Available online at www.sciencedirect.com
ScienceDirect
International Journal of Educational Development 27 (2007) 194–204
International Journal of EDUCATIONAL DEVELOPMENT
www.elsevier.com/locate/ijedudev

A study of the partnership between schools and universities to improve science and mathematics education in Indonesia

Eisuke Saito[a,*], Harun Imansyah[b], Isamu Kubok[c], Siumar Hendayana[b]

[a]*International Development Center of Japan, Japan*
[b]*Faculty of Mathematics and Science Education, Indonesia University of Education, Indonesia*
[c]*Freelance Consultant, Japan*

Abstract

This paper examines what kinds of impacts a school–university partnership has on schoolteachers and university faculty members, and what types of challenges and tasks exist. The results show the following: (1) joint lesson planning, observation, and reflection, called piloting activities (PA) have succeeded in improving teaching methodologies; (2) faculty members and teachers generally regarded the students under PA as being more participative; (3) it is necessary to ensure linkages between materials and students, as well as between students; and (4) PA resulted in the development of collegiality within schools and between faculty members and teachers.

Keywords: Comparative education; Development; International education; School–university partnership; Mathematics and science education; Indonesian

1. Introduction

In order to promote the professional development of teachers, it has been frequently claimed that it is necessary for teachers to open their lessons and teaching methodologies to observation and to observe the lessons of other teachers (Barth, 1990; Grimmet and Crehan, 1992; Joyce and Showers, 2002; Leithwood, 1992). This implies that teachers can continuously learn from the teaching practices of their colleagues and that this learning can reflect in their own lessons. As Levin (2003) states, teachers need opportunities and support for on-going professional development, and in-service teacher training within the framework of a school–university partnership has been widely designated as one of the major approaches to this. Gross (1988) pointed out that the training provided through such partnerships could facilitate the professional development of teachers and also improve the university faculty members' understanding of the realities of the school environment. However, some reports claim that the partnership does not always easily produce such benefits for both parties but rather causes confusion or confrontation (Clift et al., 1995; Johnston, 1997).

With regard to the experiences in non-Western countries, there are case studies from Hong Kong (Fung, 2000), Singapore (Jones et al., 1999), and South Africa (Harvey, 1999; Johnson et al., 2000). In the Hong Kong case, at an early stage, teachers

*Corresponding author.
E-mail address: saitoeisuke@hotmail.com (E. Saito).

0738-0593/$ - see front matter © 2006 Published by Elsevier Ltd.
doi:10.1016/j.ijedudev.2006.07.012

were particularly reserved in verbalising their own thinking and commenting on other teachers' views. However, they gradually became keen to share their problems, complaining about the pupils and seeking help from each other and the researcher with regard to ways of organising lessons and conducting activities (Fung, 2000; p. 159). As the implementation proceeded, the teachers grew slightly more relaxed and allowed more time for pupils to express their views and to think (p. 162). With regard to Singapore, Jones et al. (1999) investigated the case of partnership with teachers in primary and special schools. In the project, teachers appraised their own professional development needs and discovered the nature of the problematic behaviours of students in the classroom. Accordingly, they found the nature of such behaviours to be relatively mild and amenable through the use of comparatively simple classroom management techniques. Jones et al. (1999) state that teachers are able to devise such techniques through collaborative work with colleagues, and this leads to the importance of an attempt to target the professional development of teachers on the basis of reflection on their practices. Harvey (1999) focused on South African cases of in-service training programmes for primary science teachers and claimed that teachers who invited colleagues to observe their lessons made substantial changes to their teaching methodologies as compared with teachers who did not do so. However, Harvey (1999) was rather modest in gauging how sustainable it would be for the teachers to continuously conduct lessons in a constructivist manner. Harvey (1999) concluded that it was necessary to monitor the situation further. Johnson et al. (2000) conducted a case study on a science teacher development project that aimed to change the teaching-and-learning approach from 'chalk and talk' to a pupil-centred, group-work based and autonomous learning-oriented one. The local educational authorities participated in this project; they permitted the participating teachers to make changes and also allowed for the movement of funds to support the new strategy (Johnson et al., 2000; p. 580). The study concluded that effective learning strategies, participation and sustainability can go hand-in-hand (Johnson et al., 2000; p. 581).

Even in Indonesia, which is the focus of this study, there is a necessity for continuous professional development programmes. However, in-service training programmes in the country are seldom capable of addressing the realities faced by teachers in classrooms (Joni, 2000). There are some institutions for in-service teacher training, such as Pusat Pengembangan Penataran Guru (PPPG: National Teacher Training Centres) and Lembaga Penjamin Mutu Pendidikan (LPMP: Educational Quality Assurance Institutes), at which participant teachers have to take courses (Japan International Cooperation Agency, 2003). Furthermore, there has been an attempt to provide in-service training at school sites nationwide, as a programme called Pemantapan Kerja Guru (PKG: meaning 'upgrading the work of the teachers') (Adey and Dillon, 1994; p. 2), which was later developed as Musyawarah Guru Mata Pelajaran (MGMP: Subject-wise Teachers' Self-learning Association). However, MGMP activities tend to be conducted in the central cities of districts and are attended by representative members from various schools and regions; clinical, school-based activities such as the original one under PKG are seldom organised, mainly due to financial constraints. Due to these reasons, in-service training in Indonesia has little impact in a real classroom situation.

