refinement of the lesson plan was done. This process also included interviews with the students, analyses of observation findings with reference to the Taxonomy of Educational Objectives (Bloom 1956) and the comparison of the research findings amongst classes. The results show that the ACS help students to become more confident speakers during the picture discussion examination. Students have shown improvement in expressing themselves in a more systematic and organised way. The framework- guideline approach has made oral examination (picture discussion) preparation easier.

Keywords:
Picture analytical skills
Lesson Study

D66-PP TR717

Lesson Study: using Logger Pro to trace and analyse the motion of moving objects

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Research has established that introductory physics students have consistent difficulties with the interpretation of kinematics graphs of position, velocity, or acceleration versus time. Robert J. Beichner's (1996) research "The Impact of Video Motion Analysis on Kinematics Graph Interpretation Skills" (1996) reported that by utilizing the video analysis technique in teaching, pupils' ability to interpret Kinematics graphs has shown a significant improvement as compared with the traditional instruction. Thus our research focus is to explore the effectiveness of the video analysis technique in improving pupils' ability to interpret kinematics graphs. We hypothesize the greater the integration of video analysis into the teaching of kinematics, the greater the pupils' understanding of the relationships between kinematics variables and their connections to graphs. Students will develop a sound conceptual understanding through graphical and dramatic representations before moving on to an algebraic treatment of problem solving.

Keywords:
Logger Pro; ICT; video analysis; Inductive & Deductive Reasoning; Kinematics Graphs

D67-PP TR717

Incorporation of collaborative learning (COL) and self-directed learning (SDL) to enhance students' learning in salt preparation

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This paper examines the attempt by the upper secondary Chemistry teachers to explore and design lessons which incorporate Self-directed Learning (SDL) and Collaborative Learning (CoL) in enhancing our students' learning of the topic "Salt Preparation". The lessons are designed for student-centredness and the provision of an experiential learning environment. The students involved are in the Secondary Three Express stream. Each group of students was expected to design a suitable experiment of preparing a salt of their choice. Relevant learning materials such as videos of methods of salt preparation, theories and questions for discussion were uploaded into 'Edmodo', an ICT platform which was used to support their SDL. Through these, the students were being directed to take ownership, manage and monitor their own learning. The lesson study model was adopted to create a learning community for the other chemistry teachers to learn from the research teacher and a knowledgeable other was invited to share collaboratively during the post-lesson discussion. A laboratory session was also arranged for various groups of students to try out their proposals with their suggested methods after being vetted by the teachers to ensure that all the safety aspects were observed. This again provided them another opportunity to work together in groups in the practical context. Measurements both qualitative (reflection and survey) and quantitative (student-designed experiment and the actual salt preparation) were conducted to gather the necessary feedback from both students and teachers involved. Generally the feedback and results had been encouraging and positive.

Keywords:
self directed; collaborative; chemistry, salt preparation

D68-PP TR717

Does knowledge about nature of Science facilitate conceptual understanding? A proposal of instructional intervention

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Understanding nature of science (NOS) has been advocated as a central aim

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Keywords:
Nature of Science; Conceptual change; Intervention

in science education because it facilitates science content learning. However, little evidence has been provided that supports this argument. This study is to explore if conceptual understanding of physics (mechanics) could be enhanced with an instructional intervention integrated with NOS ideas, and to test the integrative theory informing the intervention design to explain its mechanisms. The intervention consists of three components: (1) class preparation, (2) class instruction and (3) assignment. Class preparation is to help review previous learning and preview forthcoming lessons. Class instruction was designed based upon coordination between literature on studies of science (e.g., philosophy of science) and conceptual change in science education that informs processes students are intended to undergo and pedagogical elements each topic module would have. Students begin with constructing initial ideas about particular phenomena to explicate their prior knowledge. Then, they are guided to critically analyze and examine these ideas in terms of fit with empirical evidence, alignment in tool use for observation and measurement with science practice, consistency in defining concepts, and compatibility with existing knowledge. This contributes not only to bring about conceptual conflict, but to introduce a set of criteria for evaluating an idea as scientific or not, including structural and empirical nature of science knowledge. Next, guided by clarification of tentativeness of science explaining the necessity and benefit of idea revision, students are intended to develop science knowledge by modifying their initial ideas. Hereafter, the knowledge is evaluated against the criteria introduced previously. Finally, they are required to review how their knowledge develops and compare science knowledge with the initial ideas, in order to help understand why the former is superior to the latter. Class instruction would last for 15 lessons (40 minutes each) over a 4-week period. Assignment includes journal writing and practice to help reflect learning process and consolidate conceptual understanding. All the above content is contained in a student workbook. This study is expected to shed light on the construction of a subject matter-specific curricular model of NOS in secondary science education.

D69-PP **TR718**

An inquiry approach for collaborative learning on the experiences and engagement of students' learning in integrated Science, a school based curriculum

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Keywords:
Lesson Study; Energy; Integrated Science; Lower Secondary Science; Collaborative Learning; ICT

This paper focuses on lessons using the inquiry approach. It incorporates collaborative learning on the experiences and engagement of students' learning in Integrated Science, a School Based Curriculum. The Integrated Science module was rolled out to all Secondary 2 pupils as part of the Lower Secondary Science program. It uses Environmental Science and Energy as the theme to design an interdisciplinary science curriculum. The team used lesson study to design a lesson package on the concept of Energy, to illustrate the idea and understanding drawing upon various topics from Physics, Biology and Chemistry in Lower Secondary Science. The lesson design based on 2 cycles of lesson study by teachers with different fields of expertise and the study was conducted on 120 secondary 2 express students. Activities planned comprised hands on self discovery activities, collaborative tasks and group discussion. Pre and post surveys were conducted for planned activities in the lesson study, which integrated ICT, to find out if they were fulfilling their objectives in improving students' learning and increasing their engagement level. We used the PETALS framework for evaluation.

D70-PP **TR718**

Formative assessment to enhance student learning and motivation in Science

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Formative assessment informs teachers and learners about students' progress towards learning goals. The goal of the lesson study project was to examine