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Using Assessment of Project Work to Teach Thinking

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A renewed interest in thinking and assessment was heralded by Singapore Prime Minister Goh, "The Ministry of Education ... is looking into giving more weight to school assessments based on project work, which is a better test of pupils' ability to innovate and apply knowledge" (Goh 1996). In January 1997, the Minister of Education, Rear Adm. Teo Chee Hean echoed this sentiment, "Refining the methods of assessment would provide a better test of students' ability to innovate." (*Lianhe Zaobao,* 31 January 1997)

To expand on this interest in assessment, this article advocates the use of assessment to encourage and monitor thinking skills in project work. The first part briefly covers what is thinking, project work and assessment. The second part presents an example of project work and an assessment of the project with an emphasis on different thinking strategies.

Thinking

> *"Those who study without thinking is labour lost; while those who think without studying are dangerous."*
>
> Ler Chin Tuan, 1905

A salient word in education these past two decades is *thinking*. In the "Thinking Curriculum", students engage in real-life tasks which require complex thinking, planning and evaluating. In this curriculum, the process is as important as the product of learning. (Resnick & Kloper 1989).

Four principles of the thinking curriculum promote in-depth learning:

1. Students use essential concepts and processes to construct historical accounts, design experiments to answer questions about natural

phenomenon, use mathematics to model real-world events, or write for real audiences (Fennimore & Tinzmann 1990).

2. Content and process objectives involve real-world tasks. Students engage in real-life thinking through solving problems and making decisions and collaborating with others.

3. Students engage in meaningful, complex tasks rather than isolated skills and facts.

4. The thinking curriculum connects content and process to the learners' backgrounds. In this way, students can connect, expand and refine their prior knowledge.

Project work

"A distinguishing mark of a project is the whole child responding to a situation."

Progressive Education, 1924

Project work requires students to perform under "realistic" conditions using a combination of abilities and skills. Students learn by going through a complex, extended process. They learn by producing an important product such as a research paper, a report on an experiment, a work of art or a new invention, e.g. a way to decrease labour time.

The work done in projects is closely aligned to the ultimate learning targets of schooling. Students acquire new knowledge by building on their previous knowledge. Students are actively engaged in their learning by their involvement and exploration in task-like activities. More importantly, they construct meaning for themselves by doing project work.

Assessment

"Assessing a student's competence means we are collecting information to help us decide the degree to which a student has achieved the learning target."

Anthony Nitko, 1996

To begin with, assessment encompasses more than testing, and much more than standard tests such as the PSLE and the "O" and "A" level examinations. Assessment also includes "authentic" ones which closely parallel the learning activities and outcomes desired in project work Performance-based assessment is an authentic assessment used in project work. It requires the students to complete, demonstrate or perform the actual behaviour of interest (Jorgensen 1993). Performance assessment tasks concentrate on both content (concepts and knowledge to be learned) and process (how the students learn). In this type of assessment, students may use equipment, follow specific procedures, and work individually or together.

Assessment of project work sets criteria or learning targets for students to attain. These criteria follow teaching/learning objectives based on subject area content and skills. The criteria are related to the real world and require knowledge to undertake meaningful assignments.

Furthermore, assessments which have clear criteria, develop thinking. One set of assessment criteria may include thinking strategies, such as accessing and searching for information, selecting credible and relevant information, and interpreting and synthesizing information to complete a task. Another set of assessment criteria may focus on innovative thinking in project work. When students have an achievement target (criterion) to "aim towards" and an extended period of time to complete the task, they are more likely to achieve the level of thinking and innovation expected by the teacher.

In sum, thinking, project work and assessment are invariably linked. Through self-assessment or peer/teacher assessment of project work, students can think through the knowledge content and process of learning. Teachers well know that most students study those things they will be assessed and conversely, ignore those things which they will not be assessed. So assessment of project work can be the impetus and catalyst to learn and foster thinking skills. Teachers who authentically assess project work are better able to engage students in thinking and learning. Involved students have positive attitudes towards learning because they know what the achievement targets are and have various ways to display their knowledge. While students relate basic concepts to what they know, authentic assessment of project work requires them to apply what they have learned to meaningful and real-world applications.

The second part of the article presents an example and an assessment of project work which can be completed by the teacher, by the students themselves and/or by their peers.

AN EXAMPLE OF PROJECT WORK: INVENT AN ORGANISM

The teacher presents the following project work to the students who are given three weeks to complete the assignment.

> *As a genetic engineer, your task is to create a new organism. Access and search for information about the life functions of the amoeba, paramecium, hydra, earthworm and grasshopper. Through analysis of the various functions, select the best and create a new organism for any place on earth.*
>
> *You may create this organism in any way that you like and place it in any environment. Your primary task is to convince me and your peers that your organism can survive in a place where you have placed it. Your product for this project may be a written report, a video tape, a drawing, a model or any other way that you first check with me.*
>
> *As part of your work, keep a research notebook with all pertinent information about the five organisms and your newly-created organism as it develops. Use the notebook to reflect on what you are doing in this project.*
>
> (adapted from Linda Huebsch, 1993)

In this project work, thinking strategies are assigned: search, select and generate innovative alternatives. Assessment targets and criteria focus on these specific thinking strategies which students must meet in order to receive a commendable, superior or exceptional grade.