Given this situation, although some informal school–university partnerships may be developed on a voluntary basis in Indonesia, such practices tend not to be probed or explored. This lack of study of school–university partnerships results in the insufficient development of knowledge and insights with regard to assisting the professional development of teachers on the basis of classroom-level practices. This is a major problem because, firstly, Indonesian teachers have few opportunities to access resources that can enhance their practical professional capabilities. Secondly, university faculty members, who are expected to function as academic resources for teachers' professional development, also cannot accumulate practical knowledge and insights.

Therefore, it is imperative to conduct case studies on school–university partnerships in Indonesia. Based on this need, the present paper will examine what kinds of impacts a school–university partnership has on schoolteachers and university faculty members, and what types of challenges and tasks exist. As a case study, the Indonesian Mathematics and Science Teacher Education Project (IMSTEP) will be analysed. With these aims in mind, the paper is divided into five parts. Following this introduction, Section 2 contains a brief description of IMSTEP, and Section 3 explains the research methodology. The Section 4 contains the analysis. The Section 5 presents some concluding remarks.

2. Description of IMSTEP

2.1. General background of IMSTEP

Indonesian mathematics and science teachers' comprehension of their subjects and their pedagogical skills are said to be at a low level (Joni, 2000). In order to change this situation, some universities and schools have begun to improve mathematics and science teaching through collaborative activities under the aegis of IMSTEP, which was technical cooperation programme by the Government of Indonesia and the Japan International Cooperation Agency (JICA). The recipient organisations under IMSTEP were the Indonesia University of Education (UPI) in Bandung, The State University of Yogyakarta (UNY) and The State University of Malang (UM).

In 2001, these three institutions introduced in-service teacher training, known as 'piloting activities' (PA). PA involves schoolteachers and faculty members jointly developing lesson plans, putting these plans into practice in the classroom and then reflecting on the lessons. Both lower and upper secondary schools (junior and senior high schools, respectively) were targeted; each university chose two lower and two upper secondary schools as partners. UPI targeted grade 1, UNY was in charge of grade 2 and UM focused on grade 3, again at both lower and upper levels of secondary education from 2004 till 2005.

The following is a detailed explanation of the PA procedure. The PA cycle was composed of three stages: a planning session, the open lesson, and a reflection session. The planning session was a preparatory workshop that each university held at the beginning of each semester for all the participants involved in PA. The participants were science and mathematics teachers in the targeted schools, who opened their lessons for observation and criticism, and university faculty members involved in science and mathematics education, who worked with the schoolteachers. The group spent an entire day generating consensus on which topics should be covered through the PA. During parallel sessions, held according to subject, the participants consulted their colleagues with regard to the teaching methodologies to be used and the approximate time schedules during the semester. Detailed decisions regarding lesson plans were fundamentally the responsibility of each teacher and were not discussed in the workshop period. The targeted teachers occasionally sought consultation with university lecturers. In the next stage, the open lesson, teachers invited their counterpart university faculty members to observe their lessons. Sometimes, other targeted teachers from the same or other schools joined in the observation of lessons. A detailed explanation of the procedure of the lesson is provided in the next section. The third stage, the reflection session, was conducted almost immediately after the observation of the open lesson. During this session, the teachers and the observers shared views and comments. The length of the discussions varied from 30 to 90 min, depending on the availability of time. The observers made comments and provided inputs to the teachers in order to enable them to conduct more effective lessons in the future.

During the semester, a team of two or three teachers and at least two university faculty members for each subject at each educational level in the regions selected for PA repeated this entire cycle to ensure that all the selected topics were covered. The number of lessons and reflection sessions varied according to each department's decision on the number of topics, which varied between two and three. In general, PA was conducted at least once a week for each teacher.

The general procedure followed for an open lesson was as follows: the lesson began with an introduction, after which the students' knowledge on the topic was assessed. The teacher assigned tasks to the students, who worked in small groups. The targeted teachers organised group activities in every observed lesson. The number of students in a group varied depending on the situation in the classroom. In many cases, this number ranged between four and six. There were 45–48 students in a class. The group activities mainly included physical tasks and internal discussions. The physical tasks, which included experiments and measurement taking, often involved solving problems in worksheets along with the other group members. Based on the results of the activities, a class discussion was held and students and teachers drew conclusions about their topics through an exchange of ideas.

The innovation brought by PA is the shift of views on teaching and learning in a classroom situation from a conventional approach to a constructivist one. The conventional approach lays emphasis on the transmission of knowledge and skills from teacher to students through the channels of reading and lecturing (Collins et al., 1995).

