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Measuring Change in Understanding: Assessing understanding when using an Understanding by Design framework for professional development

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Background

This paper relates the major evaluation tool used in 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. Documenting teachers' capabilities to plan effective pedagogy, including assessment, the project offered comprehensive training through mentorship and collaborative planning.

Research Questions

This intervention program employed an Understanding by Design (Wiggins & McTighe, 2005) curricular framework. Evaluation of the effectiveness of this intervention was determined through different measures using both qualitative and quantitative data. There were a number of different research exercises that were a part of the evaluation. They included analysis of classroom pedagogical coding, interview of teachers and transcriptions of classrooms.

This study addressed a major question in the evaluation of the intervention, "Was there any evidence of change in levels of understanding of students as displayed in student work, pre- to post-intervention?" A validated set of dimensions was used as the basis of this study to make comparative judgments about amounts of understanding as can be seen in the student work pre- to post-intervention.

Specific aims of this study were:

- i. To use a set of dimensions of understanding as a tool in evaluating change in amounts of understanding in student work as a result of an intervention to change pedagogy and learning.
- ii. To investigate any evidence of change in understanding as seen in student work in each of the three subjects, mathematics, science and English in the intervention
- iii. To investigate any evidence of change of the three dimensions of understanding depth, breadth and quality as seen in student work in each of the three subjects.

Methods

The methodology is based on a research activity, sponsored by the Queensland Department of Education, New Basics Research Program, in Australia, which compared student work in trial schools and other schools looking for a difference in richness as a result of implementation of the Rich Tasks which were a part of the New Basics Framework (Queensland Department of Education, 2004).

The Understanding by Design (UbD) framework has six facets of understanding (explanation, interpretation, application, perspective, empathy, self-knowledge) that are used to drive the design of curriculum, pedagogy and assessment. These facets were too broad to use for the purpose of considering student work in isolation. The underpinnings of UbD were used to validate a set of features that were applicable to identifying understanding in student work. These features called our "Articulation of Understanding," which are grouped in three categories called dimensions. A set of

dimensions for examining student work and finding evidence of understanding cannot be provided using a checklist of attributes that may or may not be present. It is a complex inter-related construct suitable for holistic judgments using pair-wise comparisons and not judgments against a non-trivial scale. The methodology in this study used pair-wise comparisons of student work.

Frame

Pair-wise comparisons were used because they are qualitative judgments, which can be quantified, giving a rank order for understanding as 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)

Analysis of paired comparison judgments provides “scores” that are used to rank order the folios. The first step in examining the research hypothesis is to determine the rank order of the folios under investigation for each subject (mathematics, science and English). The rank order of folios displays the placement of the pre- and post- intervention folios for a particular subject. To test for “no change or negative change” pre- to post-intervention, a rank test was used that was capable of showing a difference in location of pre- and post- intervention folios within the rank order (Brunner & Munzel, 2000; Munzel & Hauschke, 2003). The null distribution of the test statistic was resampled 10,000 times to determine significance. The p-value for the tests was obtained by calculating the proportion of times the test statistic from resampling was greater than that of the observed dataset. For this exercise, the effect of student work produced post-intervention, rather than student work produced pre-intervention, is called the “intervention effect”. The intervention effect is taken to be the probability of a folio from post-intervention being ranked higher than a folio from pre-intervention plus half the probability of a tie. The null hypothesis could be presented as: Intervention effect is greater than 0.5.

Research findings

The measuring change exercise revealed that there was at least one dimension of understanding in post-intervention student work than pre-intervention student work in all subjects. The combination of these and the intervention study’s other findings indicated that post-intervention the teachers changed the types of instruction to students. They concentrated more on curriculum-related matters and less on behaviour or directions to students. The increase in the evidence of understanding in student work and changes in classroom talk would seem to triangulate the positive effect of the intervention on student learning.