School-University Collaboration for Improving Quality of Secondary School Science and Mathematics Teaching

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Abstract

A mini piloting of school-university collaboration has been tried out for improving the quality of secondary school Science and Mathematics Teaching. The procedure of piloting was done in three phases, i.e. pre-trial phase, trial phase, and post-trial phase. Faculty members and Science and Math schoolteachers developed collaboratively hands-on and daily life based teaching models in pre-trial phase. Trial phase included application of developed teaching models and post class discussion for feedback. Collecting information concerning appropriateness and effectiveness were conducted in post-trial phase. It was found that the mini piloting activity gave benefit for both schools and university. The collaboration has improved student-learning activity of science and mathematics at schools.

Introduction

- *Problem on science and math teaching in Indonesia*

  The project for improvement of science and mathematics teaching for Primary and Secondary Education in Indonesia (IMSTEP) had been implemented since 1998 for five years.

  Three universities, Indonesia University of Education (UPI), State University of Yogyakarta (UNY), and State University of Malang (UM) have implemented collaboratively the IMSTEP project.

The project activity was initiated by conducting school survey to grasp the trend of the situation of science and mathematics teaching at primary and secondary schools, particularly curriculum, teaching-learning process, teaching materials as well as methods of evaluation. Faculty of Science and Mathematics Education (FPMIPA) of UPI conducted the survey to three primary schools, three junior secondary schools, and three senior secondary schools in Bandung areas covering questionnaire administration, classroom observation, and interview as well. It was found in those surveys that: (1) Teachers feel that load of curriculum content of math and science was too heavy and some parts of curricular content were difficult to be learnt by students; (2) Teachers' lecture dominated teaching-learning activities; (3) Lack of teaching aids and teaching materials available in schools and used in teaching-learning activities; (4) Poor science laboratory facilities and lacks of hands-on activities in teaching-learning process; (5) Objective testing dominated classroom assessment and focused on cognitive aspects of learning achievement.

- *Curriculum reform in Indonesia*

The government of Indonesia has reformed the school curriculum for primary, junior and senior secondary schools since 2000. The concept-based curriculum has changed to competency-based curriculum. In case of science subject, the competency-based curriculum has emphasized not only on conceptual understanding and its application but also on scientific skills, such as investigation, scientific communication, creativity development and problem solving, and scientific attitude and values. With the developed curriculum, it is expected that teaching paradigm will be shifted from teacher-centered to student-centered. The developed competency-based curriculum has been tried out at number of schools in the country.

- *Technical corporation Project for improving Science and Mathematics teaching in Indonesia (IMSTEP)*

  It was belief that the quality of science and mathematics teaching in Indonesia can be improved through improving the quality of pre- and in-service teacher training program, as indicated by improving the graduate quality. The IMSTEP project that supported under the Government of Japan were designed to improve the capacity building of three faculties of science and mathematics education of UPI, UNY, and UM as project implementers. Those three universities had run several activities, particularly, review and revise curriculum and syllabi, development of textbooks, development of teaching materials for pre- and in-service teacher training program, and development of method of evaluation in science and mathematics. After mid-term evaluation, the project scheme were adjusted by including piloting activity for science and mathematics teaching at junior and senior secondary schools to meet stakeholder needs, so that the project give quick impact to quality improvement of science and mathematics teaching at junior and senior secondary schools. Therefore, the IMSTEP project supported the three universities to collaborate with neighboring schools to improve their quality of science and mathematics teaching. The school-university collaboration is continued in the 2-year Follow-up program of IMSTEP in the year of 2003 to 2005.

Methodology

- *Objective*

  The objective of the school-university collaboration is to improve science and mathematics learning in pilot schools through application of several project outcomes (teaching models, practical work activities, teaching materials, and assessment model) as well as evaluating appropriateness and effectiveness of the

model. In addition, this activity is intended to get feedback for improving quality of pre- and in-service teacher training program.

- *Scope*

  Faculty of science and mathematics education of UPI involved three junior secondary schools and two senior secondary schools in Bandung. School-university collaboration was based upon a principle of school empowerment. The developed teaching models for secondary school science and mathematics were based upon hands on activity, daily life, and local materials.

- *Procedure*

  Pre-trial phase

  - Selection of pilot schools was based on willingness and commitment to participate collaboratively.
  - In-campus workshops involving schoolteachers and faculty members of FPMIPA UPI were held to identify the problem facing in science and mathematics teaching and to develop collaboratively alternative teaching models based on hands-on activity, daily life, and local materials. The developed teaching models include teaching plan, teaching materials, student worksheets and method of assessment. The developed teaching materials were tried out prior to real teaching activities at classes.