Although Collins et al. (1995) list broadcast radio, television, videotapes or films as possible additional media, it would be improbable to expect to find such relatively new technology in the classrooms of developing countries. In most cases, including in Indonesia, teachers are largely dependant on lecturing. On the other hand, constructivist views stress communication among students. Their purpose is to jointly construct an understanding of different ideas; therefore, this approach requires active discourse and consensus building through discussion, argumentation, enquiry or brainstorming (Collins et al., 1995; Fraser, 1995). Based on this constructivist approach, PA has attempted to foster the learning of mathematics and science at both lower and upper secondary levels. More specifically, the teachers and faculty members jointly attempted to introduce a greater number of experiments, small group activities, presentations and discourses.

3. Research methodology

This paper will employ the methodology of a case study as an analytical method (Cohen et al., 2000; Creswell, 1998). In other words, it will provide an in-depth description and interpretation of PA, using interviews and focus group discussions as a means of data collection. The focus group discussions involved 48 participants: 14 teachers and 34 faculty members.

In Bandung and Malang, the interviews with teachers were conducted in their schools, while in Yogyakarta, the teachers were invited to the university campus for discussions. All of the participating schoolteachers were engaged in PA, while the faculty members included both coordinators of PA and management staff, such as the heads or secretaries of the departments concerned. The focus group discussions were conducted from May to June 2004. Each discussion lasted for 90 to 150 min and was scheduled between 09:00 AM and 03:30 PM. The number of the participants in the discussions varied from 2 to 6. All transcripts of the focus group discussions were translated and typed out, and the authors categorised their statements on the changes that they perceived. All types of changes were noted, including participants' personal opinions, teaching methodologies, the learning processes, student behaviour, and so on.

In addition, there were a series of lesson observation sessions and corresponding reflection sessions in seven lower and six upper secondary educational levels. The frequency of the authors' participation in PA varied due to school vacations and holidays. However, on an average, the authors attended the lessons at least twice a week. The lessons observed were not transcribed; however, notes taken by the authors were used in the analysis. The total number of observed lessons was 53, and observations were made at least twice per school.

4. Analysis

4.1. PA in practice

PA has been successful in improving 'visible practice' (Inagaki and Sato, 1996), such as dealing with lesson plans, students' worksheets or process skills. The remarks made in the focus group discussions show that the attention of both schoolteachers and university faculty members tends to be drawn to such easily observable and recorded items. As far as the authors observed, in most of the cases, PA teachers attempted to facilitate student learning by forming small groups consisting of 4 or 5 students and providing them with mediating materials. Examples of these materials are experimental equipments (in science) or worksheets with questions. A series of pictures of the actual situation of student learning, in which students were divided into small groups and mediating materials were used. Harvey (1999) stated that it was difficult to stabilise the change in the lesson mode; however, the lessons were conducted by using methodologies in most of the 53 cases observed by the authors. Some of the examples of lessons are shown in Fig. 1.

While there was active interaction within groups, however, the sharing of findings, statements, observations or questions between groups was rarely observed. Although the students made presentations to the rest of the class at the end of group activities, the presentations tended to merely report the results of activities, observation or experiments. They seldom involved the entire class in arguments, discussion or debate. This exposed the limitations of teachers' skills and of faculty members' support towards helping teachers become capable of facilitating the integration and development of students' findings, thoughts, observations or ideas in PA.

The ability to involve the entire class in arguments or discussion also requires teachers to reflect on students' presentations or arguments. However, according to the series of observations, both faculty members and PA teachers tend to pay more

