

INFUSING THINKING INTO CURRICULUM CONTENT

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Helping students become more effective thinkers is a fundamental goal in education. In recent years societal demands for higher order thinking has generated a strong interest among educators in the teaching of thinking skills. The educational system in Singapore has undertaken major initiatives to introduce far-reaching curricula changes to promote creative and critical thinking in students. In attempting curricula innovations, educators in Singapore find themselves confronted with a confusing variety of models of thinking skills and approaches to the teaching of thinking. They have to grapple with myriad of issues including the conflicting demands of teaching curriculum content and the necessity to inculcate thinking skills. This paper describes a major pilot project which attempted to address some of these key issues. The outcome is an integrative model and framework for a thinking curriculum that was successfully implemented in vocational education. This model has been adapted and currently taught in pre- and in-service teacher education courses. In this paper, a brief description of the thinking model is provided as well as the key steps involved in implementing and delivering a thinking curriculum.

INTRODUCTION

In the last three years, a slew of educational initiatives was initiated in Singapore education in response to Prime Minister Goh Chok Tong's call for "Thinking Schools, Learning Nation." The emphasis on promoting thinking and creativity was spearheaded by the recognition that rapid changes brought about by globalization and the onslaught of the technological and information revolution necessitate the development of a "new" type of citizen - one who can manage increasing amounts of information, who can sort through the information, choose information that is relevant and effectively use that information. The traditional "drill and kill" approach was deemed inadequate in educating such a citizen. A fundamental review of the goals of education was therefore undertaken by the Ministry of Education in Singapore, with far reaching implications for curriculum and assessment, as delineated in the document "The Desired Outcomes of Education."

In tandem with these educational initiatives, Singapore Polytechnic launched a major pilot in January 1997 which resulted in a model of the thinking curriculum for vocational education. This paper describes the pilot project and outlines the main components of the thinking model that evolved as well as key steps in the implementation of a thinking curriculum.

A PILOT THINKING PROGRAM

Issues Considered

In attempting to conceptualise a thinking model, one first task is to ensure to engage faculty in the clarification of key issues. At the onset of the pilot, a seminar was organised for curriculum leaders to provide a platform to clarify issues and concerns. The following were some of the main issues that were discussed:

1. Why teach thinking?

Many lecturers questioned the need to teach thinking to students as it is assumed that thinking is a natural activity that every human engages. However as has been pointed out, performing thinking activities such as comparing and contrasting, predicting, finding causes, etc. does not necessarily involve either critical or creative thinking. It is how people perform these activities which determine whether critical and creative thought is involved. Teaching thinking becomes even more important as most students are found to be quite deficient in reasoning skills (Perkins, 1981). Teaching of thinking has become an educational imperative in Singapore education where the goal is to produce citizens that can play a constructive role in society.

2. What are the thinking skills?

Thinking has been variously defined and many lists of thinking skills exists, including Bloom's Taxonomy (1956) which describes several categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. Nickerson (1981) has suggested that no one taxonomy exists. However, there is agreement on some common components of thinking. These include basic micro skills such as compare and contrast, classification, causal explanation, and complex processes such as decision making, problem solving, as well as metacognitive strategies. In addition to cognitive skills, a good thinker possesses certain traits and dispositions such as perseverance in searching for information, open-mindedness, curiosity, empathy, reflective capability, making judgement after considering many angles, (Costa, 1996; Glatthorn & Baron, 1992).

3. What will be the focus of attention - the skills or the content?

The need to balance the teaching of knowledge and the development of thinking skills to process that knowledge is an educational imperative in order to prepare students to adapt to societal demands and changes. Other competencies have been identified as important to develop that will enable students to become 'lifelong learners,' including acquisition of knowledge, communication skills, and self-management skills. Thus in conceptualizing a thinking model, SP has identified the following as important components of a thinking curriculum: a well integrated knowledge base, thinking skills and processes, thinking dispositions, and strategies for life long learner.

4. What instructional approach should be used?

Several options were considered. One was to assume that existing curriculum already teaches appropriate thinking skills. Although many lecturers are effectively promoting in the classroom, clearly there is a need for greater emphasis on teaching of reasoning and problem solving skills. The traditional lecture approach does not allow opportunity for analysing problems and issues. Another approach considered was to have certain thinking skills strategies taught in a separate thinking skills course as an elective. However, one compelling reason against this approach is that if thinking is taught in only one or two courses, it will not take root. A third approach is the infusion approach which seeks to integrate thinking into content instruction, and which is based on three key principles (Swartz & Parks, 1992):

1. The more explicit the teaching of thinking is, the greater the impact it will have on students
2. The more classroom instruction incorporates an atmosphere of thoughtfulness, the more open students will be to valuing good thinking
3. The more the teaching of thinking is integrated into content instruction, the more students will think about what they are learning.

As the weight of research suggests that a more explicit approach yields better learning, this approach was adopted in the pilot project. Swartz' instructional methodology for infusing thinking into content was chosen because its key features, namely, graphic organizers and thinking maps, was considered to be a useful starting point for the teaching of thinking skills in the classroom.

