

S -05

AN EFFECTIVE CURRICULUM UNITS FOR RUNNING INQUIRY BASED SCIENCE LEARNING ACTIVITIES IN SCHOOLS: A SUCCESS STORY

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Abstract

Promoting Real Australian Indonesian Science Education (PRAISE) is a collaboration Indonesia-Australia pilot project. The project managed by SEAMEO QITEP in Science, in which innovative inquiry based science learning resources were developed and piloted in ten junior secondary schools in two areas namely Bandung City and West Bandung County, West Java Province, Indonesia. This project was intended to provide an effective curriculum units for running inquiry based science learning activities in schools which appropriate with local condition as well as able to generate students with high motivation and high achievement in science fields which can be expected to grow as scientists in the future. Data analysis indicated that the utilization of PRAISE curricular units improves the quality of science learning in terms of activeness of students during classes, students' motivation to learn science, students' daring to express their opinions during discussions, students' collaborations, eradicating classroom discipline problems, attractiveness of learning activities as well as providing opportunity to develop students' scientific investigations and to apply their knowledge in daily life. Utilization of PRAISE curricular units for science learning also significantly improve students' basic inquiry skills.

Introduction

Developing of science education need comprehensive investment not only fiscal and capital but also proper curriculum, effective method of science delivery, availability of quality science reference book, beside teacher professionalism and student characteristic. These will create an academic atmosphere which provide opportunity to students to elaborate their talent and cultivate their leadership. To pursue this idealism, it needs effort and collaboration from many education stakeholders both nationally and regional.

SEAMEO QITEP in Science as regional center dedicates its activities to increase the outcome of science learning process through improvement of science teacher and science personnel educator quality in many levels of geographic areas, science district, national and regional. One of the activities that have been conducted was PRAISE (Promoting Real Australian Indonesian Science Education), pilot project, collaborated with Australian Government within the frame work of Agreement between DIISRTE and SEAMEO QITEP in Science. This project focus on development of science teaching and learning through conducted serial of activities namely development curriculum unit as science book resources, teacher workshops and field implementation unit which involving 10 Junior High Schools, 50 science teachers and 2800 students grade 8.

This paper was intended to report the whole process of the pilot project which started on March

2013 to March 2014, covered the achievements, the feedback and also the recommendation for future activities. To increase the integrity of the project, the independent evaluator has been invited to observe and examine the project. Detail of the evaluation was also attached.

What is PRAISE?

PRAISE stand for Promoting Real Australia-Indonesia Science Education is a pilot project which focus to improve science education by engaging students in an inquiry-based approach, and encouraging teachers to work as effective teams with a focus on student learning outcomes. Collaborated with Science by Doing Centre, a national institution that funded by the Australian Government, that have extensive experience in promoting a comprehensive inquiry based science education. The project has been received strong support from Indonesian Governments authorities, since the Education Ministry through official opening of PRAISE teacher workshop, Head of Educational of West Java Province and Bandung Districts.

The scope of the project covered two main things. These were:

1. Development of curriculum resources and tested
2. Professional Learning Approach through serial of designed workshops for science teachers

To assured that project was effectively implemented, the center maintained intensive communication and received guidance from the experts of Science by Doing which lead by Professor Denis Goodrum, Director Executive of Science by Doing. Beside also there was an evaluation of the project which was conducted by a team of independent researcher.

Development of Curriculum Resources

As mentioned that the availability of the proper learning resources is essential to guarantee that teaching and learning process were delivered effectively. It has to be accessible both for teachers and also student as reference and guidance. Ideally, the learning resources shall accommodate teacher interest, content of series of activities that student able to conduct independently, using simple material and property, close relationship with daily life so student eagerly to elaborate and explore. The unit also shall to be incorporated with national curriculum to avoid any resistances from other parties that possibly occur. More importantly it has to be tested using appropriate methods, consistently monitored and evaluated by the experts.