  Trial Phase

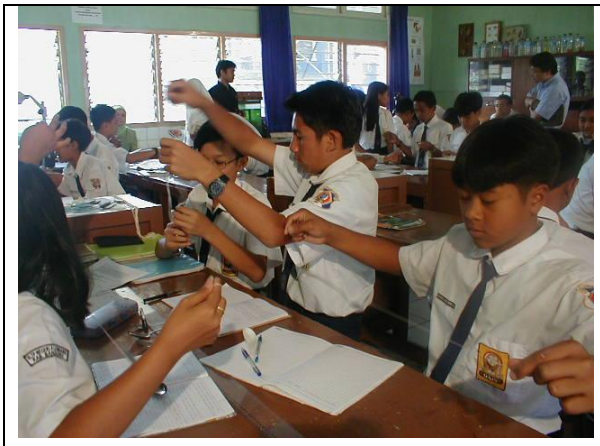
  - Teachers applied the lesson plans in teaching, while faculty members attend the class as assistant and observer (Some prospective teachers and non-pilot teachers voluntary attending and observing the teaching-learning activities).
  - Post teaching discussions between teacher and faculty members (in some occasion attended by JICA experts) on experience in applying the model, as well as improvement should be done in next teaching period.
  - Preparation for next lessons.

Post-trial phase

- Faculty members collected information concerning appropriateness and effectiveness of the models through student questionnaire, observation notes, and informal interview to participating teachers.

Results

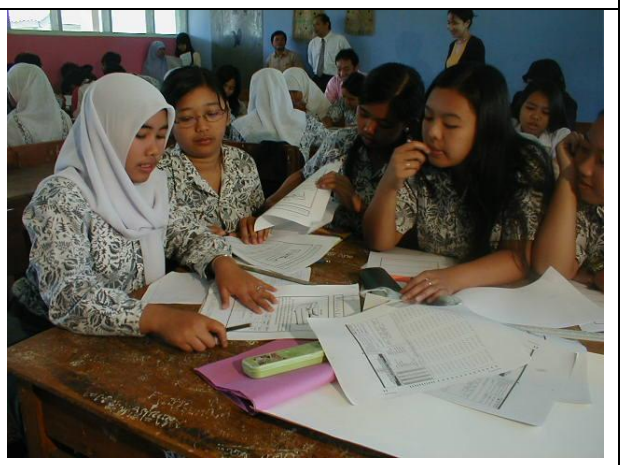
Following pictures are student activities at piloting classes.



Using simple apparatus, students are learning biology

Students are doing physics experiment

Students are doing chemistry experiment



Learning mathematics through sharing ideas among classmates

Students were learning science and mathematics actively through hands-on, daily life, and local materials based teaching model.

To obtain the information regarding the impact of piloting, questionnaire were distributed to 14 piloting teachers. The result is shown on table 1. Questionnaire was asking several

aspects concerning teaching materials, teaching method, evaluation, and motivation. Each aspect was rated from 1 to 4, meaning: 1 = not agree, 2 = less agree, 3 = agree, and 4 = most agree).

Table 1. Results of survey to piloting teachers

	ASPECTS	Average score
Teaching Materials		
	Printed Materials	
	1. Self producing teaching materials for students	2.6
	2. Producing teaching materials for students in cooperation with UPI teaching staffs	3.7
	3. To obligate students to use certain textbook	2.7
	4. To obligate their students to use textbook published by private publishers	2.1
	5. To give freedom for students to choose textbooks	3.5
	6. Preparing worksheet to activate students	3.1
	7. Using worksheets produced by publisher	2.3
	Teaching Aid	
	8. Always utilizing teaching media (chart, model, ect.) in teaching	3.2
	9. Prepare teaching media by him/herself	2.3
	10. Prepare teaching media (chart, model, ect.) together with students	3.2
	11. Often using OHP in teaching	2.6
Teaching method	**Hands-on Activity**	
	12. Holding practical works at least once a month	2.9
	13. Carrying out practical works in school laboratory	2.9
	14. Carrying out practical works in classroom	2.2
	15. Carrying out observation activities in field	2.7
	16. Using material found in surrounding for practical work activities	3.5
	17. Supported by school principal in carrying out practical work activities	4.0
	18. Involve students in preparing practical works	2.4
	Class Discussion	
	19. Always undertake to create “students active learning” in class	3.9
	20. Always providing opportunity to students to ask questions	3.9
	21. Always asking question to stimulate less active students	3.7
	22. Always create group discussion in class	3.6
	23. Always providing opportunity for students to express their opinion freely	3.8
Evaluation	24. Convinced that their students are fun in learning	3.6
	25. Students can apply their knowledge in their daily life situations	3.1
	26. Not only measure students’ mastery on curriculum content from his/her scores in National Leaving Examination	3.4
	27. Consider students’ activities in classes for an evaluation	3.8
Motivation	28. Often participating on seminar/workshop hold by FPMIPA UPI	3.5
	29. To implement new methods exercised or discussed in seminar and workshops in school	3.4
	30. Receive innovative ideas from FPMIPA UPI that quite feasible to be applied in school setting	3.7

Conclusion

- *Student active learning*

  As a result, the school-university collaboration gave benefit for school and university. Piloting activity improved students' enthusiasm, students' motivation, students' activities, and students' performance. Students enjoyed learning science and math during piloting activity due to some reasons. According to students' respond, the lesson was not so formal, the contents were easier to learn, students able to express their ideas, students got much time for discussion with their classmates, more experiment science and math.

- *Teachers' professionalism*

  This activity improved teachers' professionalism in terms of teaching performance, variation of teaching methods/approach, and collaboration. Teachers got alternative method to let students learn and construct their own concepts. However, teachers took time to get used to develop teaching model by their own. Faculty members got to know more about the problems faced by teachers.

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