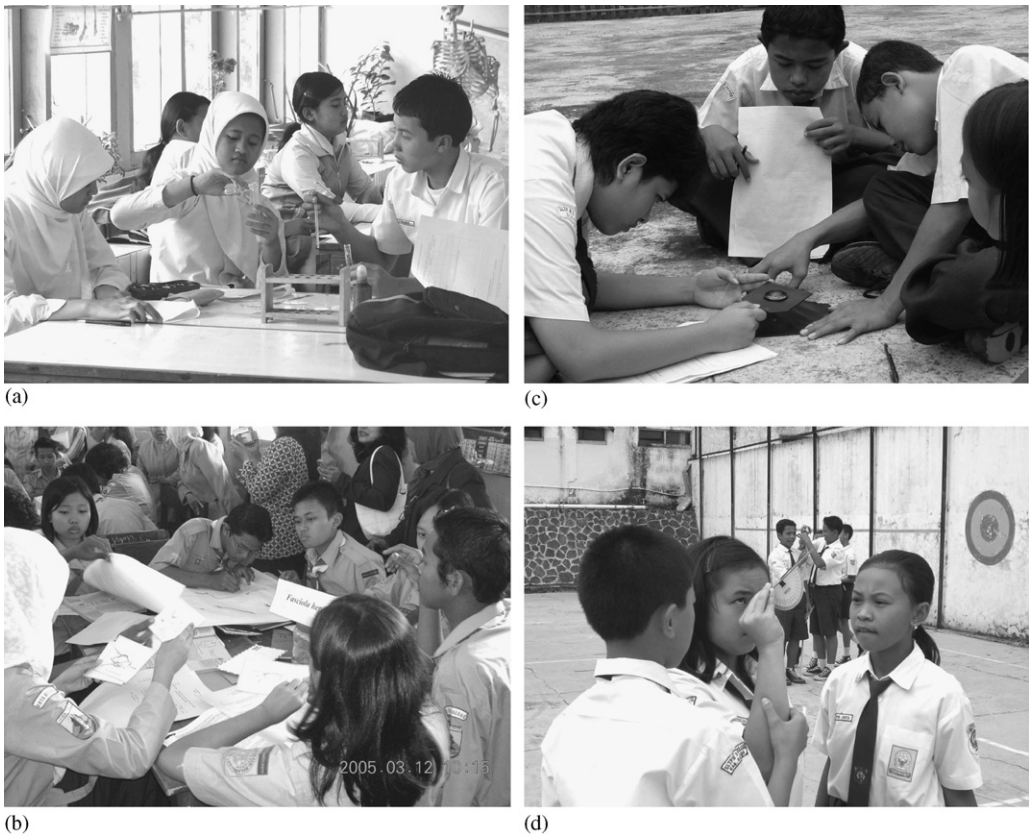

Fig. 1. Student learning in PA. (a) Chemistry for high school, (b) biology for high school, (c) physics for junior high school, and (d) mathematics for junior high school.

attention to following steps in teaching theories. Reed et al. (2002) state that teachers who are reflective-in-action during lessons offered learners richer, more coherent and more appropriately scaffolded learning experiences (pp. 270–271). Further, Zeichner and Liston (1996) note that reflection does not consist of a series of steps or procedures to be used by teachers; rather, it is a holistic way of addressing problems (p. 9). Thus, the present situation of PA suggests that PA teachers and faculty members need to be more reflective and devote greater consideration and sensitivity to their teaching-related problems in reality.

4.2. Activeness

Although there are some differences in definition, the faculty members and the teachers generally regarded the newly developed readiness of students to ask questions or to participate in activities as 'active' attitudes. Harber and Davies (1998) state that a monotonous classroom environment prevails in developing countries. Indonesia has been no exception. In such circumstances, it is certainly significant for students to take the initiative in conducting some activities. As far as the authors observed, whenever group activities were conducted, most of the students became engrossed in them. Even those students who were apparently uninterested in learning the subjects grew eager to participate in the assignments with other students.

The following is a description of an upper secondary biology class that some of the authors observed in Yogyakarta. The topic of the lesson was the cells of stems, and the lesson focused on the water transportation system in plants. The teacher spent approximately 10 minutes to explain the topic and then instructed the students to conduct observation. The students observed the plants in groups consisting of approximately 4 students. Most of the students paid attention to the teacher's explanation. However, one male student did not sit in the front of the class. He seldom saw the teacher and looked instead at the opposite bottom corner of

the classroom. While the other students began to move to another corner of the classroom in order to prepare for the group activity by picking up microscopes and the prepared specimen, this student remained seated, talking to a neighbouring male student.

Nonetheless, when these two students began to work with two female students in a group, the student who had not been sitting in the front became very eager to learn. His participation in the activity was rather gradual. He sat in front with the other students and began to handle leaves as the material for observation. Then, he observed the activities of the female students and the neighbouring male student. Afterwards, he gazed at the activities of the other students and then began to help them by adjusting the mirror attached to the microscope. Thus, the introduction of group activities and mediating materials bring about such a change in students' learning interest that even those who are apparently indifferent to learning join in the activities.

Although the lesson described above seems to have been very successful in enkindling the students' interest in learning, there was a problem with regard to how student learning should be scaffolded. In the group referred to above, other students took the initiative in most of the major tasks, such as observation, discussion on the results of observation or writing down the results of observation on transparencies. Although the male student who was initially indifferent became deeply absorbed in observing the other students' activities, he rarely began any activities in the group or exchanged ideas or results of observations. Thus, even during group activities, some students were dominant during assignments while the apparently 'passive' students did not have the opportunity to participate equally. Moreover, there appeared to be no special awareness of that student's situation. Due to this lack of awareness on the part of the teacher, who was the facilitator, there was the risk that this student's interest in or curiosity about observation would not lead to dialogue with other students on the results of observation.

Therefore, it is essential for teachers to help such students and groups: teachers need to ensure that materials not only mediate student learning but also promote interaction among students (Abdal, 1998; Ishii, 2003). This necessity is applicable to the faculty members as well. In the lesson described above, although several faculty members were present to observe the lesson, they sat in the rear. Although they sometimes moved around the classroom and observed student activities, they tended to focus on groups whose members were engrossed in the activities and pose questions to those students. This implies that even faculty members have a serious lack of interest in students who find it difficult to participate in mediated learning. Therefore, it is imperative for both PA teachers and faculty members to be more vigilant about the situation in the classroom and to pay special attention to students who are not participative (Saito et al., 2006b).

In the case study in Namibia, O'Sullivan (2002) claimed that the reflective skills in that country were not on a par with the Western level of reflection, despite O'Sullivan's belief in lesson observation as a critical follow-up method. For this reason, O'Sullivan referred to the impoverished educational and professional background in Namibia (p. 198). A similar tendency is seen in the Indonesian case. According to the observations, the reason for this lies in the lack of attention to and carefulness about the smaller events in classrooms. This dearth of attention and carefulness results because the frameworks or theories of teaching that are introduced into the Indonesian context take precedence over the emerging reality in classrooms.