Refer to the above considerations; the process of the unit development can be described as follow:

1. Determination of the theme of curriculum unit, that it was The States of Matter because it can provide a basic understanding of science when it was linked to other topics such as life science, physics science and earth and space science. The content material covered for 8 weeks period of trials to the student of grade 8.
2. The book produced was written in Bahasa Indonesia and English versions and composed of book resource for the students that include a series of learning activities which require students to investigate a variety of questions. While teacher guide books provided advice to the teacher how to implement the book with the inquiry-based teaching approach embedded in them.
3. The appointment of writers. The team was taken from internal of the center intended to empower the staff and at once the experience could be viewed as capacity building in IBSE. The writers traveled to Science by Doing, Canberra, Australia, on 6-13 April

- 2013 for expert consultation and to give deeper understanding about the method in producing the inquiry based unit curriculum and application the unit in the class.
4. Layout book designed by invited graphic designer to give the impression that stimulated the readers (teacher and student) to elaborate further.
 5. Book reviewed and examination. There were intensive activities of book to be reviewed and examined by the experts, students and teachers to ensure that the final product met the criteria standard learning resources. The tested was conducted :
 - Internal evaluation by:
 - a. Writers team
 - b. Selected Students grade 8 and their science teachers
 - c. Inquiry Based Science Learning (IBSL) in-country training in Aceh
 - Pre Trial Science Teacher Workshop
 - Field Trial in the class
 - Mid Trial Science Teacher Workshop
 - Post-Trial Science Teacher Workshop/reflection
 2. Book production in Indonesia and English version will be printed as the output of this program.



The workshops

The workshops have been designed as Professional Learning Approach that covered several strategic issues include enhancement teacher pedagogical skill, familiarisation new skill and technique, formulation teaching strategies during trial, utilisation of local and simple resource, development model of community learning. The instructors for the workshop were from Science by Doing (from Australia) and QITEP in Science. However that important part of the workshop was to receive comprehensive feedback of the book such as material and content, sequence of the activities, lay out and other related component. Beside that the workshop also highlighted the issues raise as the impact of implementation new skill and approach in their learning practise include class management, student behaviour and attitude into science. Series of the teacher workshop was participated by 47 science teacher from 10 selected Junior High Schools, private and government, around Bandung district.

1st Science Teacher Workshop conducted on 6-8 September 2013

The 1st workshop was intended to familiarise the teachers both the book and the technique, beside also as teacher preparedness prior implementation. The inquiry teaching approach and technique were delivered by experts of Science by Doing include Prof Denis Goodrum. Detail of the workshop process, the output and the feedback from the teachers incorporated in the 2nd

report for September 2013.

2nd Science Teacher Workshop conducted on 8-9 November 2013

The workshop was held in the middle of unit field testing to detect the obstacles, the problems and the issues which was raised during the implementation and to give strengthening of the teacher inquiry skill. Several main concerns were found during field testing. Such as number of activities that have to be carried out during piloting, the skill of the inquiry of the teachers, time management to apply inquiry based concept properly, in adequate teaching aids, additional reference to explain the science concept. This workshop also found the effectiveness of 10 field assistances to solve their problem and to maintain the consistency of the field test.

3rd Science Teacher Workshop conducted on 29-30 November 2013

The workshop was kind of reflection post field testing to measure the effectiveness of program, the achievement, recommendation and suggestion for the future activities. In this workshop, teachers shared their experience, telling their impression toward this project, advantages of the new technique and skill in shaping their teaching activities, changing of their students' attitude toward science learning etc. Detail the feedback and suggestion from teachers in regard to book content, behaviour of teaching and learning process, student attitude were presented in one of the *attachments*.

The Implementation Phase

The curriculum unit in form of teacher guidance book and student book were tested in the class to observe the compatibility of this approach in the class room which have more than 40 students. The trial was conducted for 8 weeks started on 30 September to 28 November 2013 involving 2800 students of grade 8, in 10 selected junior high schools by 47 trained teachers. The books were distributed couple weeks before implementation phase conducted. To maintain the consistency of the trial and also to anticipate of the problems that possibly occur during trial, 10 field assistances has been appointed to do regular visit to each school. During the implementation phase, there was two accession of school visits to observe directly how teacher conducted class lesson using PRAISE book and student attitude toward the lesson. The first visit by Diastika Rahwidiarti from Tertiary Education and Knowledge Sector, AusAID together with Prof Yves Quéré, Co-Founder *La main à la pâte* on October 2013 to SMP 6 and SMP Taruna Bhakti, located in Bandung Municipality. The second visit was on 29 November by Aida Upitis, Counsellor of Education and Science, DIICCSRT, Australian Embassy and her staff, Dr Kerry Wild and Jeff Birney from Science by Doing. They were impressed and found that this project was effective to encourage students more engage in class, showed enthusiastic, while the teacher looked confidence in conducting the lesson. Team works between students and teacher, among students also established while doing science activities. Group discussion also worked effectively. Support from the principals and supervisors were also received and ready to involve in continuing the project.

