resource basket from the teacher's desk and take 20 minutes to complete Task 1.

1. Study the photograph samples:
   - Sample A: Drying of puddles of water
   - Sample B: Drying of clothes
   - Sample C: Drying of vegetables, fruit
   - Sample D: Drying a child after bath and perspiration
   - Sample E: Loss of water from aquariums/ponds

   **Record your answers in the worksheet attached.**

2. Identify what's common amongst the photographs.
3. What process has taken place?
4. Next, put a drop of rubbing alcohol on your fingertip.
5. What has taken place?
6. Write your conclusion in the space provided.

Task 2: Factors affecting the rate of evaporation

You have 35 minutes to complete Task 2. Task 2 is an activity in which you will determine how wind will affect the rate of evaporation.
1. In the basket, you will find two handkerchiefs. How are they alike?
2. Wet the two handkerchiefs completely.
3. Hang the two handkerchiefs in the classroom on the line provided by your teacher.
4. Note the time on the clock and record this in the worksheet.
5. Use a fan to blow on one of the handkerchiefs for 10 minutes.
6. At the end of ten minutes, stop the fan. Record the time in your worksheet.
7. Feel the handkerchiefs and record your observations about the wetness of the two handkerchiefs.
8. Record the time.
9. Continue blowing at the same handkerchief for another 5 minutes.
10. Feel the handkerchiefs after 5 minutes. Record your observation.

- What do you think has taken place?
- Where has the water gone?
- Why do the two handkerchiefs feel different?
- What conclusion can you make?

**Bonus - Task 3: Use of CD-ROM**

1. Complete the quiz in unit 3 of the CD-ROM.
2. Record the time you took to complete the quiz and your score in the worksheet.

**APPENDIX 2**

task-management roles with primary facilitator competencies identified for a S-O-L environment

*(Lee, 2001)*

**APPENDIX 3 POST PROJECT PERSONAL LEARNING CONTRACT**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>What is my purpose?</th>
<th>What became of my purpose?</th>
<th>Describe essential differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>To develop a set of thinking skills to support research for project work resolving students’ habit of adopting a &quot;cut and paste&quot; mentality.</td>
<td>To expose students to hands-on experiential learning such that they can hopefully learn in the long run to adopt a natural attitude and disposition towards critical thinking/problem solving.</td>
<td>Rather than teach critical thinking skills out of context, an immersive approach was adopted. Rather than skills, it is attitudes and dispositions that matter; this increases transfer across disciplines and more importantly, in real world situations.</td>
</tr>
<tr>
<td>What actions shall I take?</td>
<td>What did I do?</td>
<td>Differences</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploratory conversations with principal and teachers to further assess needs.</td>
<td>Further self-reflection and conversations with stakeholders.</td>
<td>Increased the degree of partnership in the AR project by giving teachers’ responsibility of imparting CT attitudes to students.</td>
<td></td>
</tr>
<tr>
<td>Literature review.</td>
<td>Problem is not critical thinking skills, but the design of project work.</td>
<td>This gave teachers ownership of the problem. With a vested interest in improving their own classroom practice, teachers identified the objectives and strategies suited for the class.</td>
<td></td>
</tr>
<tr>
<td>Preliminary workshop to impart skills to students.</td>
<td>Organised a teachers’ workshop to introduce them to conversational tools.</td>
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<td></td>
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<tr>
<td>Reflective log.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up conversations with school.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How shall I judge my success?</th>
<th>How well did I do?</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Learning plans have been acknowledged as a valuable tool to impart life skills for coping with changes. Greater acceptance and enthusiasm from both management and staff. Students also enjoy the engagement in discovery learning.</td>
<td>Students’ interest in working with LPs. A tool applicable across contexts especially to aid CBL technology rich lessons now exists.</td>
</tr>
<tr>
<td>Students should ideally be able to use tools independently, reading information sources more carefully, and increasing the quality of written reports.</td>
<td>Students’ interest in working with LPs. A tool applicable across contexts especially to aid CBL technology rich lessons now exists.</td>
<td>Semi-structured interviews and questionnaires were used.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Review</th>
<th>What were the strengths?</th>
<th>What improvements are needed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers self-initiating the problem solving process.</td>
<td>Teachers function as Learning Coaches.</td>
<td>More time to engage teachers in further cycles of reflection and action.</td>
</tr>
<tr>
<td>Teachers have acquired experience in using conversational</td>
<td></td>
<td>To encourage teachers to integrate LPs as a tool for teaching on a regular</td>
</tr>
<tr>
<td>tools to facilitate the reflective practice.</td>
<td>basis.</td>
<td></td>
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<tr>
<td>------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>To develop teacher facilitation competencies as Learning Coach, Task Supervisor and Intentionality Manager.</td>
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</table>