4.3. Collegiality among school teachers

Another result of PA has been the development of collegiality within schools. In one piloting school, the teachers met to share what they had learned in PA. They have now set up an internal MGMP in their own school. Observing this movement among the science teachers, the school principal decided to establish internal MGMPs for other subjects as well. The teacher who founded that movement in the school recalls the following:

> In the past, teachers always went their own way, without knowing or sharing the problems of other teachers. However, we discovered that it was easier for us to solve our problems if we discussed them with our colleagues. We now use this internal MGMP as a medium to share and solve these problems. Another effect was that the relationship among teachers in the same department strengthened (quote from a focus group discussion, 28 May 2004).

As a means of overcoming professional isolation, the teacher invited other teachers to meet in order to learn more about the results of PA:

> I knew that my friends also liked to get new ideas, especially those that could improve our school and the learning process there. In fact, that was my intention—to help us improve. At that time, I was using cooperative learning, particularly the jigsaw model, and I faced many problems, including the reactions of some of my friends. However, I made the effort to overcome those problems. After seeing the results and their appropriateness to the new curriculum, those friends who had initially opposed this programme switched over to supporting it. As for the internal MGMP, we really had had nothing like it before PA (quote from a focus group discussion, 28 May 2004).

This represented a change in the nature of PA from one of support for a limited number of teachers in a school to school-based training. School-based training is one of the most powerful methods of professional development for teachers (Inagaki, 1986; Reed et al., 2002) if it is serial and provides opportunities for teachers to increase their ties with others. Thus, it should be noted that PA acted as the trigger for change in a school's culture and encouraged lesson improvement. This case is quite significant because it shows how teachers can bring about a change by themselves and how school principals can develop a school culture to facilitate the teachers' participation in activities aimed at their professional development. It should be noted, therefore, that IMSTEP should explore ways to strengthen and facilitate both teachers' and school principals' interest in school-based training.

Further, the present authors consider that the next challenge for that particular school is whether the teachers can allow colleagues to observe and reflect on their lessons, focussing on the interaction with students in a concrete context. Reflection is an activity for critically reviewing whether, how and why students with various backgrounds and living situations could or could not learn effectively. A series of works on lesson reflection (Inagaki, 1986; Inagaki and Sato, 1996; Ito, 1990; Macleod and Golby, 2003; Ose and Sato, 2000, 2003) present detailed descriptions of some specific learning experiences of both teachers and students. In the case described above, the key to further success depends on whether or not the teachers can explore their teaching and learning process thoroughly. Saito et al. (2006a) researched some PA schools' development of joint observation and reflection on lessons as part of INSET, which involved all of the teachers there. However, such attempts are still emerging, and their development will only be ascertained later.

4.4. School–university partnership

According to the results of interviews, PA was a significant process for university faculty members, because it offered them a major opportunity to increase their understanding of the realities of the classroom. As mentioned earlier, in-service training programmes in Indonesia tend to be lecture based and have little impact in a real classroom situation (Japan International Cooperation Agency, 2003). In addition, Joni (2000) pointed out that practical types of training were most essential in order to improve the quality of teacher education, particularly in the fields of mathematics and science. Such experiences gave faculty members an opportunity to discover the reality of the school environment and the education there. One of the faculty members described the experience of being involved in PA as follows:

> To be honest, my educational background is in the field of pure science. However, by being extensively involved in PA, I have gained many new experiences in the fields of teaching and learning. For instance, I now know how a teacher prepares a teaching plan, makes a worksheet, prepares learning media, and all the other steps in the teaching process right up until the lesson evaluation (quote from a focus group discussion, 15 June 2004).

Through working with schools, faculty members have developed closer relationships with teachers. In order to support piloting teachers, some of the faculty members attempted to set aside sufficient time to ensure that teachers felt satisfied that they had understood the procedures properly.

> To conduct the experiment, the teachers had to spend extra time both in preparing the experimental equipment and in conducting the experiment by them themselves beforehand. Teachers did not have breaks between one lesson and the next, so they had to prepare one or two days in advance… We spent an entire morning working

> with the teachers on their preparations. We had to arrange to go to the school on the teachers' day off in order to conduct the trial experiment. We coached them until they understood and carried out the experiment successfully (quote from a focus group discussion, 10 June 2004).

However, some problems arise with regard to the relationship between schools and universities. One of the PA teachers made the following comment regarding the role of faculty members:

> Although in the first semester one faculty member was our mentor, in the second semester she became only a facilitator. She merely observed the development in the class without helping us prepare lesson plans or handouts. Sometimes, I had the feeling that I was some kind of guinea pig, and I told her so (quote from a focus group discussion, 28 May 2004).

