

What does understanding look like? : Performance and assessment in using an *Understanding by Design* framework for professional development

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Abstract

This paper relates a crucial aspect of a two-year professional development innovation/research project proposed to improve Singapore's poorest performing grade 7 and 8 students' learning in English language, mathematics, and science as a consequence of their teachers' developing capacity to plan and teach. The instrument and process particularly designed as a pre and post innovation moderation exercise to find "articulations of understanding", which served as evidence of change in pedagogy and learning is described. Its set of dimensions of understanding can be used to plan and assess for cognitive depth and engaged learning.

Objectives

This paper relates a crucial aspect of a two-year professional development innovation/research project proposed to improve Singapore's poorest performing grade 7 and 8 students' learning in English language, mathematics, and science as a consequence of their teachers' developing capacity to plan and teach. The intervention program for the participating teachers from this Normal Technical (NT) stream started with a module on curriculum design and assessment practices and was followed up by intensive individual and small, discipline-based group mentoring. The innovation project employed an *Understanding by Design* (Wiggins & McTighe, 2005) curricular framework. The innovation's effectiveness was determined through different measures using both qualitative and quantitative data. The major evaluation exercise of this project addressed the question, "Was there any evidence of change in levels of understanding of students as displayed in student work, pre- to post-intervention?"

The paper details the instrument that was particularly designed as a pre- and post-innovation moderation exercise to find "articulations of understanding", which served as evidence of change in pedagogy and learning. This instrument was then validated. Its set of dimensions of understanding can be used to assess classroom materials for cognitive depth and engaged learning.

Specific aims of this instrument construction exercise were:

- i. To extract from Wiggins and McTighe's work a set of theoretical dimensions of understanding particular to being applied to assessing student work
- ii. To investigate subject experts' initial articulation of what "understanding" would "look like" in student work after they had examined some student work as a stimulus
- iii. To see if there was consensus between the experts within the same subject and across subjects
- iv. To investigate the perspectives of these same subject experts about the theoretical set of dimensions after they had used these dimensions to examine student work, and
- v. To validate a set of dimensions of understanding to be used as a tool in evaluating the professional development project.

Theoretical Framework/Perspectives

Assessment of understanding.

Understanding cannot be assessed by asking for the recall of isolated, decontextualised pieces of information and assessment that requires no more than this will inevitably move teaching away from understanding to the memorization of the information necessary to be

successful on assessment. Thus, it is not sufficient to have assessments solely obtaining evidence of memory for facts and formulas (Harlen, 1997).

Singapore uses externally devised tests at the end of year 10 to assess achievement in years 7 to 10. During these four years, teachers' on-going assessments are often a series of 'mini' assessments which have the same characteristics of the future summative assessment. Measures of transfer of learning provide valuable information in assessing the quality of understanding of the students (Bransford et al., 1999). When the summative assessment does not measure transfer of learning then it has the potential of telling the teacher and students what facts, skills that have not yet been learnt but not students' understanding. In Singapore, while the on-going secondary classroom assessments have the same characteristics as the summative assessment, teachers do not gain insight into students' understanding and cannot plan the way forward to promote incremental and cumulative learning. This is not unusual for such systems. Black and William (1998) report that a major tendency of assessment regimes such as these was for teachers to use external tests as models for their own assessments, which undermining their formative role and to relegate formative assessment to the evaluation of students' attitudes and behavior. Such practices seriously devalue higher-order thinking. Resnick (1992) states, you get what you assess, if you don't assess it you don't get it.

Basis of Methodology

The articulation of understanding and validation exercise was based on social moderation principles. Consistent and valid external moderation depends on having common understanding of standards, considering evidence (student work) and consensus building (Pitman, et. al, 1999). Within each subject area, we investigated whether experts had a common articulation of 'understanding' as can be seen in student work. They considered and made judgments and compared levels of understanding within pairs of student work.

A research activity, sponsored by the Queensland Department of Education, New Basics Research Program, in Australia, compared student work in trial schools and other schools. Known as the Rich Tasks project, it determined if some tasks as developed by participating schools were richer than conventional school ones. Dimensions of richness were extracted from the New Basics theoretical framework and validated in order that community and education partners' articulation of constructed richness was comparable and reliable and valid judgments about this construct when examining student assessment could be made (Queensland Department of Education, 2004).

Contextual Framework/Perspectives

Singapore's Normal Technical Stream

Tracking students based on exam performance is a central element of Singapore's highly structured education system. Singapore's success in international comparisons may come at the expense of opportunities for engaged learning for most mainstream and

underperforming students (Wong, 2006; Luke, et al, 2005). Singapore's Normal Technical (NT) stream, was established in 1995 to provide lowest performing/high attrition students (Ng, 1993), with differential instruction in preparation for post-secondary vocational and technical training, (approximately 15% or 7000 students of each years' cohort). The NT curriculum focused on strengthening students' foundations in English and maths in preparation for the national GCE 'N' level examinations. Despite the intent to provide these students with a more hands-on, experienced based pedagogy, Singapore's NT classrooms remain academically oriented and examination-driven, with an overemphasis on science and mathematics (Luke et al., 2005). The salient features of the NT curriculum are worksheets, behaviour and time-on-task management, drill and review, with less focus on integration of subject matter, the acquisition of meta-languages and analysis. Teacher directed and explicit instruction is consistent over all subject areas. Students are required to reproduce information, rather than actively produce and construct knowledge. NT students are not encouraged to contextualize new knowledge, either theoretically or practically. The NT curriculum is strongly classified, with knowledge highly differentiated and separated into traditional subjects.