Students are assigned to use search strategies to access information on five different organisms. They are to access printed material in the library and/or download Internet searches. Second, selection strategies are assigned for students to analyse and synthesize the accessed information. Students learn to categorize and develop an outline to do their project work. Third, thinking strategies to generate various innovative alternatives are used to develop a new organism.

ASSESSMENT OF PROJECT WORK: INVENTING AN ORGANISM

The assessment of project work may take many forms. The familiar paper-and-pencil test of knowledge over a specific time period is one form. Other alternative assessment forms include a performance assessment and peer assessment. For example, an oral report is presented on the newly-created organism. The teacher and the students in the class evaluate the report for organization of knowledge, clarity and tone of speech, use of audio-visual aids and so forth. Another assessment form is a self-administered one when a student completes a checklist of the various steps needed to compete the task at the deadline date given by the teacher. The checklist may include selecting the materials by a specific date, searching the Internet and bookmark three sources by a specific date and drafting an outline of the various life functions by a specific date.

The table on the next page is yet another form of assessment to measure critical thinking, use of knowledge, accessing and searching for information, selecting using analysis and relevant material, innovative thinking, communication of project work in writing and journal reflections. The items under the skill category are achievement targets which students focus their time and efforts to achieve. The achievement levels are the criteria that tell students what they must do to get a minimal, rudimentary, commendable, superior or exceptional grade from the teacher.

In project work, students compile, organize and prepare their journals. A natural link is made between thinking and assessment as they reflect on the process of completing the project work. When a question arises while engaged in project work, students may clarify teacher-stated criteria or develop criteria with the teacher. This process helps students think about and focus on the value of their learning.

Another facet of project work is receiving feedback from peers. Students receive peer assessment on their thinking and work prior to completing the projects. In this way, students learn to be sensitive to the feedback of others, learn to communicate and co-operate with other students as well as learn to defend their innovations.

The different skill items can be given different marks up to a total of 100. For example, a teacher may give each skill 10 marks except for innovative thinking worth 20 marks and journal reflections worth 30 marks.

Assessment Instrument for Project Work

Skill	Achievement Levels				
	Minimal	Rudimentary	Commendable	Superior	Exceptional
Critical thinking	Demonstrates little understanding and limited comprehension of how an organism survives	Demonstrates a very general understanding of the scope of the problem and focuses on only 2-3 ways an organism survives	Demonstrates a general understanding and focuses on only 4-7 ways an organism survives	Demonstrates clear understanding of at least 8 ways an organism survives	Demonstrates a clear and accurate understanding and the implications of survival involved
Use of knowledge (application)	Reiterates one or two facts without complete accuracy Vaguely covers concepts	Provides basic facts with some degree of accuracy Explains concepts in general terms	Relates only major facts with a fair degree of accuracy Analyzes concept with substantive support	Offers accurate analysis of information Provides facts to relate to major issues involved	Offers accurate analysis of issues Extensively uses knowledge to provide in-depth understanding of problem
Accessing and searching for information	Searches printed material and did not access the computer	Accesses the Internet and CD Roms, but no printed material	Accesses less than two print and non-print sources	Searches and accesses 2-5 sources of information	Searches and accesses 6 or more sources of information
Selecting using analysis and relevancy of material	Incomplete; material appears randomly chosen with no relevance to topic .	Poor selection of material with little relevance to topic	Selection of material shows some analysis and some relevancy to topic	Analytically selected material with relevancy to topic	Selection of material shows careful analysis and good relevancy to topic chosen
Innovative thinking	Little evidence of new ideas or relationships	Few new ways used to create an organism	Innovative ideas, but little explanation	Many innovative ideas with explanations	Creates an organism which exceeds conventional standards
Communication of project work in writing	Incomplete work, poor communication of ideas	Communicates information as isolated ideas in random fashion	Communicates important information but not clear	Clearly communicates the main concepts with suitable supportive details	Clearly and effectively communicates the main concepts with rich, vivid details
Journal reflections	Unorganized or missing parts	Unorganized but all parts are present	Organized but needs better development of all the parts and better reflection	Organized and shows good reflection	Well organized with good reflection on all parts

CONCLUSION

The assessment criteria of project work are explained to students at the beginning of the project. In this way, they can begin their projects knowing what is expected. During the project, they self-assess (through reflection) or have peers assess their process and initial products. Through these assessments, students may realize what information or skills they need to complete the project. At this point, the teacher provides *scaffolding* or support in terms of information, structure and direction to students.

In project work, assessment targets and criteria focus on specific thinking skills students need to use. How well they meet the criteria determines their level of achievement. Students now know what is required of them and are better able to work in a focused manner. Project work is a continuous, extended process which is linked realistically to a task. In this way, students can reflect and assess their progress through self-assessment checklists. Students can also work with peers and teachers to meet the assessment criteria set at the beginning of the assignment.

Certainly, a clear understanding and effective implementation of performance-based assessment of project work is one way to teach thinking. This refinement in the assessment method would encourage and help students to apply knowledge and think innovatively as proposed by the leaders of Singapore.

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