Aim of the Pilot Project

The aim of the infusion project was to evolve a model for a thinking curriculum for vocational education that would shift the emphasis from content knowledge to more problem solving, application and creativity. Lessons learned from the pilot modules would serve as the basis for recommendations to departments on the implications for curriculum, instruction and assessment.

The innovation commenced in January 1997 with a staff development workshop on restructuring lesson for teaching thinking for staff involved in the infusion project. Ten modules were selected for the pilot. Curriculum teams met frequently with staff developers to identify appropriate skills to infuse into the modules across a variety of teaching situations - lectures, tutorials, labs and projects. Lesson plans were restructured and carried out with classroom visits and feedback by staff developers.

The infusion was conducted on a modest scale with no attempt to change the assessment. The modules were piloted for a semester following which feedback was obtained from staff and students at the end of the pilot run.

Feedback on Pilot

Teaching staff on the pilot project documented their experiences in a log throughout the duration of the pilot. The most frequently documented experience was that the active learning nature of the infusion method increased student enthusiasm and participation. Students worked well cooperatively and shared knowledge, resulting in a greater number of students asking and responding to questions. The majority of lecturers felt that infusion helped to promote thinking for most students, although for the students to fully internalize the skills, more reinforcement was needed in subsequent lessons.

Student feedback was obtained at the end of the semester using a questionnaire. From the results, it was apparent that for many students, the infusion approach enhanced the interest of the topics and improved the quality of their thinking.

Overall, it was felt that the infusion method can be an effective approach to promoting thinking in content curriculum when the thinking skills infused clearly relate to and support the learning of content.

The pilot raised key questions for the development of a thinking model:

1. What parts of the curriculum are the most appropriate for infusion approach?
2. How much infusion can be successfully accommodated in the existing curriculum structure?

On the whole, although this particular infusion approach has much merit in that it clearly links thinking to knowledge, there are problems in trying to fit domain general thinking skills into subject specific content knowledge. There was clearly a need for a more flexible and integrative approach to teaching thinking and learning.

A CURRICULUM APPROACH TO TEACHING THINKING

The approach advocated was one that takes a whole curriculum approach and seeks to identify the kinds of thinking skills that are actually used in real life applications of the subject. This approach is based on the assumption that most curricula provide ample opportunities for students to think and develop thinking dispositions. It requires the systematic implementation of five steps.

Step 1 Identify relevant learning outcomes

What do we want our students to understand and able to do?
This involves

identifying the real world competencies that students are
students are expected

to demonstrate as a result of completing the syllabus. This can
be determined in

terms of knowledge, skills and processes, and attitudes or
habits of mind. An

example of a learning outcome for a food packaging and
design course might

be "To carry out a food development process." Once important
performance

activities are identified, the next thing is to identify the types of thinking that

underpin these activities.

Step 2 Write/review the learning objectives to incorporate these types of thinking

Writing higher order objectives is an integral part of instructional planning.

There are several characteristics of useful objectives. Well written objectives

provide clear statements of the important learning; describe student behaviour

as explicitly as possible; and emphasise what is important for the student to

learn. For example, in the learning outcome "To carry out a food development

process", the types of thinking that were identified as important were:

- analyze produce components
- compare and contrast packaging types and materials
- evaluate specified processing techniques

Step 3 Select teaching strategies used to teach these thinking skills.

In a thinking classroom, teaching strategies used to promote thinking and independent learning include using cooperative learning, role play, thinking maps, Socratic dialogue, higher order questioning and problem posing, teacher modeling, the language of thinking, graphic organisers and reflective logs or learning journals.

Step 4 Develop authentic learning tasks that will facilitate transfer of thinking skills in authentic learning contexts

Central to a thinking curriculum is the use of well constructed and managed learning tasks that reflect real world activity that involve the application of types of thinking such as:

- doing a task that involves problem solving/decision making in an authentic situation
- participating in a project work involving creation or application
- designing a prototype

- producing a letter

Step 5 Develop assessments to measure the thinking skills.

The assessment strategy used is important to the success of the thinking innovation for unless thinking is assessed, the learning outcomes will remain an educational ideal rather than a reality. A variety of methods can be effectively employed to assess thinking from fixed response questions to more open ended responses and performance-based assessments. The latter mirror real world activities and include projects, case studies, presentations, simulations and workplace assessment.

Implementation

The implementation of the thinking curriculum was carried out over 3 three years. A comprehensive staff development program to train lecturers to innovate the curriculum by infusing thinking skills into all aspects - from learning outcomes to instructional strategies, design of learning tasks, and assessment. An evaluation of the thinking initiative at Singapore Polytechnic was carried out in January 2000. The results showed that the curriculum innovation resulted in greater motivation, ability to problem solve.

Staff development and support emerged as the most critical factors in the success of the thinking initiative. Strong leadership and commitment of the principal is another major factor which contribute to the success of the programme. Objectives was articulated in the school mission statement and use as means of appraising departments.

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