This quote reveals both the teachers' acceptance of the superiority of the faculty members and their frustration owing to their superiors' malfunctions. The participants in the focus group discussion quoted above were all female teachers, and the faculty member mentioned was also female. The PA teachers appreciated the knowledge shared, the information provided and the consultation offered by the faculty member in a really close relationship, since it is difficult to expect this in the Indonesian context (Joni, 2000). Thus, PA teachers greatly appreciated the opportunity to grow in a professional capacity.

With respect to the problems—dissatisfaction or frustration—the last quote reflects the PA teachers' perception of faculty members as a source of knowledge, information, theories, and so on. If faculty members do not function as such a source, the PA teachers appear to get frustrated. We received similar complaints about other faculty members from some PA teachers. Some of the faculty members did not attend the lessons, or even if they did, they stayed in the classroom for only a short period. The comments that they made during the reflection were very superficial, such as merely saying 'it was a good lesson,' without providing any inputs or feedback. The teachers—both the PA teachers and the colleagues—were dissatisfied with the insufficient guidance. According to them, they expected to upgrade their skills and knowledge on conducting lessons with the help of suggestions and comments from the faculty members.

In the last case, the PA teacher and the colleagues were female whereas the criticised faculty member was male. The original relationship between them might not have been as close as the one between female PA teachers and faculty members in the second case. Yet, even this case involving the male faculty member and the female PA teacher reflects the dissatisfaction caused due to insufficient feedback. Although this PA teacher might have merely expressed a demand for greater care and attention as a partner in PA, this quote does reveal her general expectation of the faculty members as a source of information, knowledge and theories.

This suggests that although PA is supposed to be an action research programme, where equal relationship should be pursued, the relationship between teachers and university faculty members is asymmetrical (Dahlström, 2003; Ebbut, 2000; Elliot, 1991). In this case, the faculty members would construct the ideas or concepts for lessons and the PA teachers would implement those ideas in classrooms. Mokuku (2001) reported a similar type of 'demarcation of works between university and school in conducting action research' in South Africa. Moreover, PA was rather one-sided; teachers were expected to open their lessons to criticism, while the faculty members enjoyed the freedom to say anything they pleased. Yet, based on the results of interviews, very few questioned this relationship. Sato (1999) pointed out the peculiarity in the relationship between faculty members and schoolteachers in Japan: despite having had few experiences in conducting lessons in schools, researchers would 'guide' and 'instruct' teachers, who had richer and wider experience in teaching in schools. Ironically, this relationship appears to be reproduced and strengthened.

One of the major reasons for the construction of such an asymmetrical relationship is that dialogical relationship between faculty members and PA teachers has not been sufficiently developed. In particular, as PA teachers apparently valued the authority of faculty members, the latter would need to make an effort to set up a dialogical relationship with the former. Weiler (2001) conducted a case study on pre-service education in Zambia that was intended to develop a dialogical relationship with teachers' college students. Weiler (2001) pointed out the importance of listening to students and respecting them as professionals. Although the case of Weiler (2001) was based on pre-service education, the results of the study would be applicable even in

the case of in-service education, such as PA. In fact, the importance of listening to and respecting teachers would be more significant in this context, because PA teachers are real professionals, accumulating various types of experiences in teaching. Faculty members should learn from the PA teachers' rich practical experiences.

4.5. Time management

The main concern among teachers and faculty members exists that PA is time-consuming. Both of them complained about the strain of covering the entire curriculum while also pursuing the targeted experimental activities.

> The problem is that if we conduct too many experiments, the curriculum targets will not be fully met. I think this causes a huge dilemma for the teachers. If they have too many experiments, they will not finish the theory that they wish to discuss. We are unsure of what to prioritise (quote from a focus group discussion, 27 May 2004).

This problem with time management reveals a possible inconsistency between the system of the new curriculum and the examination system in Indonesia. PA stresses the importance of interaction between students and teachers as well as practical work in the teaching-and-learning process. It should be noted that in the academic year 2004/2005 a new curriculum was introduced, which was based on the framework of constructivism, with emphasis on the competency of students (Hamid, 2004). Therefore, PA functioned as trial of the new curriculum in a real classroom situation. However, as the experiences in PA have shown, it is very time-consuming to conduct lessons based on a constructivist approach. At the same time, the national examination system requires schools to cover an extensive curriculum, with the main focus on memorisation of subject items. Therefore, both faculty members and teachers often felt the strain of reconciling the curriculum and the examinations.

This is a global concern—one that some countries have addressed by reforming their evaluation systems. There is a strong necessity for the Indonesian government to learn from the experiences in other countries. Finland, for instance, reduced the content of the curriculum and changed the evaluation system from national to school-based (Webb and Vulliamy, 1999; Webb et al., 2004). In Japan, the government started to reduce the content of the curriculum since the 1970s and then decided in the late 1990s to implement a further reduction of 30% from the previous one, with an emphasis on experiential learning or problem-solving (Mochida, 2003). However, the type of question items in the entrance examination did not change much, and this inconsistency led to a gap between schools. To elaborate, some private schools attracted talented students by providing intensive training for the entrance examination, ignoring governmental curriculum, while public schools were at a disadvantage in terms of competition since they were obliged to follow the curriculum set by the government (Sato, 2000; p. 46). Thus, the PA experience and foreign cases indicate that it is necessary to review and reform the educational evaluation system in Indonesia in accordance with the introduction of the new curriculum. If this is not done, there will be further confusion, and the educational gap between the advantaged and the disadvantaged will expand.

