SS01-1

Multiple representations: an alternative way for students' learning of mole and stoichiometry

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Learning chemistry can be regarded as a process of associating macro, submicro and symbolic representations. While chemists and chemistry teachers can do it at ease, sometimes it is not the case for students.

In this paper, I will exemplify some explicit teaching strategies that I have used to develop students' capability in linking these representations. Particularly, strategies of teaching and learning of the topic "Mole and stoichiometry", which is regarded by many students as the most challenging topics in chemistry, will be illustrated through my own classroom video clips (with English subtitle). In the lesson, students would explore the macro phenomena of the combustion of magnesium. They were also asked to predict the change in the mass of the piece of magnesium before and after burning. Many of them predicted that the mass of the product being lower than the piece of magnesium. Their pre-conception was then scrutinized with the use of a diagram that represented the reaction at a submicro level. Students' learning outcomes from that teaching strategy will be shown and discussed.

As the role of the triplet in chemistry is emphasized in my teaching, some more examples from various chemistry topics will be discussed in my presentation.

SS01-2

Metavisualization and students' learning: an analysis of Hong Kong Diploma of Secondary Education chemistry examination paper

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While science educational researchers focus on improving curriculums, teaching, learning and assessment, many different stakeholders in the society seem to concern mainly on assessment that is manifested by high stake public examinations. For example, teachers may tend to pay a lot of attention to what is asked in examinations, what type of answers is worth scores in examinations, what subject exam reports and exam administering body say about students' performance. It is especially the case in Hong Kong in 2012 when the first public examination on the new senior secondary school structure was held. It is in this context we find that science education research can match with the expectation of teachers. In this presentation, we will report an analysis of the Hong Kong Diploma of Secondary Education (HKDSE) 2011 chemistry examination paper through the lens of 'metavisualization' (Gilbert 2005, 2008). The way that metavisualization should facilitate students' reasoning about the chemistry tasks will be exemplified. We argue that metavisualization plays a key role in the meaningful learning of chemistry, and is a key in helping students to excel in public examinations. It is suggested that metavisualization should play a more prominent role in the daily teaching and learning of chemistry.

SS01-3

Problems and solutions of learning scientific investigation in junior secondary science - a Hong Kong experience

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The official Junior Science (Grades 7-9) curriculum and Chemistry curriculum (Grade 10-12) have emphasized the role of scientific investigation for more than a decade. Nevertheless, there are still rooms for improvement in Hong Kong students' understanding and conducting scientific investigation. For example, Hong Kong students' performance in TIMSS 2007 revealed that many of them were unable to differentiate observation from conclusion. Also they were weak in writing experimental procedures and interpreting experimental results. An analysis of textbooks for Junior Science level in Hong Kong shows that the way that they frame practical activities are

problematic. Very often, there was no clear indication of the purpose of the activities, what data to be collected from the activities, how to interpret the data and how to approach drawing conclusion from the activities.

In this paper, we will exemplify these problems, which we believe are general to an international context, through an analysis of local textbooks. Based on the identified problems, strategies that the first author used in enhancing students' learning of scientific investigation will be reported. They included a modification of the presentation of laboratory activities based on these textbooks; the use of a consistent framework in representing laboratory investigations; and supporting students in drawing conclusions. The presentation will also report students' learning outcomes on scientific investigation after the first author experimented these strategies.

SS01-4

Students' visual representation of metallic bonding

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This study investigated students' mental visual representations and interpretations of diagrams in a physical science (metallic bonding) topic. Data collection and data interpretation were guided by dual coding theory. Three Grade 10 students who represented high, medium and low achieving in chemistry were interviewed. There were striking similarities between the medium- and low-achieving students. Although their verbal recalling could be accurate scientifically, their visual representations (through drawing) of such verbal recalling were very different from the accepted scientific views. They might have adopted the same strategy in their drawing: they made a dominant, if not a sole, use of verbal recalling and then transferred such mental verbal representation into a drawing. The case studies thus highlight the importance of a combined use of verbal and visual/ diagrammatic representations in the teaching and learning of science. Principles for good practice in designing diagrams are also discussed.

SS-03

Assessment as 'fire': Insights from 35 years of experiences

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Assessment, in whatever form it takes, is widely recognized as one of the main determinants of educational practice. In recent years, new approaches to assessment have been advocated. These have come primarily from a variety of overlapping debates concerning the purposes of assessment, and their impact on the process of teaching and learning. For instance, 'Assessment for Learning' is understood in different ways, and these different meanings may not always benefit students' learning. Drawing on my personal experiences, I will use authentic examples to illustrate how I perceive the role of assessment and its impact on classroom teaching and learning. The examples range from strategies I used when I was a secondary school teacher, public examination questions I set when I was a public examination officer, homework assignments I crafted for students as an author of school science textbooks, classroom videos and student work that I have collected as a teacher educator, and research findings from international comparative studies on student achievement in science.

To organize the discussion in the symposium, I will use a metaphor of fire to illustrate how assessment can be a good servant or a bad master of classroom teaching and learning, depending on how the teacher makes use of it. Through the various examples, I will bring into light the crucial role of teachers in mediation and in bringing about changes envisaged in the new assessment reform. In particular, the importance of raising their awareness and competencies in creating opportunities for classroom assessment is stressed. It is hoped that the audience will find the assessment exemplars useful in the following ways: (1) as a source of models of practice to apply and test in their own classroom; and (2) as a set of ideas to be debated upon and to act as a springboard to reflection on their own existing practice.