Project Monitoring and Evaluation

To maintain the accountability and transparency of the project, independent team researchers from Teaching Institute was appointed. The research have revealed several findings which support the expectancy of the project, include changing student learning behaviour, the importance of science hands on and activities to explain the science concepts, increase teacher confident. In other words, the result found the effectiveness of PRAISE project into their learning and teaching behaviour and more importantly that this model was in line with national curriculum 2013 and PRAISE approach can be used to conduct teaching and learning accordingly. Detail of evaluation project accompany with the report as one of document.

Conclusions

Utilization of PRAISE curricular units improves the quality of science learning in terms of activeness of students during classes, students' motivation to learn science, students' daring to express their opinions during discussions, students' collaborations, eradicating classroom discipline problems, attractiveness of learning activities as well as providing opportunity to develop students' scientific investigations and to apply their knowledge in daily life.

Utilization of PRAISE curricular units for science learning significantly improve students' basic inquiry skills, i.e. observing, classifying, interpretations, data analysis, experimenting, predicting, and communicating. Therefore it is quite reasonable to utilized PRAISE curricular units as an instrument to improve students' inquiry skills through science learning.

Utilization of PRAISE units was not so conclusively improve students' attitude toward science and science learning. There was an evidence to indicate that utilization of PRAISE units tends to enhance students' positive attitudes toward science, attitudes toward science instructions, and students' motivation to learn science. Nevertheless, PRAISE units were not significantly enhances students' belief about effective science instruction and their beliefs about science. Implementation of PRAISE curricular units in a very short time (2-3 months) was not able to enhance some of affective aspects of science learning targets. However, there was a reason that longer utilization of the PRAISE curricular units may result more strongly enhancement of those kinds of science learning targets.

PRAISE curriculum units are feasible to be utilized effectively in schools. However, for the sake of more effective implementation of those curricular units, the units should available for all students in the classroom. Besides, availability of standard reference science textbook in school as well as reduction of content knowledge involved and scope of learning activities in the units were viewed by participant teachers as important factors to enhance the positive impact of the PRAISE units. Moreover, participant science teachers viewed that learning scenario designed in PRAISE curricular units and its teacher's guide play a role as a model for implementing scientific approach in science learning as expected by the new curriculum (The Curriculum 2013).

Project Dissemination

Socialisation of a project or activities is important to gain support from many parties and stakeholders and as a public accountability from the project administrator. PRAISE project has been disseminated in many forums, include:

1. Indonesia – Australia, Bilateral Meeting on Science and Technology, on 30 April 2013 in Puspitek, Tangerang.
2. SEAMEO Center Director Meeting, on 1-3 July 2013 in Bangkok.
3. 5th COSMED on 11-14 November in Penang, Malaysia.
4. Reported to Governing Board Meeting, on 23-28 September 2013 in Bali as highlight center initiatives.

Recommendation and Future Project:

1. The workshop prior trial and as the critical phase to prepare the teachers shall to be divided between workshop for familiarise the book and workshop for familiarised the technique with time longer.

2. Previously the project was conducted as the contribution of SEAMEO QITEP in Science in regard of science education development. However, on the way of carried out this project, most of the teacher responded positive toward this project because not only in line with the national curriculum 2013 but also as a bridge to understand the way that teaching science as required by the curriculum. This opinion was detected by the evaluator.
3. Time management become the issues in application of the method properly. It was suggested to formulate the activities which could cover many issues in the next unit development. In addition, the activities may consists of compulsory activities and optional activities.
4. Teaching aids that used in experiment is another problem due to that it was suggested the book also mentioned about the alternative material that can be used without changing the science concept.
5. Result from evaluation report suggested that this project was successful and meet the expectation. Due to that, it was suggested to held a pilot project more comprehensively with consist of many units, cover more large areas, increase number of school involved and prolong field trial.
6. Refer to the limitedness of qualified human resources, it was suggested that in the future project development, IBSE capacity building could become part of the project.

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