In Yogyakarta, some teachers and faculty staff in the chemistry and biology departments attempted to solve this problem by carefully designing experiments that would simultaneously cover two topics. Both teachers and faculty members reported this initiative at focus group discussions on 10 June 2004. The authors also observed similar attempts in Malang on 29 March 2005: three types of experiments—gravity, electricity and light—were simultaneously conducted in several small groups of third grade students who needed to prepare for the graduation examination. In Indonesia, graduation examinations are conducted at the end of each educational level, beginning from the primary level, and have special significance in deciding student articulation: upper educational level institutions select their students primarily on the basis of the results of these examinations. In the case in Malang, the teacher attempted to reduce the time taken to cover these topics by simultaneously conducting three experiments.

PA has a special purpose: to change the nature of learning in mathematics and science education in Indonesia. In other words, PA should enable students to achieve a deeper understanding of topics. Since the academic year is of a fixed duration, the number of topics to be able to be covered by PA is believed to be less than the conventional way. However, learning in PA should require and enable students to develop their cognitive abilities, regardless of their previous

academic achievements. Hitherto, PA laid emphasis on activities that involve the use of experiments or physical materials. However, faculty members and PA teachers admitted that in the final grade, learning tends to be conventional. If that is true, there could be a compromise and adjustment between the conventional method and the PA method with regard to smaller group activities, mediating materials and the sharing of ideas. This implies that informal and small pair discussion can be utilised even during a lecture and that any questions, even including past problems in national examinations, that require student deliberations can be used as part of the mediating materials in the lessons. By doing so in the final grades of both lower and upper secondary levels, PA teachers will be able to adjust their time schedules with those of the national examinations while also conducting PA-style lessons in their schools.

5. Conclusion

The aim of the present paper was to examine what kinds of impacts a school–university partnership has on schoolteachers and university faculty members, and what types of challenges and tasks exist. The results show that, firstly, PA has succeeded in improving 'visible practise', such as dealing with lesson plans, students' worksheets, or process skills. Secondly, although there are some differences in definition, the faculty members and the teachers generally regarded the newly developed readiness of students to ask questions or to participate in activities as 'active' attitudes. However, it is essential for teachers to increase their skills and insights with regard to helping students and groups by facilitating the activities. Thirdly, it is necessary to ensure linkages between materials and students, as well as between students. This necessity is equally applicable to the faculty members. Fourthly, PA resulted in the development of collegiality within schools. In addition, through working with schools, faculty members have developed closer relationships with teachers. However, it is necessary to further discuss the nature of the appropriate relationships between faculty members and PA teachers. Finally, PA is perceived as time-consuming teaching approach. Both teachers and faculty members complained about the strain of covering the entire curriculum while also pursuing the targeted experimental activities. It is therefore necessary to develop some time-saving strategies within the framework of PA.

This research was qualitative and did not include assessment of cognitive abilities. Thus, it is necessary to conduct a quantitative survey to measure the impacts of PA. In addition, this paper focused mainly on the pedagogical aspects of partnership. However, PA is a project between schools, universities and a foreign donor agency. Future research should analyse its managerial process with regard to decision-making, collaboration between three universities or problems that emerge in the process. Finally, IMSTEP, including PA, was a project by the Indonesian government, which has different bodies in charge of higher education, secondary education and teacher development. There were a number of administrative negotiations between these bodies and universities; however, this paper did not consider those issues. Further research should examine such negotiations as administrative or political processes.

Acknowledgements

We would like to express our gratitude to JICA for sanctioning this paper. However, the views expressed herein do not necessarily reflect JICA's official opinions.

In addition, we are greatly indebted to the translators—Dyah Intan, Siti Marifah, Fitra Lugina, and Marwaty—for providing us with oral translations and for typing in English the results of the series of focus group discussions for this paper. Further, we are especially grateful to Nigel Dixon, Yuko Ogino and Herawaty Susilo for their meaningful suggestions and comments.

References

Abdal, H., 1998. Constructivism in Teacher Education: Considerations for Those Who Would Link Practice to Theory. ERIC Clearinghouse on Teaching and Teacher Education, Washington, DC.

Adey, P., Dillon, J., 1994. Large scale delivery of effective staff development in Indonesia. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, 7th April.

Clift, R.L., Veal, M.L., Holland, P., Johnson, M., McCarthy, J., 1995. Collaborative Leadership and Shared Decision Making. Teachers College Press, New York.

Collins, A., Greeno, J.G., Resnick, L.B., 1995. Learning environments. In: Anderson, L.W. (Ed.), International Encyclopedia of Teaching and Teacher Education. Elsevier, Oxford, pp. 340–344.

Dahlström, L., 2003. Critical practitioner inquiry and the struggle over the preferential right of interpretation in the South. Educational Action Research 11 (3), 467–478.