Why is Understanding important?

Developments in cognitive science have shown that “usable knowledge” is not the same as a mere list of disconnected facts. Being able to use knowledge to solve new types of problems requires one to “understand” knowledge. Thus, recent teaching and learning practices emphasize learning with understanding (Bransford et al., 1999). Such learning is tightly related to thinking and reasoning (Perkins and Unger, 1999).

A common belief among teachers is that high-achieving students are the only students that can cope with higher order thinking or in other words, reasoning and understanding (Zohar, Degani & Vaaknin 2001). Participating teachers in this intervention report in baseline interviews shared this belief. But both high- and low-achieving students benefit from pedagogies that foster understanding with poorly performing students scoring the greatest gains (Zohar & Dori, 2003).

Using Understanding by Design as Professional Development in the Intervention

Understanding by Design's (Wiggins and McTighe, 2005) is a curricular framework guided by cognitive psychology research targeted at improving student achievement through standards-driven curriculum development, instructional design, assessment and professional development. As reported by the National Research Council in the USA (Bransford1999) effective learning includes students' understanding and application of knowledge. UbD's focus on authentic pedagogy and assessment is supported by many international research studies (e.g. Newmann et al., 1996; Smith, Lee, & Newmann, 2001; Newmann, Bryk, & Nagaoka, 2001; Martin, Mullis, Gregory, Hoyle, & Shen, 2000; Stiger & Hiebert, 1999; and Hayes, Lingard, & Mills, 2000).

Method

This exercise looked for evidence of the construct, “understanding”, in the students’ work. Student work (not just assessment) is taken to be the product of learning insofar as learning itself, in a pure state, cannot be observed. The dataset as concrete demonstrations of what is experienced/expected by students in the classroom was collected over a three week period.

To gauge the evidence of student understanding, we developed and validated a tool called the “dimensions of understanding.” Finding evidence of understanding cannot be provided using a checklist of attributes that may not be present. It is a complex inter-related construct suitable for holistic judgments, made through pair-wise comparisons. Using the tool as a basis of these comparisons, qualitative judgments were made that can be quantified, giving a rank order for understanding evidenced in the student work. Pair-wise comparison methods (David, 1988), have two important advantages over other methods for generating rankings. First, the complex process of reaching a single judgment about a given object against a non-trivial scale or the similarly complex judgment of the relative merits of many objects compared simultaneously is replaced by a simpler set of comparisons of two objects at a time. Comparing two objects at a time is a simpler task and is usually more reliable. Secondly, the pair-wise ratings of a single judge can be checked for internal consistency, something that cannot be done for a set of ratings against a scale or a single ranking. (Allen, 2000)

Moderation

A full-day two-part research activity was planned. In the first phase, participant judges were given very little guidance on how they should interpret “understanding” and how that is evidenced in student work. They were given some dictionary definitions of “understanding” which they were told might or might not help them clarify the concept of “understanding”. The participating judges were considered subject experts.

First, participants were isolated from each other and given four pairs of samples of student work to examine. Their first task was to decide if one of a two pieces of student work showed more understanding than the other and to record these judgments. During this part of the activity participants were asked to write comments about their observations as well. Participants then took part in focus group discussions in which they were asked questions on what they saw in the student work and what they expected to see as evidence of understanding.

In the second phase, participants were presented theoretical dimensions of “understanding”. They were given a brief explanation of these dimensions.

Theoretical Dimensions of Understanding

Breadth	Depth	Quality
Recognition of conditions	Connections to outside of the school setting; school, discipline, unit	Cognitive depth in constructing meaning through analysis and synthesis
Discernment between	Reflexivity about nature of	Justification and reasoning

possibilities; prioritizing	knowledge-flexibility openness	
Ordering, sequencing and structuring	Valuing and appreciating (intrinsic) “worthwhileness”	Judging against criteria
Invention and transfer	Sense of the discipline	

They were then asked to make additional comparisons of paired samples of work. Each participant was given different pairs to compare than in the previous phase. They were asked to record their judgments. After these judgments the focus group discussion concentrated on the validity of the theoretical dimensions and the reasonableness of looking for direct evidence of understanding in student work.

Data Analysis

A discourse analysis was completed on the transcripts of the focus groups and the comments made by the judges when examining student work in the first part of the activity to determine if there was a common articulation of understanding within each subject group. A second analysis was completed of the individual subject focus group of transcript to determine validation and utility of the theoretical dimensions.

Findings and Significance

Assessment provides teachers and students feedback about what point of development their understanding has reached. Teachers need a useful gauge of understanding to interpret and assess student work and to change their instruction accordingly. The dimensions of understanding developed in this project have potential to guide teachers in framing and assessing student work. The moderating judges in the same subject area made comparable statements of what understanding should look. They also validated the theoretical dimensions of understanding, extracted from the UBD framework. A common theme of their discussions was that most assessment instruments in the data set were not requiring students to demonstrate understanding. The articulation exercise developed in this project may be an effective professional development tool to build teachers capacity to plan and assess for understanding.

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