

Colorful Chemical Experiment Kit: From School Laboratory to Public Demonstration

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The blue bottle experiment was first mentioned in the chemical education literature as a simple experiment on kinetics. The original formulation contains only glucose, NaOH and small amount of methylene blue. The solution turns blue when shaken and fades to colorless upon standing. This bluing/de-bluing process can be repeated many times and can be compared to the color of animal blood in the respiratory cycle. This classical demonstration is a versatile pedagogical tool, not only in physical chemistry but also in analytical, biological and organic chemistry. Though the concept of this experiment is relatively straightforward, there is growing body of research on it. These include a number of modifications to the original formulation (e.g. chemical traffic light, vanishing valentine, variations of sugar and solvent, replacement of NaOH and sugar with ascorbic acid for green chemistry), chemical pattern formation in methylene blue-glucose system and a number of applications of the reaction (e.g. oxygen indicator for intelligent food packaging and oxygen scavenger for super-resolution imaging). In this manuscript, we present a comprehensive review of all literatures relating to the experiment since 1954 and discuss our use of the experiment for public science demonstration and undergraduate laboratory. The colorful chemical bottle experiment kit was developed in 2006 in collaboration with Thailand's National Science and Technology Development Agency (NSTDA). More than 2,000 of them were sold or distributed around the country and the demonstration has been shown to the public at many national and local events including Science Week, Children Day and various educational activities at NSTDA's Sirindhorn Science Home. The experiment has also been introduced to an integrated laboratory course at the Mahidol University International College. Our modifications to the traditional experiment and our pedagogical approach to explain the experiment to different audiences are discussed in this paper.

Keywords Biological chemistry; Kinetics; Reaction mechanisms; Pattern formation; Redox reaction

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The Implementation of VDO Lab Streaming to Enhance the Students' Engagement for 3rd Year Laboratory Class

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Previously, the frequent mistakes and the instructor feedback from the experiment could not be communicated among to enhance students' learning outcome as the insufficient preparation of students before the laboratory. This research aimed to apply of VDO Lab streaming supporting the students to prepare themselves for laboratories and their communication platform anytime and anywhere. There were 2 labs for this research: WS1 for water softening and SA2 for solid alcohol production for 37 students in 1st semester 2014. The procedure consisted of the production of VDO Lab streaming by the instructor with learning content. Secondly, the VDO file was posted and shared on the Facebook for all students to learn repeatedly before the laboratory. And the student outcome was evaluated by the questionnaire. Among 11 questions, it showed that they satisfied WS1 of 3.19 score and SA2 of 3.12 score from the statistical results. It meant that the students preferred to learn the lab by VDO Lab streaming. It had provided their clear concept as multimedia and various experimental procedures better than the manual did. Additionally, WS1 and SA2 had standard deviation of 0.49 and 0.38 with the variance of 0.24 and 0.14, respectively. More details will be discussed extensively. Finally, the VDO Lab streaming enhances the student engagement to meet 21st century learning skill effectively.

Keywords Student engagement; VDO lab streaming; Laboratory teaching tool

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How Do I Improve My Students' Mental Model in Rate of Reaction?

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Mental model plays an important role in student's learning. When students start learning science concepts, they will build models about scientific phenomena in their mind called mental model. Mental models can be shown as express models such as drawing, explaining, acting, etc. This study was aimed at investigating the ways to develop students' mental model in rate of reactions through Model-Based Inquiry (MBI). Action research was used as research methodology in which I researched my own teaching in a chemistry class with 28 grade-11 students. Data from my reflective journals and mental model questionnaires were main raw data sources. I founded teaching with videos, pictures, stories, or events and having students discuss together after presentation can develop students' mental models. In addition, giving students time for designing and discussing about their experiments before they start finding the evidence, make them do experiment fast and effectively. The research findings suggest that chemistry teachers should give clearly criterions to students before they present and reflect their mental models. This can help them evaluate their models more effective.

Keywords Mental model; Rate of reaction; Model-based inquiry (MBI)

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How Do Students' Argument Skills Improve through Socio-Scientific Issues in Fossil Fuels and Their Products Learning Unit?

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Argument skills play a crucial role in fostering students to be the scientific literate person. Students who have argument skills can make a decision upon reasons and evidences. This classroom action research was aimed at investigating the best practice of teaching chemistry to promote argument skills via socio-scientific issues (SSI). The participants were 46 twelfth grade Thai students studying petroleum chemistry in the first semester of 2014 academic year. I as a researcher who researched my own teaching collected data from my reflective journal, students' reflective journal and argument skills questionnaire (ASQ). I found that debating could help students practice and improve their reasoning skills and make them concern the importance of evidence to create the reliable argument. Moreover it is found that the competition to answer questions in class let students practice reasoning. The result form ASQ indicated that teaching via SSI could improve student's argument skills.

Keywords Argument skills; Socio-scientific issues; Fossil fuels and their products learning unit