Ebbut, D., Robson, R., Worrall, N., 2000. Educational research partnership: differences and tensions at the interface between the professional cultures of practitioners in schools and researchers in higher education. Teacher Development 4 (3), 319–337.

Elliot, J., 1991. Action Research for Educational Change. Open University Press, Buckingham Quoted by Ebbut, D., et al. (2000).

Fraser, B.J., 1995. Student perceptions of classrooms. In: Anderson, L.W. (Ed.), International Encyclopedia of Teaching and Teacher Education. Elsevier, Oxford, pp. 416–419.

Fung, Y., 2000. A constructivist strategy for developing teachers for change: a Hong Kong experience. Journal of In-service Education 26 (1), 153–167.

Gross, T.L., 1988. Partners in Education. Jossey-Bass, San Francisco.

Hamid, M., 2004. Kebijakan implementasi kurikulum berbasis kompetensi (The policy for the implementation of the competency-based curriculum). BERITA UPI 231, 11–18.

Harber, C., Davies, L., 1998. School Management and Effectiveness in Developing Countries. Continuum, London.

Harvey, S., 1999. The impact of coaching in South African primary science INSET. International Journal of Educational Development 19 (3), 191–205.

Inagaki, T., 1986. Jugyo Wo Kaeru Tame Ni (Changing Lessons). Kokudosha, Tokyo.

Inagaki, T., Sato, M., 1996. Jugyo Kenkyu Nyumon (Introduction to Lesson Studies). Iwanami-Shoten, Tokyo.

Ishii, D., 2003. Constructivist Views of Learning in Science and Mathematics. ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus OH.

Ito, K., 1990. Konai Kensyu (School-Based Training). Kokudosha, Tokyo.

Johnson, S., Monk, M., Watson, R., Hodges, M., Sadeck, M., Scholtz, Z., Botha, T., Wilson, B., 2000. Teacher change in the Western Cape, South Africa: taking a big step in science education. Journal of In-service Education 26 (3), 569–582.

Jones, K., Quah, M., Charlton, T., 1999. Professional development in response to problem behaviours in primary and special schools in Singapore. Journal of In-service Education 25 (1), 55–68.

Joni, R.T., 2000. Indonesia. In: Morris, P., Williamson, J. (Eds.), Teacher Education in the Asia-Pacific Region. Falmer Press, New York, pp. 75–106.

Levin, B.B., 2003. Case Studies of Teacher Development: An In-Depth Look at How Thinking about Pedagogy Develops over Time. Lawrence Erlbaum Associates, NJ.

Macleod, F., Golby, M., 2003. Theories of learning and pedagogy: issues for teacher development. Teacher Development 7 (3), 345–361.

Mochida, K., 2003. Saikin no wagakuni ni okeru gakuryoku mondai (Contemporary issues on academic achievement in Japan). Hikaku Kyoikugaku Kenkyu (Comparative Education) (29), 3–15.

Mokuku, T., 2001. Encounters with action research in the African context: a case study in the school curriculum in Lesotho. Educational Action Research 9 (2), 187–198.

Ose, T., Sato, M., 2000. Gakko Wo Tsukuru (Establishing a School). Shogakkan, Tokyo.

Ose, T., Sato, M., 2003. Gakko Wo Kaeru (Changing a School). Shogakkan, Tokyo.

O'Sullivan, M., 2002. Effective follow-up strategies for professional development for primary teachers in Namibia. Teacher Development 6 (2), 181–203.

Reed, Y., Davis, H., Nyabanyaba, T., 2002. Investigating teachers' 'take-up' of reflective practice from an in-service professional development teacher education programme in South Africa. Educational Action Research 10 (2), 253–274.

Saito, E., Sumar, H., Harun, I., Ibrohim, Kuboki, I., Tachibana, H., 2006a. Development of school-based in-service training under an Indonesian mathematics and science teacher education project. Improving Schools 9 (1), 47–59.

Saito, E., Harun, I., Kuboki, I., Tachibana, H., 2006b. Indonesian lesson study in practice: case study of Indonesian Mathematics Science Teacher Education Project. Journal of In-service Education, accepted for publication.

Sato, M., 1999. Manabi no Kairaku (Pleasure of Learning). Seori Shobo, Yokohama.

Sato, M., 2000. Manabi kara Tousousuru Kodomotachi (Escape from Learning). Iwanami Shoten, Tokyo.

Webb, R., Vulliamy, G., 1999. Managing curriculum policy changes: a comparative analysis of primary schools in England and Finland. Journal of Education Policy 14 (2), 117–137.

Webb, R., Vulliamy, G., Hämäläinen, S., Sarja, A., Kimonen, E., Nevalainen., R., 2004. A comparative analysis of primary teacher professionalism in England and Finland. Comparative Education 40 (1), 83–107.

Weiler, J., 2001. Promoting the dialogue: role of action research at Belvedere Technical Teachers' College, Zambia. Educational Action Research 3, 413–436.

Zeichner, K., Liston, D., 1996. Reflective Teaching: An Introduction. Lawrence Erlbaum, Mahwah.