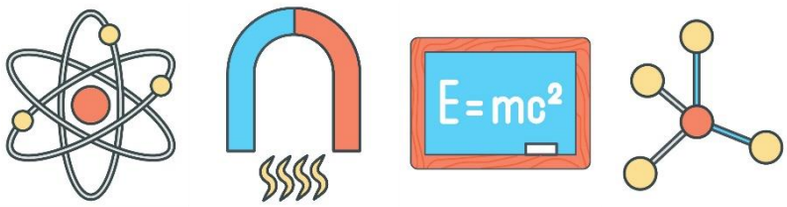
NIE RESEARCH SPOTLIGHT

Designing a Physics Curriculum for Developing Students' Science Competencies

Principal Investigator: Ast/P Jennifer Yeo
Co-principal Investigator: Dr Tang Kok Sing

With existing confusion between scientific explanation and argumentation among teachers, students and science education researchers (Osborne & Patterson, 2011), and the lack of understanding on scientific representations in science inquiry, a framework that demonstrates their relationship would offer some insights into what scientific competencies need to be developed.



Research Objectives

The goal of this study is to develop a framework that will provide a means to understand how students make sense of scientific phenomena, and to develop curriculum strategies to support the development of these competencies in students.

Research Participants & Subject Area

Junior College Year 1 students of H2 Physics

Key Findings

1. Students' constructed scientific explanations could be characterised by features of function, form and level (of precision, abstractness and complexity). Its construction was also found to entail the following processes:

a: Identifying inferred entities from physical entities present in a physical phenomenon

b: Using signs to represent inferred entities

c: Using representational schemes to think and reason about how the inferred entities interact

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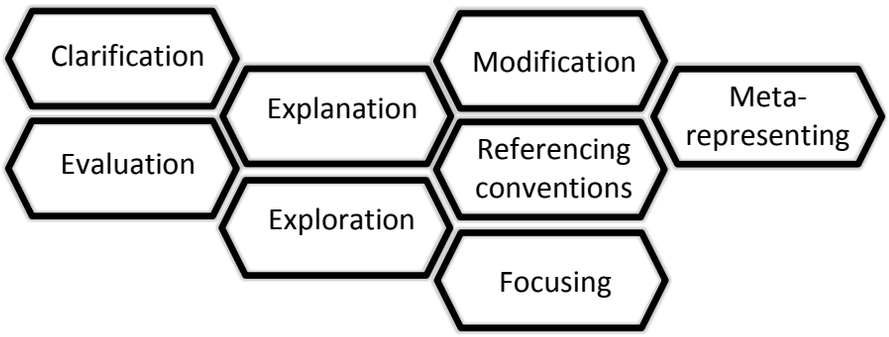
2. Argumentation is the vehicle to convince oneself and others of the explanation constructed. With a focus on the teachers' moves in orchestrating argumentation to support evaluation and refinement of students' explanatory models, we found eight pedagogical moves that were useful.



These eight moves directed students' attention to their use of representations in constructing the various features of scientific explanation.

3. The study showed that a modelling-based inquiry was useful in focusing on the features of scientific explanation because of its emphasis on constructing explanations and on the use of representations. To focus on students' explanatory competencies, strategies such as provision of evidences, explicit instruction or emphasis on domain-specific representations, use of whiteboarding and a less complex phenomenon were found useful.

Key Implications

The complexity of constructing a scientific explanation suggests that the development of this scientific practice need to go beyond teaching for conceptual understanding.

The role of representations and social function of an explanatory discourse imply that teachers need to attend to these various features in their instruction.

The features of scientific explanation could potentially provide a framework for an assessment rubric for students' explanations though more work is needed to develop the levels of each feature.

For More Information

Contact Ast/P Jennifer Yeo at jennifer.yeo@nie.edu.sg.

To visit the project page
Scan code or visit http://www.nie.edu.sg/project/oer-11-11-jy.

References:
Osborne, J. & Patterson, A. (2011). Scientific argument and explanation: A necessary distinction. Science Education. doi: 10.1002/sce.20438.

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